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Function and Work Ability Following Multidisciplinary Rehabilitation for Individuals with Chronic Musculoskeletal Pain

Thesis for the degree philosophiae doctor

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COOP/WONCA Charts
Hospital Anxiety and Depression Scale (HADS)
Sense of Coherence Scale (SOC)

ABSTRACT

Function and Work Ability Following Multidisciplinary Rehabilitation for Individuals with Chronic Musculoskeletal Pain

Chronic musculoskeletal pain is one of the leading causes of disability in Norway with major consequences for the individual and the health care system, as well as for the labour and welfare organisation. Despite great effort being put into attempting to explain the complex phenomenon and design intervention strategies, chronic inability to return to work due to chronic musculoskeletal pain is still increasing.

A prospective follow-up study was conducted in the context of a 57 week multidisciplinary rehabilitation programme in order to investigate the influence of individual and environmental factors in pain, function and work ability. This also investigated the role of individual and environmental factors in treatment outcome in individuals (aged 20-67) with chronic non-organic musculoskeletal pain conditions. Data from a comprehensive health survey, the Nord-Trøndelag Health Study (HUNT Study), were used to compare the chronic musculoskeletal pain sample with a general population sample from the same geographic area.

The empirical findings, presented in four papers (I-IV), suggest increased function on a number of variables during the rehabilitation period. In addition to a significant improvement in function during the rehabilitation period (57 weeks), a further improvement in function is seen at the one year follow-up measures. High levels of pain intensity, pain experience, and poor psychological capacity at baseline, as well as poor physiological capacity and high levels of anxiety and depression at the end of the rehabilitation program were the most important prognostic factors of variance in functioning (COOP/WONCA) over the 4 measurement periods (Paper I). No significant gender differences were found for pain and functional health status variables. However, gender differences were found in the way socio-demographic-, socio-economic-, and psychosocial factors interact to influence rehabilitation outcomes in terms of pain, pain experience, and functional health status (Paper II). Sense of Coherence (SOC) significantly improved during the rehabilitation period. Moreover a strong correlation was found between SOC, anxiety, and depression. No significant association was found between SOC and work re-entry (Paper III). Work ability significantly improved during the rehabilitation period. Age, sleeplessness, cognitive function, overall health, pain experience, and anxiety were the strongest predictors of work ability (Paper IV).

In sum, the empirical findings give preference to the emerging complex model of rehabilitation outcomes. This suggests that age, socio-demographics, emotional distress, pain experience, cognitive function, physical capacity, sleep disturbance, and overall health are important priority areas in rehabilitation programmes to improve function and work ability.

Keywords: Chronic musculoskeletal pain, function, work ability, multidisciplinary rehabilitation, individual and environmental factors

NORSK SAMMENDRAG

Funksjon og arbeidsevne etter multidisiplinær rehabilitering hos personer med kronisk smerte i muskel og skjelett system

Kronisk smerte i muskel- og skjelett system er en av hovedårsakene til uføretrygding i Norge, med store konsekvenser for individet og helsevesenet, så vel som for arbeids- og velferdsetaten. Til tross for betydelig innsats med tanke på å kunne forklare dette komplekse fenomenet og for å utvikle intervensjonsstrategier, ser andelen av personer som ikke kommer tilbake til arbeid på grunn av kroniske plager i muskel og skjelett system fortsatt ut til å øke.

Et oppfølgingsstudie ble gjennomført i tilknytning til et 57 ukers multidisiplinært rehabiliteringsprogram. Hensikten var å undersøke individuelle og omgivelsesmessige faktorers betydning for smerte, funksjon og arbeidsevne, samt å undersøke individuelle og omgivelsesmessige faktorers betydning for resultatet av rehabiliteringen hos personer (20-67 år) med kronisk smerte i muskel- og skjelett system. Det ble i tillegg benyttet data fra Helseundersøkelsen i Nord-Trøndelag (HUNT) med tanke på å kunne sammenligne utvalget med kroniske smerter i muskel og skjelett system med den generelle populasjonen fra samme geografiske område.

Empiriske funn, presentert i fire artikler, viser økt funksjon på en rekke variabler i løpet av rehabiliteringsperioden. I tillegg til signifikant økt funksjon i løpet av rehabiliteringsperioden (57 uker) sees en fortsatt økning i funksjon et år etter endt rehabilitering. Høy smerteintensitet, en opplevelse av smerten som plagsom, og lav psykisk kapasitet ved oppstart av rehabiliteringen, samt lav fysisk kapasitet og høyt angst- og depresjonsnivå ved endt rehabilitering var de viktigste prognostiske faktorene for varians i funksjon (COOP/WONCA) over de fire måletidspunktene (Paper I). Det ble ikke funnet noen signifikante kjønnsforskjeller når det gjelder smerte og funksjon i utvalget. Det ble imidlertid funnet kjønnsforskjeller når det gjelder sosio-demografiske, socio-økonomiske, og psykososiale faktorers betydning for resultatet av rehabilitering målt i smerteintensitet, smerteopplevelse og funksjon (Paper II). Sense of Coherence (SOC) økte signifikant i løpet av rehabiliteringsperioden. Videre ble det funnet en sterk korrelasjon mellom SOC, angst og depresjon. Det ble imidlertid ikke funnet noen sammenheng mellom SOC og arbeidsdeltagelse (Paper III). Arbeidsevnen hos utvalget økte i løpet av rehabiliteringsperioden. Alder, søvnproblematikk, kognitiv funksjon, generell helse, smerteopplevelse og angst var de sterkeste predikatorene for om man kom tilbake til arbeid eller ikke (Paper IV).

De empiriske funnene i disse studiene fremhever kompleksiteten i fenomenet, samt betydningen av en multidisiplinær rehabiliteringstilnærming med fokus på sosio-demografiske forhold, emosjonell problemer, kognitiv funksjon, fysisk kapasitet, søvn problematikk, og generell helse. Dette med tanke på å øke funksjons- og arbeidsevnen hos målgruppen med kroniske smerter i muskel- og skjelett system.

Nøkkelord: Kronisk smerte i muskel- og skjelett system, funksjon, arbeidsevne, multidisiplinær rehabilitering, individuelle og omgivelsesmessige faktorer

PREFACE

This thesis was written at the Department of Social Work and Health Science, Norwegian University of Science and Technology, Trondheim. The work was carried out during the years 2004-2008 with patients with chronic musculoskeletal pain conditions from Friskgården, a private rehabilitation centre in central Norway.

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ABBREVIATIONS

BPS Model	= Biopsychosocial Model
CI	= Confidence intervals
CNOMP	= Chronic Non-Organic Musculoskeletal Pain
COOP/WONCA	= Functional Health Status-COOP/WONCA Charts
GRR	= Generalized resistance resources
GP	= General Practitioner
GST	= General System Theory
HADS	= Hospital Anxiety and Depression Scale
HUNT	= Nord-Trøndelag Health Study
IASP	= International Association for the Study of Pain
ICF	= International Classification of Functioning, Disability and Health
M	= Mean
N/n	= number of
NAV	= Norwegian Labour and Welfare Organization
NSD	= Social Science Data Service
OR	= Odds ratios
REK	= Regional Committee for Medical and Health Research Ethics
SD	= Standard Deviation
SOC	= Sense of Coherence
VAS	= Visual Analogue Scale
WHO	= World Health Organization

DEFINITIONS AND CLARIFICATION OF CONCEPTS/TERMS USED IN THIS THESIS

Biopsychosocial approach: Based on growing evidence for the importance of a multidimensional approach in understanding and explaining the complexity of chronic musculoskeletal pain and associated disability, a biopsychosocial model is considered as an adequate framework in this thesis, emphasizing that biological, psychological (which entails thoughts, emotions, and behaviors), and social factors plays a significant role in human functioning in the context of disease or illness (Engel, 1977; Von Korff, Glasgow, & Sharpe, 2002; Malmgren, 2005; White, 2005; Braathen, Veiersted, & Heggenes, 2007; Wigers & Finset, 2007).

Chronic non-organic/specific musculoskeletal pain (CNOMP): non-organic musculoskeletal pain of >3 months duration (Rustøen et al., 2004a; Hagen, Zwart, Svebak, Bovim, & Stovner, 2005).

Cognitive function/capacity: In accordance with a salutogenic perspective and the concept of GRR, focusing on cognitive resources, cognitive function/capacity is in this thesis operationalized as personally experienced ability to concentrate, to remember, to understand and evaluate information, and to have sufficient knowledge, and measured by VAS (page 33-35)(Antonovsky, 1979; Eriksson, 2007).

Coping: In accordance with a salutogenic perspective and the concept of GRR, focusing on effectiveness in avoiding and /or combating variety of stressors, coping is in this thesis operationalized as personally experienced feeling of coping in daily life, and to have control and influence in daily life, and measured by VAS (page 33-35) (Antonovsky, 1979; Eriksson, 2007).

Function/capacity: A person's ability to perform the activities necessary to ensure well-being. Conceptualized as the integration of three domains of function: biological, psychological (cognitive and affective), and social (WHO, 2008). The concepts of *function* and *capacity* are in present thesis used equally.

Functioning: A generic term that includes body functions and structures, activities, and participation. It indicates the aspects of the interaction between an individual (with a "health condition") and his/her context (environmental and personal factors) (WHO, 2008).

General Resistance Recourses (GRR): "A general Resistance Resource is a physical, biochemical, artifactual-material, cognitive, emotional, valued-attitudinal, interpersonal-relational or macro socio cultural characteristic of an individual, primary group, subculture or society that is effective in avoiding and/or combating variety of stressors" (Eriksson, 2007, p. 18).

Pain experience: In accordance with a salutogenic orientation and the concepts of GRR, in this thesis understood as the personally experience of how troublesome you experience the pain in daily life (page 33-35), and measured by VAS (Antonovsky, 1979; Eriksson, 2007).

Pain intensity: In this thesis understood as the current personally experienced level of pain intensity ranging from no pain to unbearably pain (page 33-35), and measured by VAS.

Physical function/capacity: In accordance with a salutogenic perspective and the concept of GRR, focusing on physical resources, physical function/capacity is in this thesis operationalized as personally experienced muscle strength, endurance capacity, energy, mobility, and balance, and measured by VAS (page 33-35) (Antonovsky, 1979; Eriksson, 2007).

Psychological function/capacity: In accordance with a salutogenic perspective and the concept of GRR, focusing on emotional resources, psychological function/capacity is in this thesis operationalized as personally experienced mood, feeling valuable and feeling good inside, being extrovert/introvert, optimistic/pessimistic, and calm/balanced, and measured by VAS (page 33-35) (Antonovsky, 1979; Eriksson, 2007).

Quality of Life: The concept of quality of life is complex. In this thesis understood as personally experienced quality of life (page 33-35) in accordance with a salutogenic perspective that includes physical, mental, social, and spiritual health and considers people in their social and cultural context (Antonovsky, 1979; Eriksson, 2007), and measured by VAS.

Rehabilitation: "Rehabilitation of people with disabilities is a process aimed at enabling them to reach and maintain their optimal physical, sensory, intellectual, psychological and social functional levels. Rehabilitation provides disabled people with the tools they need to attain independence and self-determination" (WHO, 2008).

Salutogenic perspective: The salutogenic approach focuses on resources for health rather than on risk for disease: "Focus on three aspects. Firstly, on problem solving/finding solutions. Secondly, it identifies Generalized Resistance Resources (GRRs) helping people to move in the direction of positive health. Thirdly, it identifies a global and pervasive sense in individuals, groups, populations or systems that serves as the overall mechanism or capacity for this process, the sense of coherence (SOC)" (Antonovsky, 1979; Eriksson, 2007, p.17). Salutogenesis is considered as a theory of resources and functioning in this thesis.

Sense of Coherence: Sense of Coherence is a global orientation that expresses the ability to comprehend the whole situation and the capacity to use the resources available (Antonovsky, 1979).

Work ability: Work ability, built on the balance between a person's recourses and work demands, is an integrated approach. Individual factors such as functional capacity, competence (knowledge and skills), values and motivation, as well as the work environment; reflects work ability. As an integrated approach, work ability also extends outside the work environment to factors that are known to influence work ability such as family, friends and relatives and the broader social and policy environment (Ilmarinen, 2006).

Work re-entry: In this thesis defined as participants being on "active strategies" of return to work like rehabilitation benefit, vocational rehabilitation, part time work/rehabilitation benefit, and part time disability pension using their rest work capacity or resaving no benefit.

LIST OF PAPERS

This thesis is based on the following papers, and they are referred to by their Roman numerals:

I Lillefjell, M., Krokstad, S., & Espnes, G. A. (2007). Prediction of function in daily life following multidisciplinary rehabilitation for individuals with chronic musculoskeletal pain; a prospective study. *BMC Musculoskeletal Disorders, 8,* 65. doi:10.1186/1471-2474-8-65

II Lillefjell, M. (2006). Gender differences in psychosocial influence and rehabilitation outcomes for work-disabled individuals with chronic musculoskeletal pain. *Journal of Occupational Rehabilitation, 16,* 659-674.

III Lillefjell, M. & Jakobsen, K. (2007). Sense of Coherence as a Predictor of Work Re-Entry Following Multidisciplinary Rehabilitation for Individuals with Chronic Musculoskeletal Pain. *Journal of Occupational Health Psychology*, *12,* 222-231.

IV Lillefjell, M., Krokstad, S., & Espnes, G. A. (2006). Factors predicting work ability following multidisciplinary rehabilitation for chronic musculoskeletal pain. *Journal of Occupational Rehabilitation*, *16,* 543-555.

1 Introduction

This thesis is written with regard to chronic musculoskeletal pain, function and work ability. The rationale behind the choice of theme for this thesis was that chronic musculoskeletal pain has been shown to be one of the leading causes of disability in Norway with major consequences for the individual and the health care system, as well as for the labour and welfare organisation. Despite a great effort attempting to explain the chronic inability to return to work and design intervention strategies for individuals with chronic musculoskeletal pain, these problems are still increasing. Additional research to improve knowledge about this phenomenon is therefore warranted. In order to examine factors that might affect function and the ability to re-enter the workforce, a prospective study from a chronic musculoskeletal pain sample, participating in a multidisciplinary rehabilitation programme, was conducted. In addition, data from a comprehensive health survey, the Nord-Trøndelag Health Study (HUNT Study), was used to compare the chronic musculoskeletal pain sample with a general population sample from the same geographic area. This section includes a general introduction, theoretical and empirical foundation as well as descriptions of the treatment and the data material.

1.1 General background

Chronic musculoskeletal pain is among the major health problems in Western society, and the most common cause for sick leave and disability pension in Norway (Statistics Norway, 2006). The direct and indirect costs of chronic musculoskeletal pain and disability to the individual, his or her family, employers, and society are enormous (Anderson, 2004; Rustøen et al., 2004a; Turner et al., 2004; Ursin, 2006). In Norway, disability pensions, due to musculoskeletal pain, account for 35 % of all new disability pensioners, and the prevalence of women is higher than that of men. In addition, long-term sick leave due to musculoskeletal pain accounts for approximately 53 % of all sick leaves (Statistics Norway, 2006). Several models for work rehabilitation have been tested and evaluated, and there have been repeated political statements to do whatever is possible to support people with reduced function in order to help them to retain work. (NOU 2000:27; NOU 2001:22; Jakobsen, 2006; St. meld.nr. 9, 2006-2007; ECON, 2007; Fossestøl, 2007).

Population-based studies suggest that the prevalence of chronic pain, when chronic pain is defined as pain of >3 months duration, is increasing (Verhaak, Kerssens, Dekker, Sorbi, & Bensing, 1998; Bergman et al., 2001). In Norway, chronic musculoskeletal pain, affects approximately 25 % of the people at some point in their life span (Rustøen, et al., 2004a; Statistics Norway, 2006). Although the majority of individuals with chronic musculoskeletal pain are able to resume their normal activities, including work, quickly, substantial numbers do not, and this has major consequences for the health care system. Although its consequences are less serious than for AIDS, cancer, or heart disease, according to estimates chronic musculoskeletal pain is a more costly health problem (Statistics Norway, 2006). Chronic pain is a complex phenomenon that potentially affects all aspects of a person's life (Keponen & Kielhofner, 2006). The human costs are very high; pain, loss of quality of life, disability, and feeling of helplessness affecting the individual as well as his or her family. Helplessness is particularly related to the fact that in more then 90 % of the cases, no medical reason can explain the origin of the pain (Trunchon, 2001; Frisenschlager & Pucher, 2002). Clinical examinations or imaging tests are not found very useful, and a diagnosis of pain of non-specific origin is most often given (Trunchon, 2001).

Great effort has been put into attempting to explain the chronic inability to return to work due to chronic non-organic musculoskeletal pain (CNOMP) (Pransky, Gatchel, Linton, & Loisel, 2005). Based on established knowledge, several rehabilitation programmes addresses both biological, psychological, and social issues, and this has prompted several research projects, based on various theoretical foundations, also within Norway (Haugli, Steen, Lærum, Nygard, & Finset, 2001; Nystuen & Hagen, 2006; Anvik, Olsen, Lien, Sollund, & Hansen, 2007; Braathen et al., 2007; Brage, Sandanger, & Nygård, 2007; Ihlebæk, Brage, & Eriksen, 2007). No single theory has however succeeded in integrating all the aspects of CNOMP (Meland, 2003; Malt, 2003; Wigers & Finset, 2007). A resent study by Wigers & Finset (2007) describe chronic pain as a dynamic process that involves both neurophysiological pain regulations and learning in addition to cognitive, emotional, and behavioural conditions. All these elements mentioned above might maintain and influence on each other in a negative circle and cause even further chronification (Wigers & Finset, 2007).

A number of scientific reviews and studies have revealed how complex the phenomenon of CNOMP is and its many related factors (Linton et al., 2005; Norrefalk, Svensson, Ekholm, & Borg, 2005; Shaw, Pransky, Patterson, & Winters, 2005; McGeary, Mayer, & Gatchel, 2006; Braathen et al., 2007; Wigers & Finset, 2007). Chronic disability, and particularly occupational disability, referring to individuals who have discontinued their

participation in occupational activities, consistent with the definition of disability advanced by the International Classification of Functioning, Disability and Health (ICF) (World Health Organization (WHO), 2001), is today recognized as a complex multifactorial and biopsychosocial phenomenon (Engel, 1977; Sullivan, Feuerstein, Gatchel, Linton, & Pransky, 2005). The multidimensional nature of the CNOMP, not successfully understood by one single theory (Malt, 2003; Meland, 2003), is based on the variety of risk factors including: medical (e.g., radiating pain); background (e.g., age, sex, smoking status, economy); work place (e.g., job satisfaction, work tasks, heavy work, ergonomic); psychological (e.g., depression, anxiety, fear of pain); social (e.g., social support, social network, breadwinner status); and system factors (e.g., organizational structure, information systems) (Sirnes, Sødal, Nurk, & Tell, 2003; Turner et al., 2004; Nordlund & Ekberg, 2004; Vowles, Gross, & Sorrell, 2004; Saastamoinen, Leino-Arjas, Laaksonen, & Lahelma, 2005; Shaw et al., 2005; Greiner & Krause, 2006; Lillefjell, Krokstad, & Espnes, 2006; McGeary et al., 2006). Several studies suggests that gender, for example, may play a role in reports of pain and distress (Fillingim, 2000; Keogh & Herdenfeldt, 2002; Sirnes at al., 2003; Keogh, McCracken, & Eccleston, 2005; Garofalo, Lawler, Robinson, Morgan, & Kenworthy-Heinige, 2006; Lillefjell, 2006).

Theoretical and empirical evidence also highlight a relation between personality factors like e.g. emotions, mood, energy, extraversion, and muscular tension and pain (Costa & McCrae, 1992; Matthews & Deary, 1998; Newth & Delongis, 2004). Studies suggest that a range of negative emotions including depression, anger, and anxiety are frequently experienced by people coping with a variety of chronic pain conditions. Higher levels of negative mood tend to be associated with higher levels of chronic pain, while optimistic/pessimistic attitudes seem to predict whether the pain will interfere with daily life (Michaelson, Sjolander, & Johansson, 2004; Newth & Delongis, 2004). It is also suggested that individuals with specific personality attributes seem to be more likely than others to "convert" their emotional reaction into somatic symptoms and distress (Breuer & Freud 1995; Noyes et al., 2001; Frischenschlager & Pucher, 2002; Malt, Malt, Blomholm, & Refnin, 2002). Further it is suggested in various studies that a strong Sense of Coherence, described as the dimensions of a person's response to a stressful situation (Antonovsky, 1979), improves the prospects of staying healthy or being able to cope with health problems (Kivimäki, Kalimo, & Toppinen, 1998; Nilsson, Holmgren, & Westman, 2000; Eriksson & Lindström, 2006).

For many of the individuals with CNOMP, traditional treatments, based on a biomedical model (Brannon & Feist, 1997; Furnham, 2005), that aim to reduce pain have

been unsuccessful. In these cases participation in multidisciplinary rehabilitation programmes, where improving daily functioning and balance in occupations is in focus, is an established option (McCracken & Turk, 2002). The effectiveness of multidisciplinary rehabilitation programmes for individuals with chronic musculoskeletal pain has been evaluated (Haldorsen et al., 2002; McCracken & Turk, 2002; Sullivan et al., 2005; McCracken, MacKichan, & Eccleston, 2006; Wigers & Finset, 2007), and several studies, in Norway as well, supports the use of multidisciplinary rehabilitation programmes for individuals with CNOMP (Haldorsen et al., 2002; Storrø, Moen, & Svebak, 2004; Braathen et al., 2007; Wigers & Finset, 2007). Haldorsen et al. (2002), who compared ordinary treatment, light multidisciplinary treatment and extensive treatment for long-term sick listed employees with musculoskeletal pain, emphasize the importance of interventions of longer duration addressing multiple dimensions of pain and disability. Moreover evidence based guidelines from The American Pain Society in 2004 pointed out multidimensional rehabilitation combined with education, and/or cognitive therapy and endurance capacity training as necessary type of treatment for individuals with chronic pain (Eriksen & Ursin, 2004; Ursin, 2006; Wigers & Finset, 2007).

General reviews of the literature indicate that multidisciplinary rehabilitation programmes, that include psychosocial pain management- and physical exercise intervention, are more effective in improving function and work ability than programmes that do not include psychosocial interventions (Guzman et al., 2004; Staal, Rainville, Fritz, van Mechelen, & Pransky, 2005; Hoffman, Papas, Chatkoff, & Kerns, 2007). Treatment completers typically report decreased pain intensity, improvements in pain-related distress, lessened depression and anxiety, improved levels of coping skills, increased acceptance of pain, and increased functional health status and work ability (Vowles et al., 2004; Sullivan et al., 2005; Lillefjell, 2006; McCracken et al., 2006; Wigers & Finset, 2007), that have successfully been documented by return to work rates.

Comprehensive rehabilitation programmes for the working population with reduced function due to chronic musculoskeletal pain are however relatively new in Norway and have several practical implications compared to conventional intervention within primary care. Multidisciplinary rehabilitation programmes are resource-demanding and long-lasting, but what are the alternatives? Multidisciplinary rehabilitation programmes seem to meet a demand in the welfare state for a group of people that generally falls between two stools, and who often are sent from place to place in a fragmented diagnosing mission. The general practitioners (GP) have a particularly important follow-up role in the rehabilitation process for this group of people with chronic musculoskeletal pain. Due to the complexity of the

phenomenon, the expected responsibilities placed on the GP's might however be too extensive. Employers and employees are given greater responsibility to reintegrate sick-listed persons, and the earlier focus on disease is more or less replaced by a functional focus (Krohne & Brage, 2007). Moreover, a focus on functional assessments in connection to the employee's work assignments might cause several practical problems for the general practitioners (Krohne & Brage, 2007). However, multidisciplinary intervention is shown to be both cost-effective and achieving equal or greater efficacy in previous studies (Skouen, Grasdal, Haldorsen, & Ursin, 2002; Turk, 2002).

A pervasive topic of the present thesis is the relationship between CNOMP, function, and work ability. The thesis is based on a prospective study, presented in four empirical papers (I-IV). Taken together, these four empirical papers may contribute to our understanding of chronic musculoskeletal pain and how it is related to function and work ability. The associated costs for the health care system, as well as society, rehabilitation and the individual are strained. It would therefore be very valuable if it is possible to predict which individuals that participate in a multidisciplinary rehabilitation programme, with long periods off-work and long-term (>3 months) non-organic musculoskeletal pain, could improve their functions in daily life and find a way back to work.

1.1.1 Rationale for the thesis

When the paradigm, for explaining risk factors for CNOMP, poor function, and occupational disability, shifted from a biomedical model (Brannon & Feist, 1997; Furnham, 2005; Shorter, 2005) to a biopsychosocial model (Engel, 1977) of health and disability this led to investigations of new types of potential risk factors (see further descriptions of the models page 7-9). This in turn led to the identification of different prognostic factors and the possibility for the design of different intervention strategies for individuals with chronic musculoskeletal pain. Despite these advances, the overall rates of work disability, due to chronic non-specific musculoskeletal pain, have not changed significantly in the Western world. In fact, the associated costs have increased dramatically and give rise to concern (McGeary, Mayer, Gatchel, Anagnostis, & Proctor, 2003; Anderson, 2004; Turner et al., 2004). Another concern is the gap that seems to exist between the concepts and models of researchers and those directly involved with the care and rehabilitation of individuals with disabling musculoskeletal pain conditions (Pransky et al., 2005).

While advanced designs are appearing more frequently in chronic musculoskeletal pain research, there is now a need for prospective, inception studies so that we may learn more about the nature of the risk factors being studied. Therefore prospective studies that are conducted in a real clinical setting are still needed to support this effort in order to improve the choice of predictors, and to clarify their role in chronic disability and work re-entry. Previous research highlights the heterogeneous nature of individuals with persisting pain, and signals the importance of assessing psychosocial factors in order to better understand and manage pain-related disability (Geisser, Robinson, Miller, & Bade, 2003; Saastamoinen et al., 2005; Sullivan et al., 2005; Browne, Schug, Ray, & French, 2006). A biopsychosocial perspective, based on system theory thinking, includes both individual and environmental factors (Engel, 1977; Turk, 1996; Henderson, Kidd, Pearson, & White, 2005; Sullivan et al., 2005). A critical area for further research is the nature of interactions among these factors and their associations with chronic pain, function, and work ability.

The return to work after long period's off-work due to CNOMP is a complex phenomenon representing a dynamic process that not can be revealed by measurement at a single point in time. In order to capture the dynamic developments that disability and return to work entail, new research would therefore benefit from repeated measures over considerable time periods, rather than view the problems as static. This would provide crucial data on the processes involved and help reveal the nature of the mechanisms. Such data collections would also capture the recurrent nature of chronic non-specific musculoskeletal pain. For example, some variables may only be relevant at certain points in time, while others are important only in certain circumstances. Moreover, some variables, such as anxiety or depression, may actually show the greatest impact on function when they increase or decrease (Linton et al., 2005). Identifying such changes require repeated measures as performed in the prospective study (Papers I-IV) included in this thesis.

Although the awareness of the complexity of this phenomenon and the importance of cultural-, political-, and work environmental variables, also involved in this health problem, this thesis deals with the influence of individual and environmental factors such as; socio-demographics, socioeconomics, gender, pain intensity, pain experience, Sense of Coherence, anxiety, and depression in function and work ability for work-disabled individuals with CNOMP. By focusing on the individual as well as the contextual factors mentioned above, the empirical study/papers (I-IV) in this thesis, taken together, may contribute to our understanding of CNOMP and how it is related to function and work ability in a real clinical setting (see figure 2, page 32).

1.2 Theoretical and empirical background

Although the biomedical model (Gilje & Grimen, 1993; Brannon & Feist, 1997; Furnham, 2005) has allowed medicine to conquer or control many of the diseases that once ravaged humanity and has stimulated much progress in disease treatment, the notion that illnesses are caused by a specific pathogen places more focus on disease than on health and function (Brannon & Feist, 1997; Furnham, 2005). For many individuals with chronic musculoskeletal pain traditional treatments that are based on a biomedical model that aims to reduce pain have been unsuccessful (Sullivan et al., 2005).

No single theory has however successfully integrated all the aspects of chronic musculoskeletal pain (Malt, 2003; Meland, 2003; Wigers & Finset, 2007). Currently the existing evidence for the importance of a multidimensional biopsychosocial approach in understanding and explaining the complexity of chronic musculoskeletal pain and associated disability is growing (Engel, 1977; Trunchon, 2001; Von Korff, Glasgow, & Sharpe, 2002). Chronic non-specific musculoskeletal pain seems to be reciprocally related to a multitude of individual and environmental factors such as depressed moods, anxiety, anger, social network, social support, and Sense of Coherence (Kivimäki, Feldt, Vahtera, & Nurmi, 2000; Stordal, Bjelland, Dahl, & Mykletun, 2003; Gatchel, 2004; Veenstra, Moum, & Røysamb 2005; McCracken & Vowles, 2006).

1.2.1 Perspectives on health development and functioning

In 1977, the American Psychiatrist Georg Engel introduced the present major theoretical model; the biopsychosocial model (BPS). The model accounted for biological, psychological, and sociological interconnected spectrums, each as systems of the body. In fact, the model based on von Bartalanffys General System Theory (GST) (White, 2005), accompanied a shift in focus from disease to health, recognizing that psychosocial factors (e.g. beliefs, relationships, stress) greatly impact recovery, the progression of and recuperation from illness and disease. Engel (1977) stated

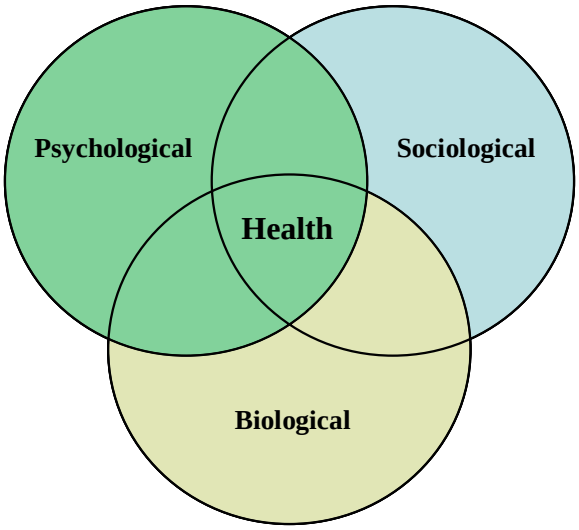

Figure 1: Biopsychosocial model

that to provide a basis for understanding the determinants of disease and arrive at rational treatments and patterns of health care, a medical model must take into account the individual, the social context in which he or she lives, and the complementary system devised by society to deal with the disruptive effects of illness, that most often is the physicians role, and the health care system. This requires a biopsychosocial model. The term biopsychosocial can in this context be defined as; "the observation that biological, psychological, and social factors are interwoven in the context of chronic disease" (Engel, 1977; Trunchon, 2001). The biopsychosocial model (Engel, 1977) does however not attempt to give a detailed account of mind-body relations.

However, prior to the adoption of biopsychosocial perspectives on chronic pain and work disability, the prevailing model was the biomedical model that emphasized a disease-based view of persistent pain and disability (Gilje & Grimen, 1993; Brannon & Feist, 1997; Sullivan et al., 2005). The biomedical model of disease has been the predominant view in medicine since the mid-nineteenth century, and has been very useful throughout history by establishing the reason why a disease occurs, and in coming up with effective treatment regimes. The model is however limiting. The biomedical model, that defines health exclusively in terms of the absence of disease, is concerned with the curing of disease and control of symptoms, and considers pathology, impairments, or dysfunction to cause disability (Brannon & Feist, 1997; Furnham, 2005). For centuries, treatment efforts have concentrated on identifying and eradicating the cause of pain symptoms. However, the biomedical promise of a cure for persistent pain and the elimination of pain-related disability have never been realized (Sullivan et al., 2005; Smart, 2006-2007). By not taking into account psychological and social factors in general, our understanding of wellbeing is limited, our treatments efforts are thwarted, and the prevention of disease is omitted. Many diseases affecting the Western society nowadays, such as heart disease, diabetes mellitus and chronic musculoskeletal pain are very much dependent on a person's behaviours and beliefs.

In recognition of its validity, the biopsychosocial model (BPS) has now been adopted by the World Health Organization (WHO) as the means of classifying the determinants of functioning, disability and health (ICF) (WHO, 2001; Dunstan & Covic, 2006). The BPS model is offered as an alternative to the predominant biomedical model (Brannon & Feist, 1997; Furnham, 2005; Shorter, 2005), and is frequently employed in the research on prognostic factors for chronic non-specific musculoskeletal pain and related disability (Turk, 2002; Sullivan et al., 2005; Pransky et al., 2005). Although the BPS model is cited as a unifying theory to explain outcomes, the evidence that BPS interventions directly affect

medical outcomes in chronic diseases is still hotly debated, with no clear answers yet (Markovitz et al., 2002). However, the evidence for the importance of the BPS model in explaining the disability associated with for example chronic musculoskeletal pain is considerably stronger (Trunchon, 2001; Von Korff et al., 2002; Lillefjell et al., 2006; Wigers & Finset, 2007).

The biopsychosocial model has been particularly important in drawing attention to the role of psychosocial factors in function and work ability in individuals with chronic non-specific musculoskeletal pain (Brannon & Feist, 1997; Turk, 2002; Pransky et al., 2005; Sullivan et al., 2005). According to the biopsychosocial model, it is impossible to fully understand the problem of chronic pain, lack of function, and work disability using physical or medical concepts alone (Feuerstein, 1991; Turk, 2002). Unlike the biomedical model, which separates body and mind, the biopsychosocial model represent a holistic perspective (Kimball, 1981; Zemke & Clark, 1996, Furnham, 2005) in that body and mind are seen as automatically intertwined. The biopsychosocial approach addresses the complexity of interactions between different domains of functioning and argues that it is the interaction of domains that clarifies important processes. This includes a more complete understanding of chronic pain, function and work ability, taking into account not only biological, but also psychological and social factors (Engel, 1977; Marmot, 2000; Marmot, 2005; Shorter; 2005; Sullivan et al., 2005; Ilmarinen, 2006). The paradigm shift from biomedical to a biopsychosocial model of disability also transfers responsibility for outcomes from the health care provider-patient relationship to a multi-player decision-making system (e.g., multidisciplinary rehabilitation programmes) influenced by complex professional, legal, administrative and culture (societal) interactions.

Systematic reviews of population-based and prospective studies indicate that initial levels of perceived pain and perceived functional disability are predictive of prolonged work disability (Crook, Milner, Schultz, & Stringer, 2002). This means that the BPS model affects disability through a patient's illness beliefs and their consequent coping strategies, including their adherence to medical treatments and advice, and also through their emotional reactions like anxiety and depression (White, 2005). Additionally the social context seems to play an important role in determining which emotions are likely to be experienced, how they are expressed, and what their consequences will be (Kubzansky & Kawachi, 2000). Although the role of the social context in function and work ability is not specific addressed in this thesis, the general relevance of socio-demographical and socio-economical factors in function and work ability in individuals with chronic non-specific musculoskeletal pain is addressed.

1.2.2 The Salutogenic Theory

The salutogenic theory, developed by the medical sociologist Aron Antonovsky, focuses on resources for health rather than on risk for disease (Antonovsky, 1979; 1987a). Antonovsky created the theory as a human global orientation, and claimed that the way people view their life have influence on their health. A salutogenic view implies strengthening people's health potential via a process of enabling individuals to manage tension, to reflect about internal and external resources, to identify and mobilize them as well as to promote effective coping by finding solutions (Antonovsky 1979; 1987a; Eriksson, 2007). Moreover, it is not only a question of the individuals own attitudes and actions, but an interaction between people and the structures of society i.e. the human resources and the conditions of the living context (Eriksson, 2007).

The ability to comprehend the whole situation as well as the capacity to use the resources available was called the Sense of Coherence (Antonovsky 1979; 1987a; Eriksson, 2007). By introducing "the health promotion concept" of Sense of Coherence (SOC) Aaron Antonovsky (1979) intended to launch an alternative approach, studying factors likely to protect people from falling ill. According to Antonovsky`s original idea it was more important to focus on peoples resources and capacity to create health than the classic focus on risks, ill health, and disease. Antonovsky (1979; 1987a) suggested that people with a strong Sense of Coherence make efficient and effective use of available resources and thus make life less arduous. Sense of Coherence is defined by Antonovsky as: "A global orientation that expresses the extent to which one has a pervasive, enduring though dynamic feeling of confidence that (1) the stimuli deriving from one's internal and external environments in the course of living are structured, predictable, and explicable (comprehensibility); (2) the resources are available to meet the demands posed by these stimuli (manageability); and (3) these demands are challenges worthy of investment and engagement (meaningfulness)" (Antonovsky, 1987a, p. 19).

Antonovsky (1987a; 1987b) describes this orientation, developed and formulated in the framework of system theory thinking, as the salutogenic process, in contrast with an orientation towards pathological consequences. It is assumed that this improves the prospects of staying healthy or at least to be able to cope with health problems should they arise. Antonovsky focused on health perception and states that "persons with a strong Sense of Coherence will consider themselves well even in a disease situation" (Antonovsky, 1979). According to Antonovsky (1987a; 1991), SOC is achieved when a person's generalized

resistant resources (GRR) are in accordance with the pressure or strain from the environment such as pressure at the workplace. The resistance resources include the characteristics of a person, a group, or an environment that facilitate effective tension management (Volanen, Lahelma, Silventoinen, & Suominen, 2004; Eriksson, 2007).

The three components (comprehensibility, manageability, and meaningfulness) of SOC describe a person's GRR (Antonovsky, 1993). The component comprehensibility, refers to the extent to which you perceive the stimuli that confront you, derived from the internal and external environments, such as making cognitive sense of information that is ordered, consistent, structured, and clear (Antonovsky, 1987a). The component comprehensibility bears some similarity to Lazarus concept of appraisal, where the interpretation of an event is more important than the event itself (Lazarus & Folkman, 1984). However the concept also expresses a generalized orientation, a belief that the signals transmitted are information, not noise, and that they can be structured and are not chaotic. The component of manageability refers to the extent to which a person perceived that resources are at their disposal that are adequate to meet the demands posed by the stimuli that bombards them (Antonovsky, 1979; 1987a). The component of manageability bears some similarity to Bandura`s concept of self-efficacy that refers to "peoples` belief about their capabilities to exercise control over events that affect their lives" (Bandura, 1989, p. 1175). Unlike Bandura, however, Antonovsky stresses the sense of manageability as a generalized orientation towards life, whereas Bandura insists that self-efficacy is a specific rather than a global concept (Bandura, 1977; 1989). The third component meaningfulness refers to the motivational belief that it makes emotional sense to cope, though life may have its pains, one wish to go on; that problems and demands that are worth investing energy in are worth of commitment and engagement, and are seen as challenge rather than a burden (Antonovsky 1979; 1987a). These three components constitute an individual's coherent understanding of the world. Whereas comprehensibility and manageability can be characterized as cognitive concepts, the third component meaningfulness is related to values, emotions, and motivation (Antonovsky, 1979; 1987a). Even though SOC is conceptualized as a personality characteristic, a substantial number of studies suggest that SOC seems to be changeable over time due to socialization processes (Antonovsky 1987a; Smith, Breslin, & Beaton, 2003; Höge & Bussing, 2004).

Previous research has supported the association between health and SOC. It has been shown in various cross sectional settings that a strong SOC is associated with better health, defined in a various ways, than a weak SOC (Antonovsky, 1991; Kivimäki et al., 2000; Höge & Büssing, 2004; Richardson & Ratner, 2005; Hansen, Edlund, & Henningsson, 2006). A

relationship has for example been found between SOC and self-rated health (Nilsson et al., 2000), health behaviour (Kivimäki et al., 1998), psycho-emotional resources (Volanen et al., 2004) and the absence of sickness (Kivimäki et al., 2000; Suominen, Helenius, Blomberg Uutela, & Koskenvuo, 2001). In longitudinal populations studies, weak SOC has been particularly associated with an increased incidence of sick leaves for women (Kivimäki et al., 2000; Suominen et al., 2001) compared with a strong SOC. Factors found to be associated with a weak SOC also correlated with disability pension (Suominen et al., 2005).

Consequently, as is further discussed in Section 1.2.3, previous studies suggest that both socio-economic and psychosocial factors contribute to SOC. Despite these encouraging results, the concept of SOC has been criticized for a possible overlap with negative emotions such as anxiety, depression, and neuroticism (Larsson & Kallenberg, 1999; Höge & Büssing, 2004; Lillefjell & Jakobsen, 2007).

1.2.3 Current Theoretical and Empirical Perspectives on Chronic Musculoskeletal Pain, Function and Work Ability

Chronic Musculoskeletal Pain

Several approaches attempt to explain the occurrence and intensity of pain. Traditionally, and in accordance with the biomedical model, pain was viewed as a physical sensation arising solely from, and in proportion to, tissue damage (Brannon & Feist, 1997; Melzack, 1999). Most investigators today agree that pain intensity is dependent of the person's individual perception. Pain is ultimately a subjective experience that has a strong psychological component (Gatchel, 2004; Haug, Mykletun, Dahl, 2004; McCracken & Vowles, 2006).

The current biopsychosocial understanding of pain is that it is a physical and emotional experience resulting from the complex dynamic processing of pathophysiological (location and intensity), psychological (cognitive and emotional responses) and social-environmental (context and relational) inputs (Brannon & Feist, 1997; Melzack, 1999; White, 2005). Melzack (1973) listed individual variables such as anxiety, depression, suggestion, prior conditioning and cultural learning as possible contributors to a person's experience of pain. This multidimensional view has also been incorporated into the definition of pain, put forward by the International Association for the Study of Pain (IASP). Here pain is defined as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage" (Brannon & Feist, 1997, p.108). The

experience of chronic pain seems to be related to important aspects of emotional, physical, and social functioning including work status (Gatchel, 2004; Knardahl 2005; McCracken & Vowles, 2006; Lau & Knardahl, 2008), and certain individuals seem to use their physical symptoms as a way of dealing with, and communicating about their emotional lives (Honkasalo, 2000; Gatchel, 2004).

An important remark is that chronic pain is not ongoing acute pain (Waddell, 2004). In general constant pain, developed as the result of an interaction between physiological and psychosocial factors, is considered chronic when it persists longer than the usual course of a disease or beyond a reasonable time required for an injury to heal (Honkasalo, 2000). Chronic pain can, according to Knardahl (2001), only be understood as a dynamic model where physiological mechanism, learning and cognitive conditions control the experience of pain and the consequences for disability.

Moreover, chronic musculoskeletal pain, defined in several studies as pain of >3 months duration (Turk and Okifuji, 2002; Rustøen et al, 2004a; Hagen et al., 2005) has been shown to be a public health problem in several Western countries in view of the high prevalence and the great impact on social and occupational functioning of the individual and on the health care system (Shaw, Feuerstein, Haufler, Berkowitz, & Lopez, 2001; Anderson, 2004; Linton et al., 2005; Lotters & Burdorf, 2006). During the last decade, an increase in the prevalence of chronic musculoskeletal pain symptoms has been reported in Norway (Norway Statistics, 2006). In a study by Bergman et al. (2001), that defined chronic pain as pain of > 3 months duration, the prevalence rates of chronic pain ragged from 10.8 % to 23.7 %. In comparison, the prevalence rate of chronic pain in the Norwegian population is high (24 %) (Rustøen et al., 2004a), suggesting that chronic pain is a significant problem in Norway.

Chronic musculoskeletal pain consists of a heterogeneous group of different pain conditions with varying degrees of severity, distribution and functional impact (Anderson, 2004). Findings regarding gender differences in the prevalence of chronic musculoskeletal pain in the general population are inconsistent. Several studies and reviews suggest that women report chronic musculoskeletal pain more frequently than men, while other studies reported no gender differences in the prevalence rate (Unruh, Ritchie, & Merskey, 1999; Fillingim, 2000; Rustøen et al., 2004a; Rustøen et al., 2004b; Hagen et al., 2005). Women tend to report pain of longer duration than men, and to report more serve levels of pain (Fillingim, 2000; Ramirez-Maestre, Martinez, & Zarazaga, 2004; Rustøen et al., 2004b; Garofalo et al., 2006). Recent research also implies that women typically become unable to work and receive disability pension due to pain in the shoulders and neck, while men more

often seem to receive their pension due to lower back pain (Holte, 2002; Rustøen et al., 2004a; 2004b).

Several factors are involved in the presence of chronic musculoskeletal pain and risk of chronic disability. Reviewing the literature of risk factors for chronic musculoskeletal pain and disability, the demographic factor most common found to be associated with chronic musculoskeletal pain and work disability is old age (Vowles et al., 2004; Lillefjell et al., 2006). A recent study by Turner et al. (2006) suggests that socio-demographic factors such as age, race, and education are significant predictors of disability caused by chronic pain. In addition the prevalence rates of chronic pain appear to be associated with a variety of social variables like gender, level of education, smoking, and poor economy (Bergman et al., 2001; Hagen et al., 2005; Saastamoinen et al., 2005). Further are certain prognostic psychosocial factors such as work conditions, depressed moods, anxiety, traumas in childhood, and a previous history of musculoskeletal pain found to be consistently related to rehabilitation outcome in individual with chronic musculoskeletal pain (Ericsson et al., 2002; Geiser et al., 2003; Vowles et al., 2004; Fillingim & Edwards, 2005; Linton et al., 2005).

According to Newth and Delongis (2004) and Anderson (2004), chronic pain is associated with a multitude of secondary stressors such as sleep disruption, unemployment and interpersonal tensions. Additionally, Svebak, Mykletun & Bru, (1994) highlight the relevance of personality in pain experience and muscle activation, suggesting a correlation between personality, emotional distress and muscle activation. This is supported by others as well, referring to an association between personality, stress sensitiveness and pain report (Matthews & Deary, 1998; Frischenschlager & Pucher, 2002; Haug et al., 2004; Newth & Delongis, 2004; Lau & Knardahl, 2008).

A recent study by Naughton, Ashworth, and Skevington (2007) highlight the role of sleep in chronic pain suffering. Further, results from study by Palermo and Kiska (2005) suggest that a relationship between the experience of chronic pain and sleep disturbance exists, and that these sleep disturbances are linked to mood disturbances and reduction in daily functioning. These suggestions are supported by Sivertsen et al. (2006) who claim that sleep disruption in general is an important predictor of subsequent disability. Moreover, previous studies suggest that negative emotions, varying in severity, including depression, anger, and anxiety are more frequently experienced by people coping with chronic pain conditions. Although depression can take many forms varying in the number and severity of symptoms, even milder symptoms of depression have been found to influence the experience of pain (Ericsson et al., 2002; Henderson et al., 2005). In addition; negative mood in general

tends to be associated with higher levels of chronic pain (Newth & Delongis, 2004). These suggestions are supported by Keough and Fisher (2001) who claim that psychosocial factors are considered to be among the most important variables that influence the total health picture. Additionally, recent studies by Kamaleri, Natvig, Ihlebæk, & Bruusgaard (2007) and Kamaleri, Natvig, Ihlebæk, Benth, & Bruusgaard (2007) suggest that functional problems increase markedly with increasing number of pain sites.

Chronic Musculoskeletal Pain, Function, and Work Ability

The influence of individual and psychosocial factors in function is believed to be stronger in persons with chronic musculoskeletal pain (Frischenschlager & Pucher, 2002; Geisser et al., 2003). In a recent study, Rudy, Lieber, Boston, Gourley, and Baysal (2003) concluded that more than 90 % of the variance in performance among disabled individuals with chronic musculoskeletal pain was predicted by psychosocial factors, with self-efficacy, perceived emotional and physical functioning, pain intensity, and pain cognition being the most important factors. Moreover, Geisser et al. (2003) maintains that individual and psychosocial factors are deemed to be of great importance in the experience of pain, cognition (thoughts, beliefs and appraisal), and in coping responses.

Previous research has rendered support to the association between individual variables and return to work rates, and to treatment outcomes in general (Nilsson et al., 2000; Holmberg, Thelin, & Stiernstrom, 2004; Suominen et al., 2005; Lotters, Franche, Hogg-Johnson, Burdorf, & Pole, 2006; Turner et al., 2006). Factors which are internal to the individuals, as well as those that are external (i.e., job stress, work place issues, health care providers' interactions, and others) have long been recognized as important determinants of function and return to work outcomes. Across studies, demographic, socioeconomic, and psychosocial variables appear to have the strongest influence on return to work rates. In prospective studies four major categories are identified: (a) medical factors (diagnosis, result of different clinical tests, previous history); (b) work-related factors (physical demands of the task, subjective appraisal of the tasks difficulty, work satisfaction, stress, monotony, support); (c) psychologically related factors (perceived pain, personality, affective variables, cognitive variables, coping strategies); and (d) socio-demographic factors (age, sex, education, ethnic background, financial compensation) (Trunchon, 2001; Krokstad, Johnsen, & Westin, 2002; Geisser et al., 2003; Saastamoinen et al., 2005; Turner et al., 2006).

Individuals respond to pressure and occupational stress in a variety of ways (Lazarus & Folkman, 1984; Antonovsky, 1991; Noyes et al., 2001; Frischenschlager & Pucher, 2002). Along with other models, the Rochester Model of work re-entry (Feuerstein, 1991) suggests that individual differences are one of several factors that are important in explaining interactions of physical factors, physical capabilities, and work tolerances in relation to work demands and the ability to manage pain and symptoms of illness (Feuerstein, 1991; Carosella, Lackner, & Feuerstein, 1994). The Rochester Model clarifies the interaction between psychosocial factors and describes how a worker's ability to return to work is influenced by his/her traits/style-, and psychosocial readiness, e.g., perception of the actual work environment and his/her expectations about returning to work (Feuerstein, 1991; Carosella et al., 1994). This is supported by Turner et al. (2006), suggesting that low recovery expectations and fears that work may increase pain are risk factors for chronic work disability. The relevance of individual differences in function and work ability, is also emphasized by Antonovsky (1979; 1987a) through the concept of individual differences with response to strain. According to Antonovsky (1979), individuals with a strong Sense of Coherence (SOC) will manage stressful experiences like chronic musculoskeletal pain and work disability and have good health. However, SOC conceptualized as a personality characteristic, seems to be changeable over time due to socialization processes (Antonovsky, 1987a; Smith et al., 2003; Höge & Bussing, 2004).

Substantial attention has been paid in recent years to the relationship between Sense of Coherence, health, and work. A significant relationship is identified between Sense of Coherence and several work related factors; SOC and sick leave process (Falkdal, Edlund, & Dahlgren, 2006), disability pension (Suominen et al., 2005), work and well-being (Virtanen & Koivisto, 2001), work attitudes (Axelsson, Andersson, Håkansson, & Ejlertsson, 2005), work stressors and strain (Kivimäki et al., 1998; Höge & Büssing, 2004), profession or kind of employment (Lundberg & Nyström Peck, 1994), and quality of work (Volanen et al., 2004). In addition SOC is found to be useful in the prediction of pain (Callahan & Pincus, 1995; Schult, Söderback, & Jacobs, 2000; Veenstra et al., 2005). This illustrates how SOC is associated with work-related psychosocial factors and social support, (Larsson & Kallenberg, 1996; Nilsson et al., 2000; Holmberg et al., 2004), and clarifies how SOC might be a relevant variable in chronic illness care (Veenstra et al., 2005).

Traditional (symptom) treatments that aim to reduce pain seem to be insufficient dealing with the complex phenomenon of chronic musculoskeletal pain. Successful interventions for achieving sustainable function and return to work must therefore address

factors that exist outside of the individual, as well as those that are in the individual (Linton et al., 2005; Sullivan et al., 2005; McCracken et al., 2006; Lillefjell et al., 2006). Several studies demonstrate that severely disabled patients with chronic musculoskeletal pain can show significant benefits following multidisciplinary rehabilitation. This benefit includes reduction in symptoms such as pain-related distress, physical and psychosocial disability, depression, and anxiety (Sullivan et al., 2005; McCracken et al., 2006; Lillefjell et al., 2006).

1.2.4 Measuring Pain, Function, and Work Ability

Pain, function, and work ability are multidimensional concepts which may relate to physical, mental, cognitive, social, economic or environmental factors (Engel, 1977; Geisser et al., 2003; Linton et al., 2005; Ilmarinen, 2006; Krohne & Brage, 2006). The biopsychosocial model, based on system theory thinking (Engel, 1977; Trunchon, 2001; Malmgren, 2005; Sullivan et al., 2005; White, 2005), is frequently employed in research on function and work ability and cited as a unifying theory to explain outcomes (Schultz, Crook, Fraser, & Joy, 2000; Malmgren, 2005; Wigers & Finset, 2007).

Several promising methodological techniques, based on various theoretical foundation (Melzack 1973; Antonovsky, 1979; Zigmond & Snaith, 1983; Costa & McCrae, 1992; White, 2005), have been used to measure function and work ability (Ilmarinen, 2006; Krohne & Brage, 2007) and to identify those at higher risk of subsequent disability (Waddell, Burton, & Main, 2003; Boersma & Linton, 2005; Linton et al., 2005; Krohne & Brage, 2007). Most instruments used in social science rely on self-reporting of feelings, attitudes, and behaviour by people in an interview situation or in response to a self-administrated questionnaire. Self-reporting measures, as used in this thesis, are essential for research because of the need to obtain subjective assessments of experiences (e.g., feelings about levels of pain, anxiety, depression, function, and health), and because the respondent has to be recognized as the best judge of his/her own health. These assessments have a broad appeal as they are often quick to administer and involve little interpretation by the investigator. Most measures of functional disability are self-reported methods, where the respondents are asked to report limitations on their activity.

There are many measures of functional ability. Some measures that narrowly focus on a range of mobility, domestic and self-care tasks, however often ignore financial, emotional, and social needs which may be equally important (Krohne & Brage, 2006). Although, it should be kept in mind that whenever evaluating constructs such as pain, function, or work

ability, one cannot assume that there will be one "gold standard" which will be the most reliable or valid measure (Gatchel, 2004). Rather, a multidisciplinary approach has usually to be employed in evaluations. This will provide potentially greater reliability in the self-assessment of pain, function, and work-ability (Ilmarinen, 2006). In this thesis a broad range of self-reporting measures, based a multidimensional system theory thinking (Engel, 1977; Antonovsky, 1979; 1987a; Ilmarinen, 2006; Eriksson, 2007), were used at three points in time during the rehabilitation period, and at a one year follow-up measurement in order to capture the processes and describe the complexity of factors involved in chronic non-specific musculoskeletal pain conditions, function, and work ability.

Pain assessments

Efforts to develop and refine a simple but useful way to measure pain subjectively have resulted in the visual analogue scale for pain measurement. A Visual Analogue Scale (VAS) is a instrument that tries to measure a characteristic, experience or attitude (or behavioural phenomena) that is believed to range across a continuum of values and cannot easily be directly measured (Wewers & Lowe, 1990). A VAS for pain measurement consists of a straight line, with labels for the extremes of pain intensity (e.g., no pain and unbearable pain) at either end. The participants/patients are asked to make a mark on the line indicating the current level of pain intensity. The utility of the visual analogue scale for pain has been enhanced in various ways over time, including the addition of verbal, numerical, or graphical anchors to help participants/patients to decide how to rate the pain. The visual analogue scale for pain has become one of the most frequently used measures of pain intensity, and has also been used in creative ways to further explore the phenomenon of pain perception and reporting, in addition to explore other health related phenomena like e.g. emotional distress, sleeplessness, tiredness, and life demands (Bowling, 1997; Haugli et al., 2001; Hunter, 2001; Zanoli, Strömquist, & Jonsson, 2001; McGeary et al., 2006; Wigers & Finset, 2007). The VAS measure has been found to be a reliable and valid instrument to measure pain and other health related phenomena (Bowling, 1997; Haugli et al., 2001; Wigers & Finset, 2007). More specific information about the VAS scale is presented in the Material and Methods section.

Functional Health Status assessments

In order to measure health and functional status, a large number of questionnaires have been developed and used (Bowling, 1997; Bentsen, Natvig, & Winnem, 1997; Ilmarinen, 2006: Krohne & Brage, 2006; 2007). In the functional health status measurement COOP/WONCA

charts, functional status represents the level of actual performance or capacity to perform, both in the sense of self-care or being able to fulfil a task or role at a given moment or during a given period. Function refers to the ability of a person to cope with and adapt to the changing elements in his or her individual environment, and to perform certain tasks to a measurable degree (WONCA Classification Committee, 1990). As in the biopsychosocial model (Engel, 1977), functional status is an aspect of health. Using the health promotion definition of WHO (Ottwa Charter for Health Promotion, 1986), "…an individual or group must be able to identify and to realize aspirations, to satisfy needs, and to change or cope with the environment…", the concept of health promotion by WHO and the operational concept of functional status begin to approach one another by seeing health as a process, enabling people to improve their health and increase their control over everyday life (Kickbusch, 1986).

The original COOP/WONCA charts have been tested against other "functional status" questionnaires in use, and the validity has been found to be satisfactory (Bowling, 1997; Bentsen, Natvig, & Winnem, 1999). A test-retest study of Bentsen et al. (1999) confirms the qualities of the charts, demonstrating good validity and reliability. By covering the domains; physical (fitness and daily activities), mental (emotions), social (social contacts), and above that general health and change in health status (Bentsen et al., 1999), the COOP/WONCA questionnaire is both clinically and research relevant and gives important information about somatic-, psychological-, and social functional capacity. In addition there are no limitations in the measurement concerning age, gender, ethnic, religious, or cultural characteristics of the individual (Bentsen et al., 1999). More specific information about the COOP/WONCA scale is presented in the Material and Methods section.

Sense of Coherence assessments

According to Blaxter (1990), it is possible to define health as coexisting with disease. The Sense of Coherence (SOC) construct reflects a person's capacity to respond to stressful situations, not unlike Lazarus concept of stress appraisal (Lazarus & Folkman, 1984). Antonovsky (1979; 1987a) states that SOC describes an individual's orientation to life and internal strength. "The nature of a person's response to a stressful situation may lead to pathogenic stress or salutogenic tension management" (Antonovsky 1979; 1987a). SOC seems to have a main, moderation, or mediating role in the explanation of health (Lindström & Eriksson, 2005; Eriksson & Lindström, 2006). Furthermore, SOC seems to be able to predict health, and high scores on SOC seem to be an important contributor to the development and maintenance of people's health. However, SOC alone does not explain the

overall health (Eriksson & Lindström, 2006). The Sense of Coherence measure (Antonovsky, 1979) has been used in a wide variety of studies (Kivimäki et al., 1998; Nilsson et al., 2000; Volanen et al., 2004; Hansen et al., 2006) to explain health and work ability. The SOC measure seems to be a reliable, valid, and cross-culturally applicable instrument to measure how people manage stressful situations and stay well (Eriksson & Lindsstöm, 2006; Eriksson, 2007; Feldt et al., 2007). More specific information about the SOC scale is presented in the Material and Methods section.

Anxiety and Depression assessments

Emotions play an important part in most chronic health problems and numerous scales have been developed and used all over the world for the detection of emotional distress (McDowell & Newell, 1996; Bowling, 1997). The Hospital Anxiety and Depression Scale (HADS), developed in the setting of an hospital medical outpatient clinic by Zigmond and Snaith (1983), is a brief and widely used instrument to measure psychological distress in chronic pain patients. In the development of the HADS, items related to emotional and physical disorders (e.g., headaches) were excluded. Zigmond and Snaith (1983) aimed to distinguish between the concept of anxiety and depression and items included were based solely on the psychical symptoms and neurosis.

Unlike most other self-assessment scales, the HADS is not derived from factor analysis but from clinical experience. However, factor analyses in subsequent studies indicated that items could be grouped according to the two main constructs; anxiety and depression. Mykletun, Stordal, and Dahl (2001) suggest, in a large population study, that the Hospital Anxiety and Depression Scale is established as a widely applied and convenient self-rating instrument for anxiety and depression in individuals with both somatic and mental problems. More specific information about the HAD scale is presented in the Material and Methods section.

1.3 Description of the multidisciplinary rehabilitation programme

The empirical study (Papers I-IV) included in this thesis was conducted within the context of a multidisciplinary rehabilitation programme at Friskgården (described in Table 1). The multidisciplinary rehabilitation programme is based on a biopsychosocial perspective (Engel, 1977; Feuerstein, 1991; Trunchon, 2001; WHO, 2001; Wigers & Finset, 2007), assuming that biological, psychological, and social factors are interwoven in the context of chronic disease. The programme focuses on the rehabilitation of function and work ability as a subjective process involving individual factors such as functional capacity, competence (knowledge and skills), values and motivation, as well as the work environment. As an integrated approach, the rehabilitation programme also extends outside the work environment to factors that are known to influence work ability such as family, friends and relatives and the broader social and policy environment.

Inspired by elements of salutogenic thinking (Antonovsky, 1979; 1987a; 1987b; Eriksson, 2007), the multidisciplinary rehabilitation programme, developed for individuals on sick leave with complex musculoskeletal disease conditions, has a significant focus on strengthening existing recourses; both internal and external, to create new one's, and to make them available for the participants to be aware, identify and benefit from them.

Functional restoration in pain management has been widely studied, and a large body of research has indicated high rates of success measured in improved function and work ability (Haugli et al., 2001; Guzman et al., 2004; Vowles et al., 2004; Sullivan et al., 2005; McGeary et al., 2006; Wigers & Finset, 2007). Additionally a great body of literature indicates that physical exercise interventions, with a primary focus on improvement of functioning instead of pain relief, might be effective to improve function and return to work (Staal et al., 2005; Pedersen & Saltin, 2006; Braathen, 2007; Wigers & Finseth, 2007).

The multidisciplinary rehabilitation programme places a strong emphasis on function and work ability and combines exercise progression with disability management and psychosocial intervention. All participants get a personal supervisor, and individual counselling is offered during the rehabilitation period. What separate this multidisciplinary rehabilitation programme from several other working skill programmes is primarily the inclusion of elements from both health, education, and working life (qualifying measures to help people to gain and retain suitable work), where a personal supervisor at the rehabilitation centre together with each participant, coordinate the individual rehabilitation process. The follow-up programme, offered after finishing the 57 week rehabilitation period, is also an

important element in the rehabilitation process. In addition to daily routines at the rehabilitation centre (Table 2, p. 27) the participants, along with their supervisor, initiate and participate in meetings with the doctor, employer, employment-, and social security office (From 2006 the Norwegian Labour and Welfare Organization (NAV)) (St. meld. nr. 14, 2002-2003; NOU, 2004:13) as a part of the rehabilitation/work re-entry plan. In fact a considerable part of the rehabilitation takes place at each individual's workplace as workplace-based interventions. In accordance with a biopsychosocial approach, the rehabilitation programme also highlights the importance of the local environment. All the participants are out-patients, and the families of the participants are invited to participate in information meetings at the rehabilitation centre. Follow-up training is also localized in the participant's local community with a view to maintain or improve daily life functioning.

Based on a salutogenic thinking (Antonovsky, 1979; Eriksson, 2007), the main aims of the implemented rehabilitation programme (Table 1), were to increase functional capacity, decrease affective distress, educate the participants in the positive health process, and increase the return to work rates. The fundamental philosophy at Friskgården is that every individual is responsible for his/her own life, and for the directions he/she chooses. The thoughts and the content in the programme is aiming at changing the direction of the individual's focus from pain and disability to an increased awareness of his/ her own resources, potentials and competence (Antonovsky, 1979). The rehabilitation programme attempt to guide the individual's towards becoming aware of the relation of body reactions to cognitive, affective and psychological factors, and to help the individual's to find skills within them selves that enable them to change the way they cope with pain and disability in daily life. A personal rehabilitation plan, based on mapping (using standardized instruments and interviews), is formulated at the end of the first period (5 weeks) (see Table 1). The Social Security Office funded the rehabilitation period by purchasing health services.

Table 1: Content of the multidisciplinary rehabilitation programme

Period	Intervention	Duration
Period I: Mapping of the participants resources/ intensive training period	• Introduction to the rehabilitation programme and the philosophy of Friskgården. • Mapping physical-, psychological-, and social functioning (personal capacity) using 1. Standardized instruments; VAS, HADS, SOC and COOP-WONCA and 2. Personal interviews. • Individual counselling-based on the mapping and interviews; focus on strengthening existing recourses in preparation of a long-term plan for the rehabilitation process in cooperation with their GP, social security office (today`s NAV) and the employer. • Individual and group based training to improve personal capacity/strengthening existing recourses: 1. Individual exercise programme with focus on e.g., endurance, strength, mobility, and relaxation techniques, 2. Group-based education/training in different health related subjects like e.g., body structure, diet, exercise planning, coping strategies, communication, strategies for conflict negotiations, and information about the social security system, 3. Indoor and outdoor activities every day.	6h/day, 4 days a week in 5 weeks
Period II: Follow-up training/ rehabilitation period	• Mapping physical-, psychological-, and social functioning (personal capacity) using VAS, HADS, SOC, COOP-WONCA, and personal interviews at the start and at the end of period II. • Functional capacity training (individual and group-based, indoor/outdoor, education) continues. • Individual counselling; assisting the patient in the rehabilitation process, coordinate the rehabilitation process, inform about recourses and limitations in use of policy instruments. • Workplace visit; mapping personal recourses in interaction with the work environment, work training. • Clarify function and work-ability based on the mapping, work place-based intervention. • Return to work planning in cooperation with the employer and other collaboration partners.	6h/day, 1-3 days a week in 52 weeks
During/after finishing the rehabilitation period	• Follow-up activities: In addition to the regular rehabilitation programme (57 weeks), the rehabilitation centre offers group-based education/training like e.g., endurance groups, water activity groups, and relaxation training groups in the participant's local community in order to maintain or improve functioning in daily life.	1h/1-3 days a week – continuous offer

2 Aims of the thesis

The aims of this thesis were to investigate the influence of individual and environmental factors in pain, function, and work ability as well as to investigate the role of individual and environmental factors in treatment outcome in individuals with CNOMP conditions, participating in a multidisciplinary rehabilitation programme.

2.1 Specific research questions

- Does the applied multidisciplinary rehabilitation programme have any effect on pain and function in daily life in individuals with chronic non-specific musculoskeletal pain? (Paper I)
- Which factors can predict pain, pain experience and functional health status in patients with chronic non-specific musculoskeletal pain? (Paper I)
- Are there gender differences in the location and severity of chronic non-specific musculoskeletal pain? (Paper II)
- Are there differences in demographic- and socioeconomic characteristics and in various health-related variables in present group of work-disabled men and women? (Paper II)
- Are there differences in the way pain affects the treatment outcome in terms of self-reported functional health status in men and women with chronic musculoskeletal pain? (Paper II)
- Are there gender differences in the way psychosocial factors may interact to influence treatment outcome in the work-disabled with chronic non-specific musculoskeletal pain? (Paper II)
- What are the most important predictors of Sense of Coherence (SOC) in individuals with chronic non-specific musculoskeletal pain? (Paper III)
- Is there any enhancement in Sense of Coherence scores during the rehabilitation period in individuals with chronic non-specific musculoskeletal pain? (Paper III)
- Is Sense of Coherence (SOC) useful in the prediction of work re-entry in individuals with chronic non-specific musculoskeletal pain? (Paper III)

- Are individuals physical and psychosocial functioning related to work ability in chronic non-specific musculoskeletal pain conditions? (Paper IV)
- How does the complexity of socio-demographic-, socio-economic-, physical-, and psychosocial factors interact and influence the work ability in individuals with chronic non-specific musculoskeletal pain, participating in a multidisciplinary rehabilitation programme? (Paper IV)

3 Material and methods

This thesis includes a prospective follow-up study of individuals with chronic non-organic musculoskeletal pain (CNOMP), participating in a multidisciplinary rehabilitation programme, presented in four empirical papers (Papers I-IV). Additional data from the Nord-Trøndelag Health Study (HUNT) is included in order to compare the CNOMP sample with the normal population from the same geographical area.

This section includes a description of the study design, additional data included, subjects, ethics, study instruments and procedures as well as a description of the statistical analysis included in all four papers.

3.1 Design and treatment programme

The study was a prospective follow-up study. Participants were assigned to the rehabilitation programme by their GP's based on interviews, observations, and clinical tests. In cooperation with the National Health Insurance Office (today's NAV), the GP's recruited participants continuously into the 57 week rehabilitation programme.

Inclusions criteria for participation in the rehabilitation programme were that the participants had to have national insurance benefit in the form of sickness benefit or rehabilitation benefit, and have mixed chronic pain problems. In cooperation with the Public Health Services, National Health Insurance Office, Employment office (today's NAV) (NOU 2004:13; NAV, 2008), and employer an individual tailored rehabilitation programme was conducted. The rehabilitation programme (see Table 1 and 2) included both individual counselling and group-based treatment. The programme consisted of a 5-week intensive period, where the participants attended approximately 6h/day, 4 days a week, and a follow-up period of 52 weeks, were the participants attended approximately 6h/day, 1-3 days a week.

The regular drop-out rate from the rehabilitation programme is calculated to 6 %, of whom the majority of the drop-outs are men. The drop-outs are characterized by a mean age of 35 (SD = 5), that they simultaneously to assignment to the multidisciplinary rehabilitation programme had a referral to traditional medical examinations and/or treatment, and that themselves characterized their problems as non-complex with no psychological aspects. There were no drop-outs from the rehabilitation programme during the present investigation period

of 21 months. However, the follow-up questionnaires distributed one year after the participants completed the 57 week rehabilitation period (Paper I) showed that men was overrepresented in the drop-out group, reporting significant more sleep disturbance and tiredness in daily life compared to the non-dropouts. No other differences were found between the non-dropouts and the drop-outs.

The aims of the present study were to examine characteristics of the individuals with chronic non-specific musculoskeletal pain as well as to examine how these characteristics might affect the function and the ability of those individuals to re-enter the workforce, conducted in a real clinical setting.

Table 2: Daily routines at the rehabilitation centre

When	What	Where
09.15-09.30	Time of arrival	
09.30-10.00	Information, social gathering with tea/coffee	Dining hall
10.00-11.00	Individual exercise programmes with focus on e.g., endurance, strength, mobility, and relaxation techniques. Individual counselling by physiotherapists, occupational therapists or others.	Indoor exercise area
11.00-12.00	Group-based education/training in different health related subjects like e.g., body structure, diet, exercise planning, coping strategies, communication, strategies for conflict negotiations, and social security system.	Teaching room and group rooms.
12.00-12.30	Lunch (wholesome home-made food)/social gathering	Dining hall
12.45-14.00	Individual and/or group-based exercise programmes with main focus on endurance capacity e.g., walking, jogging, bike riding, cross-country skiing, paddling, outdoor life activities	Outdoor activities in the local area
14.00-15.00	Group-based mobility and relaxation training/relaxation techniques, individual counselling with personal supervisor	Indoor relaxation training area Supervisor's office
15.00-	Finish day at the rehabilitation centre	

Additional data included in the study:

Nord-Trøndelag Health Study (HUNT study)

Data from the Nord-Trøndelag Health Study (HUNT) was included in order to compare the CNOMP sample with the normal population from the same geographical area. HUNT is one of the largest health studies ever performed, and is a unique database of personal and family medical histories, collected in two intensive studies. HUNT 1 was carried out in 1984-1986 to establish the health history of 75,000 people. HUNT 2 was carried out to study the evolution of the health history of 74,000 people in 1995-1997, including blood sample collection from 65,000 people organized in a bio-bank database containing genetic information. About 75 % of the population in Nord-Trøndelag County participated in the HUNT study during its two periods (Holmen et al., 2003).

The population in Nord-Trøndelag County is stable, with a net out migration of 0.3 % per year (1996-2000), and homogeneous (less than 3 % non-Caucasian), making it suitable for epidemiology. In many respects, Nord-Trøndelag County is a representative sample of Norway. This is a fact concerning geography, economy, industry and sources of income, age distribution, morbidity and mortality. However, the county lacks a large city, and the level of education is somewhat lower than the national average, as is also the average income. Details of this comprehensive health study, covering a wide rage of topics, are described elsewhere (Holmen et al., 2003). A new survey, HUNT 3, commenced September 2006 and will be carried out in 2006-2008. In connection with HUNT 3, an extensive research project on chronic pain is planed for the next five years. This chronic pain research project is initiated by researchers at the HUNT Research Centre, Verdal, NTNU, and St. Olavs Hospital in Trondheim.

3.2 Subjects

The present investigations include data from participants at a rehabilitation centre in central Norway during a period of 21 months. Inclusion criteria for the study were; male/female, age 20-67, chronic non-specific musculoskeletal pain for 3 months or more, chronic pain in one location or more, and receiving temporary public benefit. Prospective data from a total of 178 participants; aged 20-67 was collected, representing all participant in the rehabilitation programme in the given period. All participants completed the rehabilitation period, but ten

participants were lost from follow-up analyses because they forgot to complete all questionnaires. The total sample, included for all analyse purposes, therefore consisted of one hundred and sixty eight participants (n = 168) with a mean age of 45 (SD = 9.0), of whom there were sixty males (mean age = 46.28/*SD* = 9.18) and one hundred and eight females (mean age = 45.15/*SD* = 9.05).

All participants attended in a 57 week multidisciplinary rehabilitation programme. In order to ensure the representativeness of present sample, all women and men with CNOMP seeking help at the rehabilitation clinic in a given period were included. The participants had a history of long-term (>3 months) chronic musculoskeletal pain prior to entering the rehabilitation programme. Mean duration of pain was 15 years (ranging from 3 months to 37 years) where lower back, shoulders, and neck were the most common pain location in these individuals. The majority of the participants, approximately 90 %, reported pain in more than two locations. The participants represented a mix of white-collar (23.8 %) and blue-collar (76.2 %) workers. Examples of the most common jobs in the sample were: craftspeople, industrial workers, production workers, office workers/clerical assistants, cleaning staff, shop assistants, and positions in the health and/or social service. Further characteristics of the participants are presented in Table 3 below.

In order to compare the study sample with a general population sample from the same geographical area, data from the Nord-Trøndelag Health Study (The HUNT 2 Study) were used (see Table 3). The adult population, aged 20-67 when answering the questionnaire (*n* = 52 186), from the same geographic area, consisted of 47.5 % men and 52.5 % women, with a mean age of 43.71/*SD* 12.7. The response in the HUNT 2 study was 70 %, which is considered satisfactory for a general population survey. A comparison of the pain sample and the general population from the same geographical area showed that the samples are almost identical with regard to age distribution, family situation, social network, and education level.

Table 3: Initial characteristics of the chronic musculoskeletal pain sample (*n* = 168) and the Nord-Trøndelag Health Study - HUNT 2 population (*n* = 52 186) age 20-67 year.

Characteristic	*n* = 168	*n* = 52 186
Age (mean/ SD)	45.71/ 9.0	43.71/ 12.7
Gender (% females)	64.3	52.5
Family situation (% single, solitary)	26.8	28.3
Earlier traumas in family (%)a	48.8	-
Traumas in childhood (%)a	34.5	-
Sleeplessness (%)	65.5	31.3
Tiredness (%)	69.6	45.5
Smoking (%)	45.2	36.6
Poor Social network (%)	16.7	17.5
Poor Economy (%)	34.5	15.5
Education level: (%)		
Primary school	30.1	29.1
Technical/ vocational school 1-2 year	47.6	37.1
High school	8.4	10.9
College/university<4 years	12.7	14.1
College/university>4 years	1.2	8.8

Note. a = not measured in the HUNT 2 population, for further descriptions of the variables included in Table 3, see page 38-39.

3.3 Ethics

The study was performed in agreement with the Declaration of Helsinki, and approved by the Norwegian Social Science Data Service (NSD) and the Regional Committee for Medical and Health Research Ethics (REK) of Midt- Norway. All participants were volunteers and gave their informed written consent.

3.4 Instruments and procedures

An important issue in research is to select instruments that are in accordance with the research questions. The question of validity draws attention to how far a measure really measures the concept that it purports to measure (Bryman & Cramer, 2001). Validity can be divided into different types of validity, however all types of validity are addressing the same issue of the degree of confidence that can be placed on the inferences drawn from scale scores (Bowling, 1997; Ringdal, 2001; Benestad & Laake, 2004). The assessment of validity involves assessment against a standard criterion, and factor analysis is an increasingly used technique

for this assessment (McDowell & Newell, 1996; Bowling, 1997; Kinnear & Colin, 2000).

A measure is judged to be reliable when it consistently produces the same results, particularly when applied to the same subjects at different periods of time when there is no evidence of change (Bowling, 1997). Item correlations and Cronbach alpha coefficients are often computed to test the reliability and the internal consistency of the different scales (Cronbach, 1951). Typically, the alpha coefficient should fall within a range of 0.70 to 0.90 for narrow constructs such as those defined in this thesis (Powell, 1995). Details concern the validity and the reliability of the instruments used in present study is further described below and in the original papers (I-IV) in the thesis.

Instruments used in present study were all tested in a pilot study, funded by the Norwegian Foundation for Health and Rehabilitation (Ramberg, 2002-2004). Concepts and statements were systematically discussed in workshops among the counsellors, other professionals with research competence, and client representatives that together constituted the steering committee. Moreover the instruments were tested on individuals with CNOMP, participating in the same multidisciplinary rehabilitation programme as those included in present study. The participants in the pilot study were asked to complete the questionnaire as well as to contribute comments to the questionnaire. This dialogue was particularly important in order to sharpen both the questions to be asked and the respond alternatives, to make them as unambiguous and precise as possible.

In present study a battery of self-reporting measures was administrated to the participants. The instruments used, assessing functioning in relation to health conditions, personal and environmental factors (Engel, 1977; Antonovsky, 1979; Zigmond & Snaith, 1983; Bentsen et al., 1997; Bowling, 1997), are the same instruments which are included in the daily practice at the rehabilitation centre. All measures were completed at four points in time; at the start of the rehabilitation programme (baseline), after 5 weeks of intensive treatment, at the end of the 52 week follow up rehabilitation period (totally 57 week rehabilitation period), and at a 1 year follow-up (109 weeks, only included in Paper I). In addition, and as a part of the routines at the rehabilitation centre, the participants reported background information during personal interviews at the start and at the end of the rehabilitation period.

Variables for analysis (see Figure 2 below and Table 4, p. 40) were selected in accordance with a multidimensional theoretical approach, where human functioning and its complementary notion disability are understood as experiences of people in the context of their personal recourses, in relation to health conditions and in interaction with the

environment (Engel, 1977; Antonovsky, 1979; Feuerstein, 1991; WHO, 2001; Ilmarinen, 2006). The selection of variables for analysis was also based on prior research indicating the dynamic interaction of individual and environmental factors in treatment outcome in individuals with chronic non-specific musculoskeletal pain (Antonovsky, 1979; 1987a; Matthews & Deary, 1998; Feuerstein, Nicholas, Huang, Dimberg, Ali, & Rogers, 2004; Vowles et al., 2004; Saastamoinen et al., 2005; Shaw et al., 2005; McGeary et al., 2006; Eriksson, 2007; Kamaleri et al., 2007; Braathen et al., 2007; Wigers & Finset, 2007). For more throughout descriptions of the variables included in general see page 33-40. For specific information about the variables on function/work ability (SOC, HADS, VAS, COOP WONCA) included in Figure 2 below, page 33-38 should be consulted.

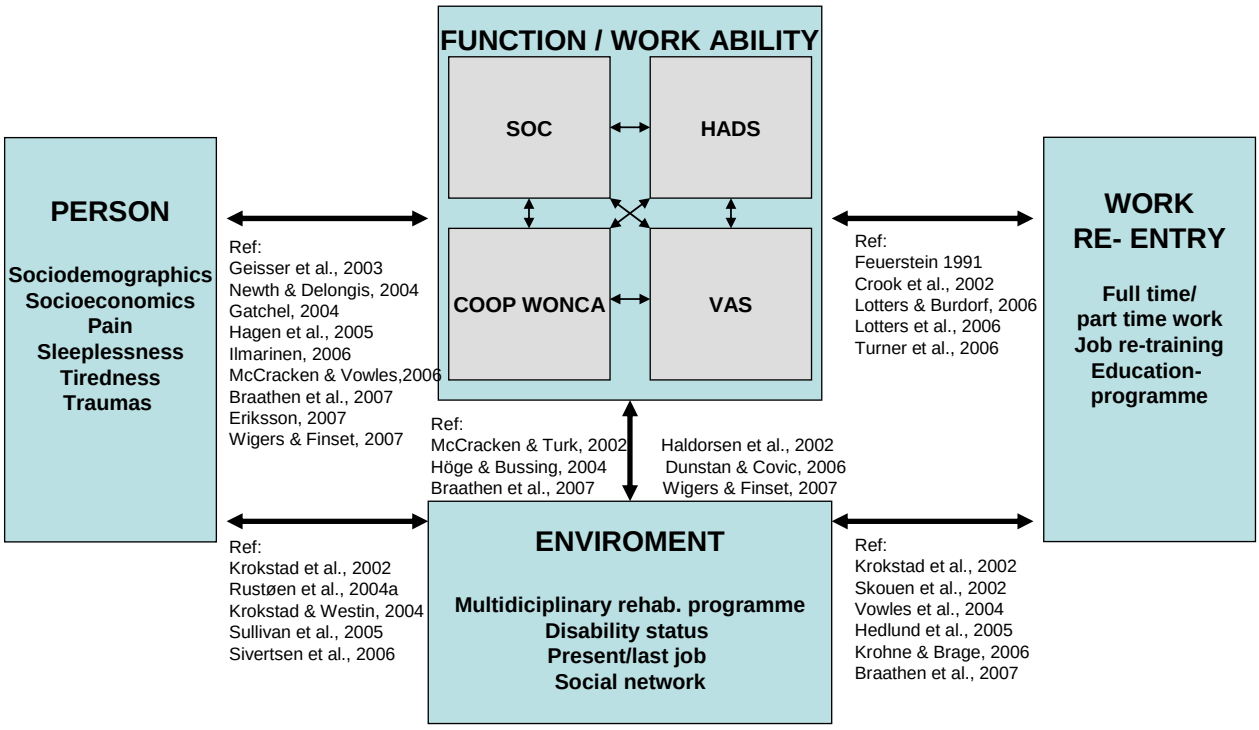

Figure 2: Variables included in present study, with theoretical and/or empirical relevance in enabling individuals with chronic musculoskeletal pain to improve function, work ability and work re-entry.

Several models based on different theoretical and empirical foundations, are made in attempt to explain the associations between individual and environmental factors in work re-entry in individuals with chronic musculoskeletal pain, and several of these models try to explain the risk factors for disease (Brannon & Feist, 1997; Espnes & Smedslund, 2001;

Steihaug, 2003; 2007). However, a multidimensional theoretical approach, understanding chronic pain, function (recourses), and work ability, implies enabling people to manage tension, to reflect about their external and internal recourses, to identify and mobilize them, and to promote effective coping by finding solutions and resolve tension (Engel, 1977; Antonovsky, 1979; WHO, 2001; 2008).

Although the awareness of the complexity of this phenomenon and the importance of cultural-, political-, and work environmental variables, also involved in the understanding of function, work ability and work re-entry, it was beyond the scope of this study to include all variables of relevance.

The measures used in present study were as follows:

Visual Analogue Scale (VAS) for Pain and Function Assessments

Based on a salutogenic view and the main elements of Generalized Resistance Resources (GRR) (Antonovsky, 1979; 1987a; Eriksson, 2007), pain and health related phenomena were measured using the Visual Analogue Scale (VAS) (Wewers & Lowe, 1990; Bowling, 1997; McGeary et al., 2006). The scale is a line of 10 cm on which marks are scored in millimetres, representing the continuum of the symptom to be rated. The VAS variables were individually measured and scored in millimetres (0-100). The participants were asked to rate the present condition/symptoms. The VAS is a tool widely used for the assessment of subjective phenomena. In order to operationalize the main elements physical-, emotional-, cognitive-, and coping resources as well as to measure pain intensity, pain experience, and quality of life, several VAS variables were required:

1. **Pain** - On a scale from 0-100 where 0 is "*no pain"*and 100 is *"unbearable pain"*- how much pain do you have at present? (Wewers & Lowe, 1990; Vowles et al., 2004; McCracken, et al., 2006; Wigers & Finset, 2007).
2. **Pain experience** - On a scale from 0-100 where 0 is *"not troublesome at all"* and 100 is *"extremely troublesome"*-how troublesome do you experience the pain to be in every day life? (Wewers & Lowe, 1990; Geisser et al., 2003; Rudy et al., 2003, Gatchel, 2004; McCracken & Vowles, 2006).
3. **Muscle strength** - On a scale from 0-100 where 0 is *"extremely poor"* and 100 is *"extremely good"* -how do you consider your muscle strength to be? (Staal et al., 2005; Pedersen & Saltin, 2006; Braaten et al., 2007).
4. **Endurance capacity** – On a scale from 0-100 where 0 is *"extremely poor"* and 100 is *"extremely good"* -how do you consider your endurance capacity to be? (Staal et al., 2005; Pedersen & Saltin, 2006; Braaten et al., 2007).

5. **Energy** – On a scale from 0-100 where 0 is *"extremely little energy"* and 100 is *"extremely energetic"* -do you feel energetic? (Costa & Mc Crae, 1992; Matthews & Deary, 1998; Newth & Delongis, 2004).
6. **Mobility** – On a scale from 0-100 where 0 is *"very limited flexible"* and 100 is *"very flexible"* - how flexible do you consider your muscles and joints to be? (Staal et al., 2005; Pedersen & Saltin, 2006; Braaten et al., 2007).
7. **Balance** – On a scale from 0-100 where 0 is *"extremely poor"* and 100 is "*extremely good"* - how do you consider your balance to be? (Staal et al., 2005; Pedersen & Saltin, 2006; Braaten et al., 2007).
8. **Good feeling inside** – On a scale from 0-100 where 0 is *"very rare"* and 100 is "*very often"* - do you usually have a good feeling inside? (Keough & Fisher, 2001; Newth & Delongis, 2004).
9. **Mood** - On a scale from 0-100 where 0 is *"very bad mood"* and 100 is "*very good mood"* – how do you consider your mood to be? (Matthews & Deary, 1998; Newth & Delongis, 2004; Michaelson et al., 2004, Palermo & Kiska, 2005).
10. **Feeling valuable** – On a scale from 0-100 where 0 is *"very little valuable"* and 100 is "*of great value"* – do you consider yourself as a valuable person? (Newth & Delongis, 2004).
11. **Extrovert/introvert** – On a scale from 0-100 where 0 is *"very introvert"* and 100 is "*very extrovert"* – do you all in all consider yourself as an extroverted or an introverted person? (Costa & McCrae, 1992; Matthews & Deary, 1998; Malt et a., 2002; Schimmack et al., 2004).
12. **Optimistic/pessimistic** – On a scale from 0-100 where 0 is *"very pessimistic"* and 100 is "*very optimistic"* – do you usually consider yourself as optimistic or pessimistic? (Costa & McCrae, 1992; Newth & Delongis, 2004; Michaelson et al., 2004; Lau & Knardahl, 2008).
13. **Calm and balanced** – On a scale from 0-100 where 0 is *"very little calm and balanced"* and 100 is "*very calm and balanced"* – do you consider yourself as a calm and balanced person? (Antonovsky, 1979; Costa & Mc Crae, 1992; Newth & Delongis, 2004).
14. **Feeling of coping in daily life** – On a scale from 0-100 where 0 is *"not any better"* and 100 is "*much better"* – do you believe you can cope better in daily life in the future compared with how you cope to day? (Antonovsky, 1979; Kivimäki et al., 1998; Nilsson et al., 2000; Geisser et al., 2003).
15. **Control and influence in daily life** – On a scale from 0-100 where 0 is *"no control and influence"* and 100 is *"total control and influence"* – do you consider yourself to have control and influence in daily life? (Antonovsky, 1979; Geisser et al., 2003; Newth & Delongis, 2004; Michaelson et al., 2004).
16. **Concentration** – On a scale from 0-100 where 0 is *"very bad"* and 100 is "*very good"* – how do you consider your power of concentration to be? (Geisser et al., 2003).
17. **Memory** – On a scale from 0-100 where 0 is *"very bad"* and 100 is "*very good"* – how do you consider your ability to remember to be? (Geisser et al., 2003).
18. **Understanding and evaluation of information** – On a scale from 0-100 where 0 is *"very bad"* and 100 is "*very good"* – how do you consider your ability to understand and evaluate information to be? (Geisser et al., 2003).
19. **Knowledge** – On a scale from 0-100 where 0 is *"no knowledge at all"* and 100 is "*considerable knowledge"* – how do you consider your knowledge, regarding possibilities for the future, to be? (Geisser et al., 2003).
20. **Self-reported quality of life** - On a scale from 0-100 where 0 is *"very bad"* and 100 is "*very good"* – how do you consider your quality of life to be? (Antonovsky, 1979; Eriksson, 2007).

The VAS variables were individually measured as presented above, and treated both as individual variables (Paper I-IV) and as sum scores (Paper I, IV) in the analysis. In order to link variables together into main factors, factor analysis was carried out. Criterions for the analysis were: (1) Variables which appear on the same factor should be correlated, and have a

correlation coefficient larger than 0.3, and (2) variables which are uncorrelated should not appear on the same factor. Analysis were first carried out by criterion 1, and then by criterion 2.

The factor analysis (varimax method), extracted with eigenvalues > 1.00 as a criterion (Kinnear & Colin, 2000), indicated that items could be grouped according to the intended constructs presented below: physical function (muscle strength, endurance capacity, energy, mobility, balance), psychological function (good feeling inside, mood, feeling valuable, extrovert/introvert, optimistic/pessimistic, calm and balanced), coping (feeling of coping in daily life, control and influence in daily life), cognitive function (concentration, memory, understanding and evaluation of information, knowledge). Pain intensity, pain experience and self-reported quality of life were treated as individual variables. When referring to the main constructs of VAS, the concepts of *function* and *capacity* are defined and used equally (page viii).

The use of the VAS in chronic pain samples is well established (Bowling, 1997; Zanoli et al., 2001; Hunter, 2001; McGeary et al., 2006; Wigers & Finset, 2007), with a reproducibility coefficient shown to be good (.75 - .83) (McDowell & Newell, 1996). The internal consistency (Cronbach, 1951) in this study for the VAS variables on function (group level comparisons), showed Cronbach`s coefficient alpha of .76. The internal consistency for the main constructs varied across the different studies as follows; physical- (.78 - .80), psychological- (.84), coping- (.60 - .63), and cognitive function/capacity (.53 - .55).

The baseline mean pain intensity and pain experience (0-100) varied across the four studies (Paper I-IV) as follows; *pain intensity* (77.36 - 77.41), *pain experience* (73.40 - 73.69). Moreover *self-reported quality of life* varied across the studies as follows (50.97 - 51.32). For the remainder VAS variables the baseline mean scores (0-100) varied across the studies (Paper 1-IV) as presented below: *Physical function/capacity*; muscle strength (42.35 - 43.84), endurance capacity (39.77 - 40.64), energy (32.93 - 33.68), mobility (33.88 - 34.10), balance (50.59 - 51.57). *Psychological function/capacity*; good feeling inside (46.21 - 47.33), mood (62.19 - 62.64), feeling valuable (58.46 - 58.55), extrovert/introvert (64.45 - 64.91), optimistic/pessimistic (61.36 - 61.67), calm and balanced (59.97 - 60.73). *Coping*; feeling of coping in daily life (55.40 - 56.15), control and influence in daily life (58.17 - 58.77). *Cognitive function/capacity*; concentration (45.30 - 46.32), memory (45.40 – 45.50), understanding and evaluation of information (59.32 - 59.54), knowledge (41.21 - 41.51).

COOP/WONCA Charts-Functional Health Status assessment

Functional health status was measured using the Norwegian version of the COOP/WONCA Charts (see appendix of instruments) (Bentsen et al., 1997). The translation has been made as a formal double forward-backward translation, involving native speakers of English and of the translation language (Bentsen et al., 1997). The COOP/WONCA charts measure six core aspects of functional status; *physical fitness, feelings, daily activities, social activities, changes in health* and *overall health*. The instrument consists of six charts, referring to the above mentioned aspects of functioning. Each chart consists of a simple title, a question referring to the status of the patient and an ordinal five-point response scale illustrated with a simple drawing. Each item is rated on a five-point ordinal scale ranging from 1 ("no limitation at all") to 5 ("severely limited"). For "change in health" score 1 means "much better" and score 5 "much worse" The reference period is two weeks. The COOP/WONCA charts reflect the patient assessment of his/her functional capacity at the given time.

Because each scale is represented by one item, internal consistency (Cronbach, 1951) for the Functional Health Status (COOP/WONCA) is only measured for the scale as a whole, showing a coefficient alpha varying from .61 to .81.across the four studies. Moreover the test-retest reliability of the original Dartmouth version and the Norwegian version is satisfactory (r = .74 - .86) (Bentsen et al., 1997; 1999) and the subscales of e.g., function and feelings have been reported to correlate well with other measures of physical and emotional functioning (McDowell & Newell, 1996). The baseline mean scores on six core aspects of functional status varied across the three studies as follows; physical fitness (2.86 - 2.87), feelings (2.90 - 2.95), daily activities (3.33 - 3.34), social activities (2.65 - 2.67), changes in health (2.96 - 2.97) and overall health (3.34) (Paper I, II & IV).

Anxiety and Depression

Anxiety and depression were assessed by using the Hospital Anxiety and Depression Scale (HADS) (Zigmond & Snaith, 1983; Bowling, 1997, Snaith, 2003). It is a brief assessment of anxiety and depression, consisting 14 items divided into two sub-scales for anxiety (7 items) and depression (7 items), in which the patient rates each item on a four-point scale (see appendix of instruments). Individual items are scored from 0-3 to 3-0, depending on the direction of the wording of the items. The scores of the items represent the degree of distress: 0 = *none*, 1 = *a little*, 2 = *a lot*, 3 = *unbearably*. All items are summed. The higher score indicates the presence of problems. In accordance with previous studies (Bowling, 1997), HAD depression ratings of 7 or less were considered to be non-cases, scores of 8-10 were

considered doubtful cases, and scores of 11+ imply definite cases. Examples of the scale are presented in the box below:

Depression	*Anxiety*
Worrying thoughts go through my mind:	*I get sudden feelings of panic:*
A great deal of time	Very often indeed
A lot of the time	Quite often
From time to time but not too often	Not very often
Only occasionally	Not at all

Based on data from a large population, Mykletun et al. (2001) suggest that the basic psychometric properties of the HAD scale as a self-rating instrument should be considered as quite good in terms of factor structure, intercorrelation, homogeneity, and internal consistency. Tests for reliability (test–retest) of the scale have been satisfactory, with a reproducibility coefficient of .67 to .77 (Bowling, 1997; Mykletun et al., 2001). The internal consistency (Cronbach, 1951) in the present study showed Cronbach`s coefficient alpha of .89 for the entire HADS, and an alpha coefficient of .85 for the anxiety and the depression subscales. The internal consistency for the entire Hospital Anxiety and Depression Scale varied from .85 to .89 across the different studies. Factor analysis (varimax method), extracted with eigenvalues > 1.00 as a criterion (Kinnear & Colin, 2000), indicated that items could be grouped according to the two main constructs, explaining 63.9 % of the variance. The baseline mean scores on anxiety and depression in this thesis varied across the four studies as follows; *anxiety* from 8.77 to 8.83, and *depression* from 5.94 to 6.03 (Paper 1-IV).

Sense of Coherence

Several studies have used one of the original scales (SOC-29, SOC-13) to measure Antonovsky's concept of Sense of Coherence (Antonovsky, 1979; 1987a; Eriksson & Lindström, 2005). The 13-item version of the Sense of Coherence Scale (SOC), derived from a theoretical model designed to explain the maintenance or improvement of one's position on a health-ease/disease continuum, was used to measure the three main elements comprehensibility, manageability and meaningfulness (see appendix of instruments) (Antonovsky, 1979; 1987a). The Sense of Coherence scale measures the dimension of a person's response to a stressful situation, which either leads to pathogenic stress or

salutogenic tension management. The scale has a 7-point numerical scale. The aggregate scoring range is between 13-91 points, and the higher they score, the stronger the Sense of Coherence of that person. The means of the 13-item SOC scale range from 35.39 to 77.60 (SD = 13.80) (Eriksson & Lindström, 2005). Antonovsky did however not express the level of a normal SOC (Eriksson & Lindström, 2005). The three main elements consist of respectively 5 items (comprehensibility), 4 items (manageability), and 4 items (meaningfulness). Examples of some of the items are; "Do you have the feeling that you don't really care about what goes on around you?", "Has it happened that people whom you counted on disappointed you?" and "Doing the things you do every day is; "A source of deep pleasure and satisfaction-Deep source of pain and boredom". Examples of the start and end points of the scale are: from "*Very seldom or never* to *Very often*", and from "*Never happened* to *Always happened*".

Validity and reliability of the scale has been tested in studies comprising more than 30 countries. Findings in previous studies prove the SOC instrument being reliable, valid, feasible, and cross culturally applicable (Eriksson & Lindström, 2005). Some studies reported test-retest correlations, which were stable at .64 over three years (Bowling, 1997; Smith et al., 2003; Eriksson & Lindström, 2005; Feldt et al., 2007). Cronbach alpha coefficients were in present study computed to test the reliability of the SOC scale (Cronbach, 1951). The internal consistency in this study (total sample) showed Cronbach`s coefficient alpha of .83 for the entire SOC-13 scale, and varied for the three subscales as follows; comprehensibility (.79), manageability (.76) and meaningfulness (.72), suggesting high internal consistency of the SOC scale. Moreover, the internal consistency for the entire SOC Scale varied from .80 to .83 across the studies (Paper I-III). The factor analysis (eigenvalues > 1.00) (Kinnear & Colin, 2000) gave support to a three factor solution, where manageability, comprehensibility and meaningfulness loaded on separate factors, explaining 61.9 % of the variance. The factorial structure of the scale in the three dimensions is however not completely clear, and studies whether the SOC sub-scales actually correlate with the theoretical construction principles present different results (Eriksson & Lindström, 2005). The baseline mean scores on SOC in this thesis varied from 56.29 to 56.33 across the three studies (Paper I-III).

Sample characteristics

The participants self-reported background information (categorical variables) during personal interviews. The information retrieved included the demographical data, disability status, social network, economy, education, sleeplessness, and tiredness. The gathered information

also included personal experiences such as bullying, and physical-, emotional-, and/or sexual abuse.

Except for education, categorized in four levels, socio-demographic variables were coded as two levels of categorical variables. For example, the participants categorized social network into (0) *lack of social network* or (1) *satisfactory social network*. Economy (financial situation) was categorized into (0) *poor economy/financial situation* or (1) *satisfactory economy/financial situation,* and sleeplessness was categorized into (0) *insignificant sleeplessness* or (1) *considerably sleeplessness*.

Disability status was registered in the following categories; rehabilitation benefit, vocational rehabilitation, part time work/rehabilitation benefit, sick leave part-time disability pension, disability pension, social assistance, students, or unemployed. In addition the position percentage was registered in five categories (0 = *not in work*, 4 = *75-100 % position*). Further the participants were categorized in "active" and "passive" strategies for work ability and work re-entry. Participants who reported working on a part-time or full-time basis were categorized as "active" and coded as having returned to work, as were individuals in job retraining or education programmes. These latter two variables were categorized as "active" strategies by means of representing levels of functioning that in some ways mirror the work environment and bring forward work-related behaviour in the participants. Participants in job retraining or education programmes have to go somewhere on a daily basis and keep functioning at a relatively consistent level. Participants on sick leave, disability pension and those who had applied for disability pension were categorized as "passive" and coded as not returned to work.

Table 4: Variables used in Papers I-IV

Variables	Papers			
	I	II	III	IV
Demographical variables	X	X	X	X
Present/last held job	X		X	X
Work status/disability status			X	X
Percentage position			X	X
Employment affiliation		X	X	X
Pain location and duration	X	X	X	X
VAS				
Pain intensity	X	X	X	X
Pain experience	X	X	X	X
Physical function/capacity	X	X		X
Psychological function/capacity	X	(X)		X
Cognitive function	X	(X)		X
Coping	X	(X)		
Quality of life		X		
Functional Health Status-COOP/WONCA Charts	X	X		X
Anxiety and Depression (HADS)	X	X	X	X
Sense of Coherence (SOC)	X	X	X	

(x) = only facet variables of the main variable is used.

3.5 Statistical analysis

A summary of the statistical analysis of the various papers in present thesis is presented in this section. For further details of the statistical analysis performed, see the original Papers I - IV. Data were analysed using standard statistical techniques in SPSS for Windows (versions 11.0, 13.0 and 14.0). The selection of statistical techniques was based on the study design, since the nature of the research design has implications for the kind of statistical manipulation that can be performed on the resulting data (Bryman & Cramer, 2001).

Descriptive statistics of frequencies, percentages, mean values and standard deviation were calculated for continuous and categorical variables in order to present socio-demographic and socio-economic characteristics of the sample as well as the location and the severity of chronic musculoskeletal pain and the rehabilitation outcomes in the four empirical papers. In order to present characteristics of the HUNT 2 population (aged 20-67) (n = 52 186), descriptive statistics of frequencies, percentages, mean values and standard deviation were calculated for continuous and categorical socio-demographic and socio-economic HUNT variables as well.

The measures used in this study were tested for internal consistency (Cronbach, 1951), Cronbach`s coefficient alpha. In addition, factor analyses (varimax method) were performed to measure the number of dimensions that underlie the set of variables in the measures used (Kinnear & Colin, 2000). Several multivariate tests (Pillai`s criterion, Hotelling`s trace criterion, Wilks`lambada, and Roys`s *gcr* criterion) can be provided to assess the significance of the repeated-measures effect, and in many cases, different tests give the same results (Stevens, 1996). In studies, like in this case, where the numbers of participants in each group is equal or almost equal it does not matter which test is used (Bryman & Cramer, 2001). In this study (Papers I-III), Pillai`s criterion was used as a significance indicator. If categorical variables had more than two levels, dummy coding was performed. In all papers (I-IV) a *p*-value of less than 0.05 was considered statistically significant.

In Paper I, general linear repeated-measures analyses (single group repeated–measures design) (Bryman & Cramer, 2001; Keppel & Wickens, 2004), were provided in the VAS, HADS and COOP/WONCA variables to assess repeated measures means and standard deviations, and to assess the significance of the repeated measures effect (Pillai`s criterion) (time within-subject factor). *T*-tests (Bryman & Cramer, 2001) were performed on the anxiety and depression variables to compare the means at the first, second and third measurement in the present sample (N = 143) with the HUNT population, aged 20-67 (*n* = 52 186). *T*-tests were also used to compare the 57 week measures on pain intensity, pain experience and functional health status with the 1-year follow-up measures, as well as to compare the measures of functional health status with the normative sample from the Ullensaker study (Bentsen et al., 1997). For the initial selection of potential determinants for the outcome measures, univariate linear regression analyses were used with of significance level of $p < 0.05$. Subsequently, all independent variables that showed significant association with the outcome measures were considered for inclusion into the multivariate linear regression models. In order to identify which variables predict change over time best, all measurements across the rehabilitation period were included in steps in the same model with effects of these variables on the estimated change of the outcome variables over the measurement periods. In the final multivariate models, only variables with a p-value less than 0.05 were retained (Johnsen, 1996; Bryman & Cramer, 2001; Ringdal, 2001).

In Paper II (*n* = 168) Chi-square analyses (Bryman & Cramer, 2001) were used to test for statistically significant gender differences in categorical demographic characteristics in the pain sample. A *z*-test (Johnson, 1996) was used to test for statistically significant differences between the pain sample and the HUNT population, aged 20-66 (*n* = 51 235) in categorical

demographic characteristics. General linear repeated measures (Bryman & Cramer, 2001; Keppel & Wickens, 2004) were provided to assess repeated measures means and standard deviation in men and women, and to assess the significance of the repeated measures effect. Gender was entered as a between-subject factor. Multiple linear regression analysis was performed for men and women separately (sub-group analyses) to determine the impact of baseline socio-demographic, socio-economic, pain, and psychosocial variables on function outcomes. In order to determine if the differences between the men and woman were statistically significant, *T*-tests (Ringdal, 2001, p. 416) were performed.

In Paper III (n = 153) a comparison of the pain sample and the HUNT population was performed using *z*-tests (Johnson, 1996). Correlations between the variables in this study were performed using Persons (r) correlation coefficient (Johnsen, 1996; Bryman & Cramer, 2001). Repeated measures (single group repeated–measures design) multivariate tests were provided to assess repeated measures mean and standard deviation, and assess the significance of the repeated measures effect (Pillai`s criterion) (Bryman & Cramer, 2001; Keppel & Wickens, 2004). Multiple linear regression analysis was utilized in order to identify the socio-economic and the socio-demographic variables which were the best predictors of Sense of Coherence (SOC). In order to identify the variables in SOC which were the best predictor(s) of work status at the end of treatment period, multiple logistic regression analysis, was performed (Bryman & Cramer, 2001). Odds ratios (OR) with 95 % confidence intervals (CI) were calculated as measure of association, adjusted for age and gender.

In Paper IV (N = 143) baseline work status/ability and change in work status/ability during the rehabilitation period were expressed in frequency and percentages. *T*-tests (Johnson, 1996; Bryman & Cramer, 2001) were performed to compare the means at the first, second and third measurement in the present sample variables, and compare the pain sample (n = 143) with the HUNT population. In order to identify which measures those were the best predictor(s) of work status/ability, multiple logistic (0 = *not in work*, 1 = *in work*) and linear regression analysis (0 = *out of work*, 4 = *75-100 % position*) were performed. Odds ratios (OR) with 95 % CI and Standardized β were calculated as measures of association (Bryman & Cramer, 2001).

4 Main results

A summary of the papers; main findings and implications.

Paper I

In this paper the long-term improvement of multidisciplinary rehabilitation in terms of pain and function were investigated. Further in this paper the relative impact of individual and psychosocial factors as predictors of pain intensity, pain experience, and function in daily life was analysed. The sample consisted of 143 (N = 143) individuals with chronic (> 3 month) musculoskeletal pain, 36 males and 107 females with mean age 45. Back, neck, and shoulders were the most common pain locations, where 93.8 % reported pain in more than two locations. Data were collected prior to treatment, after 5 weeks of intensive training, at 57 weeks (end of rehabilitation period), and at 1 year-follow up (109 weeks). The participants reported mean pain intensity, measured by the Visual Analogue Scale (VAS) (0-100), at 77.3 at the start of the rehabilitation period compared to 74.1 after the 57 week rehabilitation period, and at 68.7 at the 1 year follow-up measures. Four out of five (79 %) reported to have basic or secondary education, and 59.5 % worked as unskilled or skilled workers/craftsmen. More than 37 % reported traumas in childhood, 69 % reported sleeplessness, and 74 % reported tiredness in everyday life. By comparison, 70 % of an age matched group from the Nord-Trøndelag Health Study (HUNT 2) population (n = 52 186) reported a basic level of secondary education, while 22.5 % of the HUNT population were skilled or unskilled workers/craftsmen.

Variables on the cognitive-, physiological-, and psychological functions measured by VAS, significantly increased from the 1st week to the 57th week of the rehabilitation period. At the same assessment time, pain intensity and pain experience decreased significantly, while measures of function, using the COOP/WONCA Charts, showed an improvement in feelings ($p < .05$), daily activities ($p < .05$), social activities ($p < .001$), and in overall health ($p < .01$). In addition, a significant improvement in function in daily life was found from the 57th week to the 1 year follow-up measurement. Despite this improvement, the respondents still scored significantly lower on all core aspects of functional health status compared to a normative randomized sample (N = 2864) from the Ullensaker study (Bentsen et al., 1997). Anxiety and depression decreased significantly during the rehabilitation period, but they still scored significantly higher ($p < .001$) on the anxiety and depression variables before, during

and after the treatment period compared to the HUNT population. Poor physical capacity was the only variable that was significantly associated with high levels of pain intensity and pain experience in the univariate analysis, on data measured at baseline, in the musculoskeletal pain sample. The univariate analysis, on data measured at baseline, also showed a significant association between poor overall health and high age, experience of traumas in childhood, poor social network, and high levels of pain intensity. Pain intensity associated significantly with pain experience over all measurement periods.

Variance in functioning, measured by COOP/WONCA Charts, was in the multivariate analyses significantly associated with a multitude of individual and psychosocial factors. Cognitive capacity was the only baseline measure that was found to be significantly associated with functional health status (overall health) in the final model. Poor physiological- and psychological capacity, high levels of anxiety and depression, as well as high levels of pain intensity and pain experience were the strongest predictors of reduced functioning (functional health status measured by COOP/WONCA) over the 3 measurement periods (57 week rehabilitation period). High levels of pain intensity and pain experience (β = .37*), and poor psychological capacity (β = -.68*) at baseline, as well as poor physiological capacity (β = -.44**) and high levels of anxiety and depression at the end of the rehabilitation program were the most important prognostic factors of reduced functioning over the 4 measurement periods.

The empirical findings in this paper confirm that a multitude of factors had an effect on variance in pain intensity, pain experience and functioning. This requires bridge building measures that focus on strengthening individual resources and skills in interplay with the environment, measures that demand for a substantial time-frame. Individually adapted tools to improve knowledge and the ability to e.g. strengthen physical capacity, decrease emotional distress and to improve coping skills appear to be of importance in the rehabilitation process.

Paper II

This paper addresses the queries of whether gender influences rehabilitation outcome and how psychosocial factors may interact in 168 individuals (aged 20-66) with chronic (> 3 months) musculoskeletal pain, who are work-disabled. The sample was compared with an age matched group from the Nord-Trøndelag Health Study (HUNT 2) population, aged 20-66 (n = 51 235) on several key demographic variables. Females were significantly more prevalent in the sample compared to the HUNT population (64.3 % vs. 52.6 %). Participants reported significantly lower education level and were significantly smoking more than the HUNT

population. However, the participants and the HUNT population were almost identical with regard to age distribution, family situation and social network. Women reported significantly more sleeplessness at baseline compared to men (72.9 % vs. 54.2 %). No significant gender differences were found on employment affiliation. The participants significantly improved functional health status (measured by COOP/ WONCA Charts) from the 1st week to the 57th week of the rehabilitation period. Except for Sense of Coherence (SOC) (measured by the 13 item Sense of Coherence Scale), no gender differences were found on the pain, emotional distress, function, or health-related variables. However, sleeplessness was found to be a stronger predictor of pain intensity ($t = 2.57/p < .008$) and pain experience ($t = 2.24/p < .016$) (measured by Visual Analogue Scale) among women compared to men.

Gender differences were found in baseline socio-demographic and socio-economic predictors of follow-up functional health. In women (n = 108), experiencing trauma in childhood was the strongest socio-demographic predictor of functional limitations, both after the initial training period and at the end of the follow-up training period. In the male sub-sample (n = 60), poor social network (Beta = −.353) and poor economy (Beta = −.392) were the strongest predictors of functional limitations after the initial training period, explaining 13.0–24.9 % of the variance. Poor social network, high age, and sleeplessness were also found to significantly predict worse functional health status at the end of the follow-up period in men. After the initial training period significant differences between the men and women were found on the following functional health status predictors; experience of traumas during childhood ($t = 2.56/p<0.008$) and being married/cohabitant ($t = 2.69/p<0.006$) associated with worse function in women than in men, while poor social network, poor economy, and low education level associated with worse function in men than in women. At the end of the follow-up training period high age sleeplessness significantly associated with worse function in women than in men, while poor social network significantly associated with worse function in men than in women.

Gender differences were also found in psychosocial predictors of functional health status measured after the initial training period and at the end of the follow-up training period. In women (n = 108), high levels of pain intensity, anxiety, and low scores on comprehensibility associated with functional limitations after the initial training period. In comparison high levels of anxiety and depression, and low scores on comprehensibility significantly associated with functional limitations in the male sub-sample during the same assessment period. At the end of the follow-up period, high levels of pain, anxiety, and lack of capability to understand and evaluate information were the strongest predictors of functional

limitation in females, explaining from 14.7–31.1% of the variance. In comparison, greater depression, reporting low quality of life, lack of knowledge, lack of capability to understand and evaluate information, and low comprehensibility score were the strongest predictors of functional limitations and overall health at the end of the follow-up training period in males, explaining from 7.7–42.3% of the variance. After the initial training period the differences between the men and women were statistically significant in the following pain and psychosocial predictors of functional health status; high levels of pain and low manageability significantly associated with poorer function in women than in men, while high levels of anxiety, lack of knowledge, and poor comprehensibility significantly associated with worse function in men than in women. At the end of the follow-up training period high levels of pain intensity and poor capability to understand and evaluate information significantly associated with worse function in women than in men, while greater depression was significant associated with report of worse functional health status in men than in women.

These results indicated the relevance of gender in how socio-demographic, socio-economic, and psychosocial factors influence treatment outcome in terms of pain and functional health status in work-disabled individuals with chronic musculoskeletal pain, and thereby underline the importance of individual adapted rehabilitation programmes that take in to account gender related differences.

Paper III

In this paper the usefulness of Sense of Coherence (SOC) (measured by the 13 item Sense of Coherence Scale) as a predictor of work re-entry was tested in 153 individuals (mean age = 45.6/*SD* = 9.1) with chronic musculoskeletal pain, participating in a 57 week multidisciplinary rehabilitation programme. Further the changeability of SOC, and the association between SOC and pain intensity, pain experience (measured by Visual Analogue Scale, VAS), anxiety and depression (measured by Hospital Anxiety and Depression Scale) were investigated. A significant improvement in SOC was found from the 1st to the 57th week of the rehabilitation period. In addition, pain experience significantly decreased from the 1st week to the 57th week of the rehabilitation period, while pain intensity significantly decreased from the 1st to the 5th week, but increased from the 5th week to the 57th week. A significant reduction in anxiety and depression was found. SOC, anxiety, and depression were found to be strongly correlated (r = -.37 - r = -.63). A z-test indicated significant differences between the pain sample and an age matched group of individuals from the Nord-Trøndelag

Health Study (HUNT 2) population (n = 52 186) on the demographic-, anxiety-, and depression variables.

The material was categorized in two sub-samples; "work re-entry" or "non-work re-entry". Follow-up measures (at 57 weeks) of the SOC sub-scale comprehensibility were significantly associated with follow up measures of anxiety (β = -.58, p = .019), while follow-up measures of the SOC sub-scale meaningfulness were significantly associated with follow-up measures of depression (β = -.84, p = .000) in the "non-work re-entry" sub-sample. Logistic regression showed no significant association between work re-entry and SOC.

The findings in this paper support the changeability of SOC, clarify the role of SOC in chronic pain and distress, and question the role of SOC in predicting work re-entry in a chronic non-specific musculoskeletal pain sample.

Paper IV

This paper aimed to investigate the outcome and outcome predictors of multidisciplinary rehabilitation in terms of working ability in one hundred and forty three (N = 143) individuals, aged 20-67 (mean age 45.7/SD = 8.9), with chronic (>3 month) non-specific musculoskeletal pain. Work status, pain, functional health status, and psychosocial factors were investigated previous to treatment, after 5 weeks of intensive training, and at 57 weeks follow-up. Lower back, shoulder, and neck were the most common pain locations in the sample, and almost all (93.8 %) participants reported pain in more than one location. Sample characteristics such as age, gender, and education level were found to be in accordance with the characteristics of the general population (The Nord-Trøndelag Health Study population) from the same geographic area. The participants represented a mix of white-collar (25.2 %) and blue-collar (63.0 %) workers, and 7 % of the participants had no work experience. Shop assistants, craftspeople, office workers/clerical assistants, licensed practical nurses and cleaning staff were the most common occupations.

To ensure the complexity in return to work rates participants on rehabilitation benefit, vocational rehabilitation, part time work/rehabilitation benefit, part time disability pension (using their rest work capacity), and no benefit were categorized as "on their way in/in work", while participants on sick leave, disability pension, social assistance, being students, or unemployed were categorized as "on their way out/out of work". The percentage of participants (Table 5) defined "on their way in/in work" increased from 57.4 % (n = 82) at the start of the rehabilitation period to 80 % (n = 114) at the end of the rehabilitation period. The percentage of participants defined "on their way out/out of work" was calculated to be 42.6 %

at the start of the rehabilitation period and decreased to 35.7 % after 5 weeks and further to 15.4 % (*n* = 22) at the end of the rehabilitation period. 4.6 % (*n* = 7) received other source of income/or did not complete the work status questionnaire at the end of the rehabilitation period. High age (-.231**), sleeplessness (-.535***), and tiredness (.186*) were the background variables demonstrating the strongest association with not being occupational active. Cognitive function (-.224*), overall health (.274*), pain experience (.380**), and anxiety (.561**) were the factors strongest associated with work ability at the end of the rehabilitation period. However, pain experience and anxiety were only found to be significant predictors of work status when analyses were made on a facet level, identifying predictors of benefit systems/source of income. Pain intensity and depression were found not to be useful in predicting work ability.

This paper suggests that factors like emotional distress, cognitive function and overall health are important priority areas to emphasise in rehabilitation programmes in order to improve work ability. These results underline the need for a systematic coordination of specific measures and individual adapted tools in order to improve individual recourses and skills that enable the participants to improve work ability.

Table 5: Work status and source of income in the chronic pain sample (*N* = 143) at baseline, after 5 week intensive treatment period, and after 52 week follow-up period (totally 57 week rehabilitation period) (frequency (*n*) and percentage (%)) (Lillefjell et al., 2006).

Work status/source of income	First week		5 weeks		57 weeks	
Sample N = 143	*n*	%	*n*	%	*n*	%
"On their way in/in" work						
Rehabilitation benefit	71	(49.7)	76	(53.1)	63	(43.4)
Vocational rehabilitation	10	(7.0)	8	(5.6)	42	(29.4)
Disability pension and rehabilitation benefit	0	(0)	0	(0)	4	(2.8)
No benefits	1	(0.7)	1	(0.7)	5	(3.5)
Total	*82*	*(57.4)*	*85*	*(59.4)*	*114*	*(80.0)*
"On their way out/out" of work						
Sick leave	48	(33.5)	38	(26.6)	7	(4.9)
Disability pension	3	(2.1)	3	(2.1)	13	(9.1)
Social assistance, students, unemployed	3	(2.1)	3	(2.1)	2	(1.4)
Disability pension and sick leave	7	(4.9)	7	(4.9)	0	(0)
Total	*61*	*(42.6)*	*51*	*(35.7)*	*22*	*(15.4)*

5 Discussion

This thesis includes a prospective follow-up study, presented in four empirical papers. The overall aim has been to increase the knowledge of function and work ability in individuals with chronic non-specific musculoskeletal pain; to learn more about the nature of the factors being studied; improve the knowledge of which factors can be predictors; and to clarify their role in chronic disability, function and work re-entry. This section includes discussions of the main findings and clinical implications of the findings presented in the various papers (I-IV) in this thesis, a general discussion, methodological strengths and limitations related to the study design, as well as the implications and directions for the future. For more thorough discussions of the specific topics, the discussion sections in the different papers (I-IV) should be consulted.

5.1 Main findings and clinical implications

In sum, and based on the methods used, the empirical findings in these investigations (Papers I-IV) give support to the emerging complexity in the model of rehabilitation outcomes for individuals with chronic non-specific musculoskeletal pain. However, it is important to mention that this thesis only has been investigating parts, even if crucial parts, of this vast complexity, and moreover the data material used in present study can be further utilized in order to further increase the knowledge of this phenomenon.

Improvement in function in daily life

A multidimensional rehabilitation approach emphasizes personal as well as environmental factors as possible facilitators or barriers to work re-entry (Engel, 1977; Antonovsky, 1979; Jakobsen, 2001; 2004; Torp, 2005; Ilmarinen, 2006).

For a person that receives treatment the main goal of the rehabilitation process is usually to re-establish function in daily life. Paper I suggests that the present chronic non-organic musculoskeletal pain (CNOMP) sample made improvement on several aspects important for daily life functioning during the rehabilitation period and at the 1 year follow-up. The main changes were a decrease in pain intensity, pain experience, anxiety, and depression, improved function related to emotions, daily activities and social activities, as well as improved overall health. What consequences for daily life functioning is it however likely to expect as a result of a statistically significant improvement in function during the

rehabilitation period? Some might possible argue that improvement over time is not very surprising since pain patients often are selected close to their worst status. However, the implications of chronic musculoskeletal pain for everyday function may depend not only on pain intensity and pain experience, but also on the individual and on each person's unique set of values, environmental conditions he or she is living in, and his/her earlier experience of what the pain means in daily life (Henriksson, Gundmark, Bengtsson, & Ek, 1992; Zemke & Clark, 1996; Wilcock, 2002).

By focusing on interactions and influences of a broad range of socio-demographic and psychosocial factors in pain, pain experience, and functional health status, this study (Paper I) confirms that different variables affects different aspects of daily life functioning, and clarifies the long-term improvement of a multidisciplinary rehabilitation programme (Lillefjell, Krokstad, & Espnes, 2007). The role of emotional distress and physical capacity in predicting pain and function in chronic pain conditions is supported by previous findings as well (Geisser et al., 2003; Vowles et al., 2004; Bergman, 2005; Henderson et al., 2005; Staal et al., 2005; Lotters et al., 2006). A large body of literature indicates that physical exercise interventions effectively decrease emotional distress and improve functioning in daily life activities (Newth & Delongis, 2004; Staal et al., 2005; Pedersen & Saltin, 2006; Braathen et al., 2007). Physical capacity is, according to Antovovsky (1979), seen as an important resistant resource that improves the prospects of staying healthy or being able to cope with health problems should they arise. Good physical capacity is also shown important to facilitate effective tension management (Antonovsky, 1979; Volanen et al., 2004; Eriksson, 2007). Since good physical capacity is associated with more effective coping of health problems and less pain and emotional distress, the relevance of placing a significant focus on physical capacity training in the rehabilitation of individuals with CNOMP is enhanced (Ericsson et al., 2002; Geisser et al., 2003; Henderson et al., 2005; Staal et al., 2005, Eriksson, 2007).

Though the participants in present study are long-term chronic pain patients and considerable reductions in pain and emotional distress may not be anticipated, a systematic and structured focus on alternative ways of perception and problem solving among the counsellors is probably alone not sufficient. In present study emotional distress (anxiety and depression) decreased during the rehabilitation period, nevertheless the sample still reported significant higher levels of emotional distress at the end of the rehabilitation period compared to the general Nord-Trøndelag population (HUNT Study). Repeated experiences of a miss-match between personal (internal and external) resources/skills and demands from the

environment in different areas of daily life might be one out of several explanations of the high levels of emotional distress in present sample. Emotional- and coping resources, also described as important GRR's, should therefore, even to a greater extent, be focused on in rehabilitation settings for individuals with CNOMP in order to improve their state of readiness in daily life (Antonovsky, 1979; 1987a).

A continual self-improvement in daily life functioning entails that the participants themselves, during the rehabilitation period, find skills within themselves that enable them to change the way they cope in daily life, as well as learn to analyse their occupations and the factors which affect their ability to cope with demands (Antonovsky, 1979; 1987a; Braathen et al., 2007; Wigers & Finset, 2007). This requires guidance from professionals towards becoming aware of the relation of body reactions to different stressors, as well as long-term bridge building measures that focus on strengthening individual resources and skills in different aspects of daily life and in different environmental contexts in order to improve function (Engel, 1977; Antonovsky, 1979, 1987a; Ilmarinen, 2006). Research is however needed to further clarify the role of resistant resources in general in daily life functioning of individuals with CNOMP.

Gender differences in predictors of rehabilitation outcomes

The findings in Paper II (Lillefjell, 2006) confirm that the rehabilitation intervention, by focusing on strengthening internal as well as external resources, produces improvements in a range of outcomes for both men and women during the rehabilitation period and support the findings in Paper I (present thesis) and other studies (Vowles et al., 2004; Keogh et al., 2005). As found in a previous study by Rustøen et al. (2004b), women represented the majority of the present pain sample. In contrary to research that indicates significant gender differences in pain severity, frequency, and locations (Fillingim, 2000; Rustøen et al., 2004a; 2004b; Keogh et al., 2005) the findings in Paper II weakened the role of gender differences in socio-demographics, socio-economics, and in reporting pain, pain locations, emotional distress, and functional health status in work-disabled individuals with CNOMP. Sleeplessness, found in previous studies to be an important contribution to function in daily life (Palermo & Kiska, 2005; Sivertsen et al., 2006; Naughton et al., 2007), was the only background variable that showed significant gender differences in the present sample.

Owing to the fact that several gender differences were found in how socio-demographic, socio-economic and psychosocial factors influences pain, pain experience and functional health status in present sample, males and females seems to differ in how they

make use of their recourses available when facing internal as well as external stressors in daily life. Findings presented in Paper II suggest that the influence of internal stressors like sleeplessness, anxiety and depression in functioning seems to be stronger in men than in women (Paper II), and sleeplessness, anxiety, and depression seems to correlate with traumas in childhood (Paper I). The influence of traumas in childhood, limiting functioning in daily life, seems however to be stronger in women than in men. Even if this has been confirmed in other studies as well (Fillingim & Edwards, 2005; Sivertsen et al. 2006), further research is needed to clarify the correlations between sleeplessness, anxiety, depression and traumas, and the relative importance of these factors as stressors in daily life functioning. The fact that women and men seems to differ in how they make use of their resistant resources is further underlined by findings in present study, suggesting that gender moderates the Sense of Coherence (SOC) response, with women reporting significant lower manageability and comprehensibility scores at the end of the treatment period compared to men. Why is it so? There might be several explanatory factors. However, based on the theory of Antonovsky (1979; 1987a), it might be relevant to question if experiences of traumas in childhood possibly influences the SOC score in adulthood. A possible effect of traumas in childhood on the development of Generalized Resistance Resources in individuals with chronic musculoskeletal pain should therefore be further explored in future studies.

The empirical findings in Paper II may have several implications for rehabilitation research and clinical practice by: (1) promoting a demand to further clarify gender differences in socio-demographic, socio-economic and psychosocial predictors of treatment outcomes; (2) clarifying the role of gender in the way socio-demographic-, socio-economic-, and psychosocial factors influence treatment outcomes in individuals with CNOMP, and by (3) suggesting that gender aspects should be taken into account in designing the rehabilitation intervention for individuals with CNOMP. Attention should in future studies, as well as in rehabilitation settings, also be paid to socioeconomic, socio-demographic, and gender related differences in employment, resistant resources and coping strategies.

It is however relevant to question whether gender specific intervention is needed to meet the need for gender adjustment in rehabilitation settings? Individual rehabilitation plans, focusing on strengthening what Antonovsky (1979; 1987a) called the individual's state of readiness during a process, might possible ensure the gender aspect, provided that the knowledge of gender differences is sufficient among the professionals. The demands for qualification of the professionals are therefore substantial, not only concerning gender differences, but also to generate participants' skills as well communicating among

collaboration partners (employer, NAV, GP) in order to create room for alternative courses of action. In order to generate skills, a systematic salutogenic orientation, focusing on the resources available rather than on restrictions, is probably useful in the daily actions of professionals (Antonovsky, 1979; 1987a; Eriksson, 2007). These probable implications for the rehabilitation process should therefore be further investigated and explored in future studies.

Questioning the role of SOC in predicting work re-entry

In Paper III we investigated how the Sense of Coherence (SOC) predicts work re-entry in a sample of work-disabled individuals with CNOMP (Lillefjell & Jakobsen, 2007). As expected due to theoretical assumptions (Antonovsky 1979; 1987a), and supported by previous studies as well (Weissbecker et al., 2002; Höge & Büssing, 2004; Feldt, Leskinen, & Kinnunen, 2005; Eriksson, 2007), the data suggest that SOC may be enhanced via intervention. Although gender differences not were investigated in the present paper (Paper III), empirical findings in Paper II do suggest that gender might be relevant to take into account when investigating the changeability of SOC (Lillefjell, 2006).

Due to a significant social support in a stressful situation characterized by chronic pain and work disability the extensive multidisciplinary rehabilitation programme, as presented in this study, might possibly account for parts of the improvement in SOC during the rehabilitation period. Previous studies suggests strong correlations between SOC and both work-related psychosocial factors and social support (Larsson & Kallenberg, 1996; Nilsson et al., 2000; Holmberg et al., 2004). Although work-related psychosocial factors and social support not were specific addressed in present study, it is reasonable to assume that early workplace-based interventions improves the rehabilitation process as well as increase the individuals state of readiness by reducing the expectations and insecurity in the environment. The person's resources (GRR) are then, to a greater extent, in accordance with the pressure or strain at the workplace (Antonovsky, 1979; 1987a), which is found to influence work ability (Kivimäki et al., 2000; Suominen et al., 2001; Suominen et al., 2005).

Individuals who return to full-time/part-time work may however experience different types of socialization processes and face different types of demands compared to those who take part in e.g. a job retraining or in an educational programme. Studies by Hedlund, Wendelborg, Brataas, and Landstad (2005a; 2005b), suggest that few individuals on rehabilitation benefit return to full-time/part-time work following a period on rehabilitation benefit, and that people suffering from emotional distress seems to dominate the group on rehabilitation benefit that not returns to full-time/part-time work. Return to full-time/part-time

work and taking part in job re-training or an educational programme may demonstrate a similar level of functioning, but the nature and the meaning of entering a job retraining or an educational programme is not the same as returning to work. The relevance of a socialization processes in the changeability of SOC should therefore be further investigated and explored in future studies. To improve return to work rates, this might indicate the need of a greater part of the rehabilitation process taking place in the workplace/context where the person is supposed to return to after the rehabilitation period. Emphasis should possible be given to whether individual factors, like bodily and mental capacity, are coherent with environmental factors in e.g. the work situation (Engel, 1977; Antonovsky 1979; 1987a). Low return to work rates among individuals with CNOMP might be due to the lack of an extensive multidisciplinary rehabilitation programme, taking into account these aspects, as offered to the Norwegian working population with CNOMP.

Contrary to several previous studies, no significant association was found between SOC, pain intensity, and pain experience in the present sample (Callahan & Pincus, 1995; Schult et al., 2000; Veenstra et al., 2005). Association between emotional resources and SOC, equally to results confirmed in previous studies as well, is further highlighted in the present paper (III) by the strong association between depression and SOC, and the fact that anxiety seems to be more strongly related to the three components of SOC than to each of the components (Volanen et al., 2004; Veenstra et al., 2005). These empirical findings raise some interesting questions related to the observed change in SOC and a possible overlap between SOC and other constructs such as anxiety and depression, which may indicate limitations of the SOC measurement. A possible overlap between negative emotions and SOC may question if the measurement captures the ideas of the theory of SOC (Antonovsky, 1979; 1987a). This question has been emphasized in previous studies as well (e.g., Höge & Büssing, 2004; Eriksson, 2007). Nevertheless, the question does not invalidate SOC as a theoretical concept. Antonovsky maintain that emotions are closely related to SOC. A person with a strong SOC is, according to Antonovsky, more likely to define a stimulus as a happy rather than a dangerous stressor, a challenge rather than a burden (Eriksson, 2007). Although overlaps between similar constructs may be considered as a weakness in the theory, it is important to realize that salutogenesis is more than a measurement of the SOC.

In sum, the empirical findings in Paper III (1) indicate that SOC is a relevant outcome variable in chronic non-specific illness care, (2) emphasize the relevance of the SOC together with anxiety and depression, and (3) question the role of SOC in predicting work re-entry in individuals with CNOMP. These findings thereby confirm the relevance of taking factors like

anxiety and depression into consideration in the rehabilitation and return-to-work process, although further investigation is needed to clarify the relevance of SOC in connection with pain, anxiety, and depression in general, and these factors implications for the individuals and for the rehabilitation practice. Further research is also needed for clarifying the structure and the different dimensions of the SOC scale.

Implementation of the SOC concept (Antonovsky, 1979; 1987a) as a systematic orientation and perspective in the daily activities and actions of the professionals seems however to be of value. Though, it is likely that one has to be cautious when using e.g. the SOC questionnaire as a screening instrument in daily practice, this because there is always a risk of negative health effects if one stigmatises people regarding their SOC. It is also relevant to question what the individual SOC at a given time really mean for practical reasons. The questionnaire might anyway be useful in the dialog between the participant and the professionals in the daily practice at the rehabilitation centre in order to identify resources (Eriksson, 2007).

Predictors of work ability and work re-entry

Findings in Paper IV suggest a strong influence of psychosocial factors in chronic pain conditions, and that multiple factors correlate with work ability; age, sleeplessness, tiredness, cognitive function, pain experience, anxiety, and overall health being the most important, accounting for a significant amount of the variance (Lillefjell et al., 2006). A socio-economic perspective seems to be particularly important. This supports the findings of other investigators (Krokstad & Westin, 2004; Vowles et al., 2004; Saastamoinen et al., 2005) who are suggesting an increasing prevalence of disability pension with decreasing socio-economic status and education. Socio-economic status and education are closely related to what Antonovsky (1979) describe as typical GRR's like money, knowledge, cultural capital and social support, which again are linked to being a part of today's working life. If a person has these kinds of resources at his/her disposal or in his/her immediate surroundings there seem to be a better chance for the person to deal with the challenges in life. However, this presupposes the ability to use the resources available (Lindström & Eriksson, 2006). Reduced function and work ability, which is the situation for the individuals in present study, may have significant consequences for e.g. income, personal position in society, and the person's chance to deal with challenges in daily life (Jakobsen, 2001). What is even more important than the resources themselves in rehabilitation settings is however the ability to create new ones and to make them available for the individuals to benefit from (Lindström & Eriksson, 2006).

The relevance of age in the prediction of work ability and work re-entry has been indicated in previous research, and it has been shown that age might have important implications from a treatment perspective (Rustøen et al., 2004a; Vowles et al., 2004; Saastamoinen et al., 2005; Lotters & Burdorf, 2006; Turner et al., 2006). Should the ageing individuals undergo rehabilitation? Is it appropriate to give priority to the ageing population when manpower needs are increasing and there is a shortage of multidisciplinary rehabilitation programmes for this target group with reduced function and work ability? Does ageing pose challenges concerning the sufficiency and design of the rehabilitation programme? Are there treatment strategies that need to be changed to better serve the aging population in returning to work after a rehabilitation period? Even though the population in Norway as a whole gets older, the debate of how to better coordinate and make use of more flexible and practical efforts to assist older people with reduced function into work seem to be incomplete (Statistics Norway, 2006)**.** Additional studies are therefore necessary to address these questions more directly even if the empirical findings in this thesis might contribute to an important debate about priorities and efforts.

A recent study by Sivertsen et al. (2006) clarifies the relevance of sleep disruption in disability pension in general. This is further highlighted in present sample, particularly in the male subsample, where sleeplessness, along with high age and tiredness, is associated with not being occupational active. Further, based on the method used, the empirical findings in Paper IV are consistent with previous findings, revealing how psychosocial factors in general are important predictors of work status (Feuerstein, 1991; Ericsson et al., 2002; Vowles et al., 2004; Turner et al., 2006) and emphasize the importance of cognitive and emotional factors in work ability as well. However, pain experience and anxiety were only found to be significant predictors of work status when analyses were made on a facet level, identifying predictors of benefit systems/source of income, and should therefore be questioned. Though, these findings may indicate that the presence of anxiety and pain experience is stronger in individual on passive strategies (definition, see page 39) compared to those on active strategies for work re-entry. In accordance with previous studies the participants in the multidisciplinary rehabilitation programme effectively made use of their resources by improving functions and work participation, demonstrated by a 22, 6 % increase in return to work rate (Haugli et al., 2001; Vowles et al., 2004; Braathen et al., 2007; Wigers & Finset, 2007).

The relevance of cognitive resources and skills in work ability and work re-entry in present sample is worth noticing. Since cognitive capacity is one of the main elements of SOC (Antonovsky, 1979) it is however a little surprising that SOC not was found useful in

predicting work re-entry in present sample (Paper III). Though, this may by due to methodological limitations of the study.

Strengthening cognitive- as well as emotional resources, create new ones, and make them available for the individuals to be aware, identify, and benefit from them requires adequate knowledge and skills among the professional as well as adequate methods of intervention (Antonovsky, 1979; Eriksson, 2007). Since an increasing number of individuals with CNOMP have been in a fragmented follow-up course for a longer period of time without any work affiliation, the return to work process might be most challenging. Utilization of existing resources (Antonovsky, 1979) and skills in order to improve function and work ability require re-orientation in daily life, which is considerable time-consuming. Some might possible argue that one year follow-up is much. It is however important to remember that the participants in present study are out-patients in individual adapted processes where a substantial part of the process takes place in the participants own environment, in cooperation with collaborators like the employer, NAV, GP`s and others involved.

Interpretations

Based on the theoretical foundation (Engel 1977; Antonovsky, 1979; 1987a) and the empirical finding in these papers (I-IV) several questions emerge: Who profit from a multidisciplinary rehabilitation programme? Which parts of the rehabilitation programme is of particularly importance or less importance in the rehabilitation process? Who are in position to be the "bridge-builders" in the rehabilitation process? Who are in position to identify and motivate the individuals fitted for rehabilitation?

Who is profiting from the multidisciplinary rehabilitation programme?

Based on the method used, the empirical findings in the papers (I-IV) suggest that limitation in function at the end of the rehabilitation period in general is associated with individual and environmental factors such as high age, poor social network, high levels of emotional distress, sleep disturbance, low physical capacity, poor cognitive function, poor overall health, and the lack of adequate coping skills. Moreover findings from the papers in the thesis indicate that younger individuals with GRR's like higher levels of education, a satisfactory social network, no sleep disturbance, good cognitive function and low/moderate levels of emotional distress at the start of the rehabilitation seem benefit most from the programme as regards to work re-entry.

As illustrated in Figure 2 (page 32), the relevance of e.g., physical-, cognitive-, and coping resources in improving function and return to work has been indicated in previous research as well (Marhold, Linton, & Melin, 2001; Staal et al., 2005; Sullivan et al., 2005; Dunstan & Covic, 2006; Lotters et al., 2006; Pedersen & Saltin, 2006; Braathen et al., 2007; Wigers & Finset, 2007). Marhold et al. (2001) suggest that cognitive behavioural interventions have a more pronounced impact on return to work outcomes the earlier they are implemented following the onset of work disability. The improvement in self-rated functional capacity, such as physical capacity during the rehabilitation programme, is however not dramatically better. This might be due to the fact that rehabilitation is a process of increasing awareness; enabling people to manage tension, to reflect about, identify, and mobilize internal as well as external resources, and to promote effective coping by finding solutions (Engel, 1977; Antonovsky, 1979; WHO, 2001; 2008). The rehabilitation process possibly makes the participants gradually more conscious and realistic about their own resources and how they influence functioning in daily life. Increasing awareness along with e.g. physical tests during the rehabilitation programme might therefore affect the self-rating. A drop in reported physical function after the first 5 weeks (intensive period), might be due to the fact that increased physical training and reflection itself often causes more pain and possible limitations in functioning in an early phase. This might be explained by e.g increased muscle activation, fear, emotional distress, and lack of knowledge of body reactions (Newth & Delongis, 2004; McCracken & Wovles, 2006).

Some parts of the rehabilitation programme more importance than other parts?

The empirical findings presented in this thesis might have several implications when it comes to designing rehabilitation interventions by suggesting that physical-, emotional-, cognitive-, coping-, and social resources and skills, seen together, might be important priority areas to improve the rehabilitation intervention. These findings requires a focus on single elements in the rehabilitation programme as well as on linked bridge building measures in order to carry out beneficial functional assessments and to offer a individually adapted rehabilitation programme that enables the participants to improve function and work ability. However, in order to carry out beneficial functional assessments, which constitute parts of a work ability evaluation for individuals with chronic musculoskeletal pain, a lack of a general understanding of function might be one challenge for progress in developing effective rehabilitation programmes for this target group (Krohne & Brage, 2007). Professional foundation characterises the professionals clinical reasoning and their functional assessment

approach (Krohne & Brage, 2007), e.g. their focus on curing of disease and control of symptoms (Brannon & Feist, 1997; Furnham, 2005) contrary to e.g. a salutogenic orientation focusing on the individuals existing resources (Antonovsky, 1979; 1987a; Eriksson, 2007). The fact that the drop-outs from the rehabilitation programme were those who were offered uncoordinated parallel processes of treatment simultaneously with the rehabilitation programme underline the importance of a common understanding of function among all collaborating partners in order to work for the same goal (Krohne & Brage, 2006). A general understanding of function also gives ground for development, goal-orienting, and evaluation of health services (Kjeken, Kvien, Dagfinrud, 2007). The skills of the professionals, both theoretical and clinical, is therefore vital in order create optimal room for alternative courses of action that effectively contribute to clarification of the individuals workability and need for assistance. Less focus on symptoms should however not de-emphasize the importance of a medical approach as well in enabling the participants to improve function and work ability.

Multidisciplinary approaches in general are found effective in improving physical and psychological functioning. These gains alone are however insufficient to produce return to work (Dunstan & Covic, 2006). Additional strategies, designed to facilitate work resumption, are necessary to form a comprehensive biopsychosocial intervention. In accordance with salutogenic orientation (Antonovsky, 1979; 1987a) and supported in previous studies as well (Haldorsen et al. 2002; Volanen et al., 2004; Braathen et al., 2007; Wigers & Finset, 2007), a focus on the individuals resources and capacity to improve function and work ability rather than the classic focus on risks, ill health, and disease is of value. In that respect a focus of the time-frame is essential.

The employer seems however to be central in deciding whether or not people with reduced work capacity are to be included in the workplace (Jakobsen, 2004; 2006). The law, like the Working Environment Act (Ot.prp.nr.24, 2005-2006) underlines the employers' responsibility to take measures to adapt the work situation to the worker, and that this process first and foremost is to be done at the workplace. It might therefore be particularly important to involve the employer as early as possible in the "return-to-work" process.

Present study (Paper I-IV) was not designed to evaluate the rehabilitation programme, neither as a total nor as single isolated elements. However, based on understanding of the multidimensional nature of work ability and work re-entry (Engel, 1977; Antonovsky, 1979; 1987a; Ilmarinen, 2006) and the empirical findings in present study (Papers I-IV), rehabilitation programmes will possibly benefit from including a physical exercise component, including participation in everyday activities; a psychological component,

involving the use of e.g., cognitive-behavioural strategies; and an occupational component to give the intervention a focus on function and work ability. The relevance of including elements mentioned above in rehabilitation programmes is supported by other studies as well (Ursin & Eriksen, 2004; Ursin, 2006; Braathen et al., 2007; ECON, 2007; Wigers & Finset, 2007). Although the findings in these papers (I-IV) imply that some parts of the rehabilitation programme are more important than others, it is very important to take into consideration that this study has not evaluated parts of the rehabilitation programme, but seen the programme as an integrated whole, as a tailor-made individual process with individual courses.

Several studies emphasize the importance of interventions of longer duration addressing multiple dimensions of pain and disability (Haldorsen et al., 2002; Storrø et al., 2004; Braathen et al., 2007; Wigers & Finset, 2007). According to Antonovsky and a salutogenic orientation (Antonovsky, 1979; Eriksson, 2007) a person's generalized resistant resources (GRR) should be in accordance with the pressure or strain from the environment in order to improve function and work ability (Volanen et al., 2004). This illustrates the need for a combination of systemized functional assessments as well as various flexible bridge building measures, co-ordinated in order to facilitate improvement in function and work ability in individuals with complex musculoskeletal pain conditions (Krohne & Brage, 2006; 2007). Exactly the complexity in long- term chronic musculoskeletal pain conditions, illustrated in present study (Papers I-IV) and in other studies as well (Braathen et al., 2007; Wigers & Finset, 2007), requires flexibility in measures in order to take in to consideration varying degree of work ability as cross a period of time, dependent on the context and/or variation in state of health (Dunstan & Covic, 2006).

Even if so is stated politically, there is nevertheless a question whether modern working life has a place for people in general who need modified and adapted equipment, work part time or on modified work schedules. The recent political strategy of replacing rehabilitation of longer duration with standardised full unit-priced funding procedures of shorter duration (St.meld. nr. 9, 2006-2007; NAV, 2008) might therefore have several consequences for individuals with considerable needs for individual adapted tailor-made solutions. How is it e.g. possible to maintain the continuity and the flexibility in measures, which seem to be of particularly importance for individuals on long-term sick leave with reduced function in order to improve work ability, with the new "short term" strategy? Is it reasonable to assume that standardised measures of shorter duration first and foremost will serve individuals on short term sick leave or/and frequent short term sick leave?

Future research should try to identify individual as well as contextual factors that strongly influence work ability, since these factors may act as either barriers or facilitators to work re-entry (Jakobsen, 2004). In order to capture the process of rehabilitation long-term (2-5 year) follow-up studies are recommended.

Who are in position be the "bridge-builders" -Who identifies and motivates the individuals fitted for rehabilitation?

The involvement of individual as well as environmental factors in the rehabilitation process requires qualified professionals with adequate competence and skills to address resources for improvement both on an individual- and on a system level. The theoretical orientation and clinical skills of the professionals might therefore be one key area to focus on in order to strengthen the individual's state of readiness during the rehabilitation process.

Due to the knowledge and the possibility to cultivate an educational setting, focusing on resources and function, the professionals at the rehabilitation concept studied are in positions to be the bridge-builders in the rehabilitation process that ensure the continuity, coordinate the process and maintain focus on function. It is however not likely that all rehabilitation concepts are in the same favourable position that makes it possible to cultivate a focus on resources and function. Although a growing body of knowledge illustrates a need for systemized functional assessments as well as various flexible bridge building measures, co-ordinated in order to facilitate improvement in function and work ability, the treatment offered to individuals with chronic musculoskeletal pain is still dominated by a medical approach where people often are sent from place to place in a fragmented cause-finding mission (Krohne & Brage, 2006, Braathen et al., 2007; Wigers & Finsset, 2007).

However, who are in position to identify and motivate individuals with CNOMP fitted for rehabilitation? The GP's, the case-worker at NAV, and the employer do all hold important knowledge about the persons/employees resources and skills that should be utilized in the rehabilitation process. The case-worker in NAV and the employee might however lack authority to be the identifiers and motivators due to their double-role as respectively administrator of the funding and as manager directly responsible for the companies' performance. Though, the GP's have the authority required to identify and motivate the person/employee that potentially profit from a multidisciplinary rehabilitation programme. Efforts to ensure that GP's and professionals in general involved in treatment have the necessary methods and knowledge required to address resources for improvement is however decisive.

5.2 General discussion

Being a part of the work life, an important arena for personal development, is of great importance also for a person with chronic musculoskeletal pain problems (Jakobsen, 2001). Though, experiences of repetitive negative responses in today's working life, dominated by efficiency improvements and changeover, might have a negative influence on the process of work re-entry for individuals with reduced function due to chronic musculoskeletal pain (Jakobsen, 2004; Torp, 2005).

The findings in Papers I-IV suggest that multidisciplinary rehabilitation programmes, represent an approach that has the potential to effectively address the factors that affect outcome in individuals with complex CNOMP conditions. By contributing important knowledge about the nature of the factors being studied and clarifying the complexity of individual and environmental factors involved in chronic disability, function, and work ability, these findings might improve the choice of predictors.

The theoretical idea was that by approaching chronic musculoskeletal pain, function and work ability from different perspectives and disciplines, bridging the gaps between them and integrating different approaches, new and more comprehensive knowledge of the phenomenon could be achieved. Based on general system theory thinking (Bertalanffy, 1968), the biopsychosocial model as well as the concept of SOC incorporates a complex of elements interacting in a functional way and changing with time (Antonovsky, 1979; 1987a; McLaughlin, Kennedy, & Zemke, 1996; White, 2005), which might help explain and understand the dynamic process of work re-entry in individuals with chronic musculoskeletal pain.

The main foundation of the concept of SOC is to create coherence between structures and systems (Antonovsky, 1979; Eriksson, 2007), which is considered as a main challenge in the process of work re-entry. Although review has demonstrated both strengths and weakness of the salutogenic theory (Eriksson, 2007), the salutogenic orientation proceeded from the assumption of human nature as heterostatic rather than homeostatic, are found appropriate in the daily activities and actions of the professionals at the rehabilitation centre as well as an orientation in this thesis by focusing on functioning rather than disease. The biopsychosocial model (Engel, 1977), being particularly important in drawing attention to significance of the context and the environment, was employed in this research on prognostic factors for chronic non-specific musculoskeletal pain and related disability. Although there is considerably stronger evidence regarding the importance of the biopsychosocial (BPS) model in

determining disability associated with chronic medical conditions (Turk, 2002; Pransky et al., 2005; Sullivan et al., 2005), the BPS model can be criticized from a philosophical viewpoint. The BPS model by Engel (1977) is inspired by General System Theory (Bertalanffy, 1968), in which nature is conceptualized as a hierarchy of systems, but Engel does not go into any detail about the interactions between systems at different levels. In addition the BPS model lacks an existential/spiritual dimension, and does not attempt to give a detailed account of mind-body relations, which might be relevant in understanding chronic musculoskeletal pain. However, the biopsychosocial model has been particularly important in drawing attention to the role of psychosocial factors in function and work ability in individuals with chronic non-specific musculoskeletal pain (Brannon & Feist, 1997; Turk, 2002; Pransky et al., 2005; Sullivan et al., 2005; Lillefjell et al., 2006). Empirical findings in the present study (Papers I-IV) as well as findings in previous studies and reviews of the literature indicate the relevance of multidisciplinary programmes that include psychosocial pain management intervention in improving function and reducing work disability (Sullivan et al., 2005; Lillefjell, 2006; Lillefjell et al., 2006; Lillefjell et al., 2007). These studies also emphasize the importance of interventions of longer duration addressing multiple dimensions of pain and disability for individuals who have been absent from work for longer periods of time (Haldorsen et al., 2002; Linton, 2002). A multidimensional perspective (Engel, 1977; Antonovsky 1979) that captures the dynamic developments that disability and return to work entail, rather than view the problems as static, has as supported by previous studies as well, therefore provided crucial data on the processes involved that might help reveal the nature of the mechanisms involved (Linton et al., 2005; Pransky et al., 2005; Lillefjell, 2006; Lillefjell et al., 2006; Lillefjell & Jakobsen, 2007; Wigers & Finset, 2007).

5.3 Methodological considerations

The validity of a study is often divided into internal and external validity. The internal validity is defined as the degree to which the results are representative for the particular cohort being studied. External validity is whether the results are applicable to other populations (Benestad & Lake, 2004). Both aspects of validity are important to determine whether studies can be used to improve knowledge and guide clinical practice.

Prospective designs are suitable for descriptive and analytic analysis, for capturing both the nature of the mechanisms to be studied and the dynamic processes involved. A prospective follow-up study design was considered appropriate for the aims of this thesis.

However, there are several limitations with the present investigations, primarily caused by a relative small non-randomized sample. Because of a relative small number of participants with mixed pain diagnoses and type of jobs, it is possible that these factors might have diminished the result, and that generalization is limited. However, in this prospective follow-up study, the participants included represent all patients seen over a period of time, and there were no drop-outs through the rehabilitation period. The reason for not including more participants, over a longer period of time, was a change in the source of funding that influenced the recruitment procedure of participants to the rehabilitation programme. These major changes in the recruitment procedure were considered to possibly influence the validity (Ringdal, 2001; Benestad & Laake, 2004; Aalen et al., 2006). Therefore, in order to secure the validity, the individuals included were those individuals with long-term chronic (> 3 month) non-specific musculoskeletal pain, recruited by means of financial resources from the Social Security Office.

In present follow-up study, all patients did not receive exactly the same standardized intervention, as would be expected in randomized controlled trials (Keppel & Wickens, 2004; Aalen et al., 2006). However, the aims of this study were to examine characteristics of the individuals in a real clinical setting and how these characteristics might affect function and the ability of those individuals to re-enter the workforce. Some might argue that "outcome" questions need a randomized controlled study design. The methodological term "outcome" can however be used as a general and clinical terminology to describe the results of a rehabilitation programme in terms of improvement in function and work ability. It is in this way the term has been used in the present papers (I-IV) and in this thesis. Repeated measures as performed in present study, mean that the observations are dependent, and this might cause incidental effects like order effects (practice), carry-over effects, and context effects (Keppel & Wickens, 2004). Measurement itself may influence the outcome by leading to efforts to address a particular risk factor.

Another limitation of the results is the possibility of bias related to the self-report. Psychosocial factors like emotional distress, secondary loss, somatisation and symptom magnification, compliance, and resistance issues might have influenced the self-assessment (Gatchel, 2004). By calculating the standard deviation (SD), the average amount of deviation from the means, on the cognitive function/capacity variable concentration, the SD was found considerably larger (SD = 47.10) compared to the SD on the other VAS variables. This may indicate that the SD has been affected by extreme values, and might limit the generalization of the results. However, the repeated measures design are efficient, allow greater comparability

of conditions, and are more powerful compared to independent groups design (Keppel & Wickens, 2004). In future studies it might also be of value to include the GP's/treating professionals` estimates of the individuals function and change in function as well.

Instruments used in the investigations were chosen in accordance with the research questions, and also integrated as functional assessments in the daily practice at the rehabilitation centre. Measuring functioning represent however a challenge (Krohne & Brage, 2007), and it might always be relevant to question if the chosen instruments are adequate to answer the research questions, and also if and in what way they are useful as functional assessments in the daily practise. Moreover there is always a discussion on objectivity versus subjectivity (Krohne & Brage, 2007). In present study a multidimensional approach was employed in the investigations to provide potentially greater reliability in the self-assessment of pain, function and work-ability. However, the measurements made such as with the VAS and the COOP/WONCA charts might be limited in content. Each scale is represented by only one item; their sensitivity is therefore potentially limited. The performance of single charts might be less precise in detecting differences in function compared to other multi-item health status scales, nevertheless the measures are found to perform well in chronic pain samples in comparison with related measures (Bowling, 1997; Bentsen et al., 1999). A recent study by Brage, Fleten, Knudsrød, Reiso & Ryen (2007) reported e.g. a strong correlation between the items in the COOP/WONCA Charts and other functional assessments like the Norwegian Function Assessment Scale and the SF-36. The VAS scale has been used in creative ways to explore the phenomenon of pain perception and pain reporting in addition to explore other health related phenomena like e.g. emotional distress, sleeplessness, tiredness, and life demands (Wewers & Lowe, 1990; Bowling, 1997; Zanoli et al., 2001; Haugli et al., 2001; Hunter, 2001; McGeary et al., 2006; Wigers & Finset, 2007). Based on the fact that the VAS tries to measure a characteristic or attitude (or behavioural phenomena) that is believed to range across a continuum of values and cannot easily be directly measured (Wewers & Lowe, 1990), it might be particularly useful in the daily clinical practice by forming the basis of individual adaptations. Such assessments, as used in present study, are clearly highly subjective, and one might argue that these scales are of most value when looking at change within individuals, and are of less value for comparing across a group of individuals at one point in time. Some caution is therefore needed in handling such data.

When evaluating pain, function, and work ability one cannot assume that there will be one "gold standard" measure which will be the most reliable or valid (Gatchel, 2004). With a view to improve knowledge and guide clinical practice, a broad range of self-reporting

measures were used in the present investigations (Papers I-IV) to capture the complexity of factors and describe the dynamic processes involved in chronic non-specific musculoskeletal pain conditions, function, and work ability. When it comes to daily clinical practice, exercise of judgement will always be an important element. Based on the complexity of the phenomenon, as presented in previous research as well as in this thesis, it is also reasonable to assume that standardized instruments solely not are sufficient in the daily clinical practice (Norrefalk et al., 2005; Shaw et al., 2005; Krohne & Brage, 2006; McGeary et al., 2006; Braathen et al., 2007; Wigers & Finset, 2007). In order capture the complexity of the phenomenon as well as to improve the selection and development of instruments used, an ongoing process with frequent evaluation is required.

The demographic composition of the sample in this study is close related to that of the large HUNT study, which greatly enhances the generalizability of the findings of the current study. Age, gender, and level of education were also found to be in accordance with the found characteristics of the general Norwegian pain population (Rustøen et al., 2004a; 2004b). This enables the differences between the sample and the general population to be studied closer without taking the above-mentioned factors into consideration as explanatory variables. The rehabilitation programme may have been responsible for changes in function, however given the design of the study with its absence of comparison groups and lack of random assignment, further investigation is still needed to clarify the relative agents responsible for change and the importance of the predictors in persistent pain conditions. Several factors like work environmental variables and the social- and economic policy might be important predictors of function and work ability as well. However, it was beyond the scope of this thesis to include all the possible predictors of pain, function and work ability. It is of our belief, despite the limitations pointed to above, that the findings in this study (Papers I-IV) might contribute to a better understanding of function and work ability, and how individual experiences and environmental variables affect function and work ability in a real clinical setting in individuals with chronic non-specific musculoskeletal pain. In addition, this is important knowledge to make use of, not only in rehabilitation of chronic musculoskeletal pain, but also in primary prevention at a population level.

5.4 Implications and directions for the future

This study (Papers I-IV), conducted in a real clinical setting, raise some interesting perspectives on the complexity of factors that impact on function and work ability in individuals with chronic non-specific musculoskeletal pain. These are factors that should be taken into account in rehabilitation settings, systemized and chained in order to facilitate improvement in function, work ability, and work re-entry. However, additional research is recommended to further clarify the role of individual as well as environmental factors in this context.

Despite empirical findings and arguments of how multidisciplinary rehabilitation programmes are cost effective in relation to improved function and work ability (Turk, 1996; 2002; Vowles & Gross, 2003; Vowles et al., 2004), multidisciplinary rehabilitation programmes, as a method of treatment, have not been very commonly used for people with chronic non-specific musculoskeletal pain in Norway. However, our data suggest that multidisciplinary research paradigms will be of value as foundation for rehabilitation procedures. The clinician's orientation would possibly benefit from the multidimensional approach (Engel, 1977; Antonovsky 1979; 1987a), in which not only health issues are addressed, but also labour market conditions, local economic characteristics, work environments (ergonomic and psychosocial), educational levels, household factors, and cultural values. A multidimensional approach represents a view that has the potential to effectively focus on function and work ability, not necessarily on rendering the individual free of symptoms. This will provide potentially greater reliability in self-assessment of function.

On the one hand, more research is needed to determine which risk factors can be effectively addressed in rehabilitation, and the nature of training required delivering these interventions competently. It would be important to identify in more detail the factors related to low socio-economic status that may lead to chronic musculoskeletal complaints. On the other hand, for several reasons, reduction in well-known risk factors may not result in improved outcomes. The risk factor may simply not be causally linked to disability. Future studies should therefore try to clarify whether chronic non-specific musculoskeletal pain is a cause for or a consequence of socio-economic and socio-demographic risk factors.

The complexity of rehabilitation is being increasingly recognized. There have been few efforts to ensure that professionals involved in treatment have the necessary methods and knowledge required to affect a meaningful change in psychosocial risk. Another knowledge gap is the role of the employer and that "players" influence on outcomes. Presumably it is the

improvement in employers' experiences and knowledge about efforts, financial support systems, and necessary adaptations required in chronic disease that facilitates work re-entry in individuals with chronic health problems. To increase our understanding of chronic non-specific musculoskeletal pain, function, and work ability/disability, it seems therefore to be essential to incorporate not only socio-demographical and clinical factors, but also occupational factors. Even broader issues such as employer reactions, the job market, and family variables, appear to be important.

Even though lots of people suffer from chronic musculoskeletal pain, the issues do not seem to be effectively addressed within a public health model of competing choices, best evidence, and cost-effectiveness (Pransky et al., 2005). When return to work for people with reduced function is to be addressed, external factors like the public policy play an important part. Although different policy efforts have made an attempt to remove barriers in society of hinder for work re-entry, better coordination and make use of more flexible and practical efforts to assist people with reduced functioning into work still seems to be part of the challenge (Jakobsen, 2001; 2004; 2006). The high prevalence of people with chronic pain, and the need for extensive rehabilitation programmes in a modern welfare state, gives rise to concern. Increasing knowledge about individual rehabilitation efforts must therefore not reduce attention to the underlying causes of incidence of these cases and future efforts in primary prevention at a population level i.e., the social- and economic policy implications of these findings. Questions like: Why is there such a high incidence and prevalence of these disorders? And what is it about the social system that perpetuates such a situation, were beyond the scope of this thesis, however, the empirical findings in this thesis do alert us to these issues.

Because the lack of function and related work disability has many faces, studying various stages of disability might be of value. For example, studying the development of problems before work disability occurs is as important as studying the return-to-work-process. Future research would possible also benefit from repeated measures over considerable time to capture data on the process involved.

6 General conclusions

The answers to the research questions addressed in the present thesis are indicated in the following conclusions:

- Pain intensity and pain experience were found to decrease significantly during the rehabilitation programme, moreover measures of functional health status (COOP/WONCA) showed an improvement in feelings, daily activities, social activities, and in overall health from the 1st week to the 57th week of the rehabilitation period. A significant improvement in function in daily activities was also found from the 57th week to the 1 year follow-up measure (109 weeks).
- Poor physiological (physical) capacity/function significantly associated with high levels of pain intensity and pain experience at baseline. Moreover, pain intensity associated significantly with pain experience over all measurement periods.
- Variance of functioning (functional health status measured by COOP/WONCA) over the 3 measurement periods (57 week rehabilitation period) were best predicted by poor physiological- and psychological capacity, high levels of anxiety and depression, as well as high levels of pain intensity and pain experience. Moreover, high baseline levels of pain intensity and pain experience and poor psychological capacity, as well as poor physiological capacity and high levels of anxiety and depression at the end of the rehabilitation program were the most important prognostic factors of variance in functioning over the 4 measurement periods.
- No significant gender differences in location and severity of chronic musculoskeletal pain were found. Neither were there any gender differences in the pain-, emotional distress-, function-, or health related variables, except from the Sense of Coherence (SOC) measures. Scores on SOC showed gender differences in the manageability-, and the meaningfulness sub-scales. Several gender differences were found in how socio-demographic-, socio-economic-, pain-, and psychosocial factors influence treatment outcome in terms of pain and functional health status.
- Sense of Coherence (SOC) significantly increased from the 1st week to the 57th week of the rehabilitation period, and correlated significantly with anxiety and depression (r = -.37-r = -.63). Low anxiety scores was the strongest predictor of comprehensibility, while low depression scores was the strongest predictor of meaningfulness. No

significant association was found between SOC end work re-entry in the chronic non-specific musculoskeletal pain sample.

- The number of participants on their way in work or in work increased from 57.4 % at the start of the rehabilitation period to 80 % at the end of the 57th week rehabilitation period.
- Age, sleeplessness, and tiredness were the background variables demonstrating the strongest association with work status. Moreover cognitive function, anxiety, pain experience, and overall health were the function variables strongest associated with work ability at the end of the rehabilitation period.

How can knowledge from the most important findings guide clinical practice?

The findings in this study emphasize the importance of considering the impact of both individual- and environmental factors on function and work ability in individuals with CNOMP in future empirical studies as well as in rehabilitation settings. Based on the theoretical framework and methods used, the findings particularly elaborate the importance of:

- Strengthening physical, emotional and cognitive resistant resources and skills in different aspects of daily life and in different environmental contexts in order to facilitate work ability and work re-entry among individuals with CNOMP.
- Significant individual- and system knowledge among the "bridge-builders" in order to create optimal room for alternative courses of action that effectively contribute to clarification of the individuals' workability and need for assistance.
- Flexible bridge building measures that take into consideration varying degree of work ability across a period of time, dependent on the context and/or variation in state of health.

Although the awareness of the complexity of this phenomenon and the limitations in the study design and instruments used regarding application and generalization of the findings, some assumptions are to be made: Although the study has not evaluated the rehabilitation programme, the findings give preference to a comprehensive multidisciplinary model of rehabilitation for individuals with long term complex musculoskeletal pain

conditions. A comprehensive programme of action should probably focus on enhancing personal resources such as physical-, emotional-, and cognitive capacity, psychosocial coping ability, as well as improving the work environment, work place relations and work processes (workplace-based intervention). Why? Whatever work or occupation, physical and psychosocial functioning capacity is an essential precondition for good general health, work re-entry, and coping at work. Coping with the constant stream of changes in today's working life is also placing increasing emphasis on psychcognitive skills, i.e. the ability and motivation to learn, understand and evaluate information, concentrate, and remember. These are important skills for daily life functioning, however often inhibited when having severe pain. Special attention should therefore be given to resistant resources and skills for active problem-solving/finding solutions. Though, it is important to be aware of probable socioeconomic differences in coping strategies. Problem-solving focused coping is e.g. found less frequent among individuals with low levels of education. Lower education also seems to have impact on employment rates in general and particularly in women in the oldest age group.

Based on the complexity of the phenomenon there is no doubt that the counsellors, as well as the employer and GP's, have key positions. The counsellor's competence is essential, requiring a substantial theoretical and empirical basis for their work as well as good practical skills, sensitivity, and intuition, which incorporate the ability to see the whole situation, contextualize it and act accordingly, in order to facilitate work re-entry. Moreover, the employers' responsibility to provide reasonable accommodation to workers with reduced function stresses that the rehabilitation process is to be accomplished in close collaboration between the employer and employee. Ultimately work re-entry depends on to what extent the employers are willing to employ people with reduced function. It is therefore essential that the support to the employees is powerful enough incentives to create a more inclusive working life.

Flexible bridge building measures systemized and co-ordinated in order to facilitate improvement in function and work ability, capturing the need for individual tailor-made processes that focus on function rather than on rendering the individuals' free of symptoms seems to be a key to promote work ability and work re-entry. Flexibility in measures means to take into consideration varying degree of work ability across a period of time, dependent on the context and/or variation in state of health. However, to make use of more flexible and practical efforts to assist people with reduced functioning into work still seems to remain a significant challenge. Development of knowledge in daily practice is important and essential

for continuously improvement of the treatment offered to individuals with complex pain conditions. Based on the importance of a knowledge-development-perspective, the recent political strategy of replacing rehabilitation of longer duration with standardised, full unit-price funded procedures of shorter duration, gives rise to concern. What are the consequences of a full unit-priced funding? How can full unit-priced funding give grounds for development, goal-orienting, and evaluation of the rehabilitation model? How is knowledge development possible without a basic funding that secure continuity of the rehabilitation model?

A systematic salutogenic orientation focusing on the resources available is probable useful in the daily actions of the counsellors. Nevertheless, to implement the salutogenic approach in all societal levels in policies is challenging. Coherence is however a key, illustrating the main challenges in the rehabilitation research and practice as well as in primary prevention and health promotion, to create coherence between structures and systems.

Additional research is however needed to further clarify the role of individual as well as environmental factors in function, work ability, and work re-entry in this context.

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ERRATUM

Paper II

Page 662, *Subjective pain and function assessments,* line 6: (7 items) should be replaced by (5 items of function)

Paper III

Page 4, line 10:
"salutogenetic" should be replaced by salutogenic

Paper IV

Page 547, *Statistical Methods,* line 4: logistic regression should be replaced by logistic and linear regression
Page 548, Table I: > 4 years should be replaced by < 4 years, < 4 years should be replaced by > 4 years.
Page 551, line 3: Table III should be replaced by Table II.

Paper I

BMC Musculoskeletal Disorders

Research article

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Prediction of function in daily life following multidisciplinary rehabilitation for individuals with chronic musculoskeletal pain; a prospective study

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Abstract

Background: The prevalence of chronic musculoskeletal pain is high, with widespread negative economic, psychological, and social consequences for the individual. It is therefore important to find ways to predict the outcome of rehabilitation programmes in terms of function in daily life. The aims of this study were to investigate the improvements over time from multidisciplinary rehabilitation in terms of pain and function, and analyse the relative impact of individual and psychosocial factors as predictors of function in daily life in individuals with chronic musculoskeletal pain.

Methods: A prospective study was conducted among one hundred and forty three (N = 143) musculoskeletal pain patients. Measures of pain, function, and functional health status were obtained at baseline, after 5 weeks of intensive training, at the end of the 57-week rehabilitation programme, and at a 1 year follow-up, using validated self-administrated measures. Linear regression analysis was applied to investigate the relative impact of musculoskeletal pain, individual-, and psychosocial factors in function.

Results: The participants studied showed a significant increase in function during the 57 weeks rehabilitation period. There was also a significant increase in function from the end of the rehabilitation period (57th week) to the one year follow-up measures. Pain intensity associated significantly with pain experience over all measurement periods. High levels of pain intensity (β = .42**) and pain experience (β = .37*), and poor psychological capacity (β = -.68*) at baseline, as well as poor physiological capacity (β = -.44**) and high levels of anxiety (β = .48**) and depression (β = .58***) at the end of the rehabilitation program were the most important prognostic factors of variance in functioning over the 4 measurement periods.

Conclusion: The data suggest that physical capacity, emotional distress and coping skills should be priority areas in rehabilitation programmes to improve functioning in daily life.

Background

Chronic musculoskeletal pain represents an important cause of reduced function in daily life, and constitutes a significant and increasing medical, social, and economic challenge in industrialized countries [1,2]. In more than 90 % of the musculoskeletal pain cases, no organic reason can explain the pain that for some individuals persists and gets worst to the point where it considerably limits function in everyday activities [3-5]. General pain, viewed as a multidimensional phenomenon with varying degrees of severity, distribution and functional impact, is considered to be chronic if it lasts for more than three months [3,6,7]. Chronification is not only tied to the duration of pain. Chronic pain is found to be associated with a multitude of secondary stressors such as sleep disruption, unemployment and interpersonal tensions [3,8,9], and psychosocial factors are considered to be among the most important variables that influence the total health picture. The influence of individual and psychosocial factors in function is moreover believed to be stronger for people with chronic musculoskeletal pain [6,10]. Pain and function can also be approached in a cultural and historical context, and are viewed as multidimensional phenomena that are influenced by many factors, such as the effect of previous experience and cultural beliefs, as well as sensory input [7,10]. In accordance to the International Association for the Study of Pain (IASP), the experience of pain is connected to emotions and is defined as 'an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage' [[11], p.108]. A study by Rudy, Lieber, Boston, Gourley and Baysal [12] concluded that more than 90 % of the variance in performance among disabled individuals with chronic musculoskeletal pain was predicted by psychosocial factors; self-efficacy, perceived emotional and physical functioning, pain intensity, and pain cognition being the most important. This is supported by Geisser, Robinson and Miller [10] maintaining that individual and psychosocial factors were deemed to be of great importance in the experience of pain. The consequences of pain for a person's everyday life are therefore not only dependent on the underlying pathophysiological impairments, but to a large extent decided by that person's perception of the disease in their present life situation. Depression, reported to be highly prevalent among people with chronic pain [2,13], can take many forms and vary in the number and severity of symptoms. Even milder symptoms of depression have been found to influence the experience of pain. Both somatic and cognitive symptoms of depression are associated with perceived psychosocial functioning among people with chronic musculoskeletal pain, even when controlling for pain intensity and other measures [2,10]. Pain-related anxiety, the belief that pain is a sign of damage or harm to the body, and that activities that might cause pain should be avoided are also believed to be important contributors to disability and adjustment among people with chronic pain [10,14]. Therefore, the individual's understanding of the symptoms and the impact of the symptoms on everyday life might be an important way of understanding pain and function.

Chronic widespread pain and poor health functioning are significantly associated with a number of environmental factors [15-17], acting both through and independently of disease. This is emphasized by Krokstad and Westin [18] who demonstrate the importance and impact of social-, non-medical-, and contextual determinants in disability. Factors such as little social support, little social anchorage, or little need of being social are found to significantly increase the odds for a person to experience a high level of pain [19,20]. The development of widespread chronic pain is also found to be predicted by higher age, drinking alcohol weekly, smoking, traumas in childhood and a family history of chronic pain. However, optimistic attitudes about how the pain will interfere with daily life, the individual's social interaction, and the individual's ability to receive assistance are factors that are found to predict pain reduction [9,19,21-24]. Multidisciplinary treatments, in general, are found to effectively improve the functioning of chronic musculoskeletal pain patients in daily life. Such treatments are more cost-effective than alternative pain control treatments (i.e. 'conservative' care and surgery), and achieve equal or greater efficiency [25,26]. People who have completed treatment typically report decreased pain intensity, less depression and less pain related anxiety, improved levels of pain coping skills, and increased function in daily life.

Chronic pain in the musculoskeletal system and responses to rehabilitation treatment has often been studied in terms of clinical factors and objective determinants of the person [9,10,19,22]. Results from several studies indicate that physical-, psychological-, and socioeconomic variables play a major role in how pain is experienced, as well as how individuals respond to rehabilitation treatment for chronic musculoskeletal pain conditions [9,10,18-21]. While advanced designs are appearing more frequently in chronic musculoskeletal pain research, there is a need for prospective, inception studies so that we can learn more about the nature of the risk factors being studied. Longitudinal follow-up studies, conducted in a real clinical setting, are therefore still needed.

The present study uses a biopsychosocial theoretical approach and the empirical findings discussed [27-29] in order to: 1. Examine improvement in function over time in individuals with chronic musculoskeletal pain participating in a multidisciplinary rehabilitation programme, and 2. Analyse the relative impact of individual and psy-

chosocial factors as predictors of pain intensity, pain experience, and function in daily life in individuals with chronic musculoskeletal pain participating in a multidisciplinary rehabilitation programme.

Methods

Subjects

The study sample consisted of 143 (*N* = 143) individuals, aged 20–67 (mean age = 45.7/SD = 8.9), with chronic (> 3 month) musculoskeletal pain, who participated in a 57-week long multidisciplinary rehabilitation programme at a rehabilitation centre in central-Norway. Data were collected at four points in time; at the start of the rehabilitation, after 5 weeks of intensive training, at the end of the 57-week rehabilitation period, and at a 1 year follow-up after end of the rehabilitation period. All participants (*N* = 143) completed the 57 weeks rehabilitation period, however, the follow-up response 1 year after the participants completed the rehabilitation period was 51 % (*n* = 72). The majority of the participants (*N* = 143) were women (74 %), and 79 % of the participants reported to have primary or technical/vocational school for 1–2 years. In addition, the majority of the participants reported to be unskilled or skilled workers/craftspeople (59 %). In order to compare the characteristics of the study sample with the general population in the same geographic area, data were used from an age-matched group (*n* = 52186, mean age = 43/*SD* = 12.7) from the Nord-Trøndelag Health Study (The HUNT 2 Study). The study was approved by Norwegian Social Science Data Service (NSD) and the Regional Medical Ethical Committee of Mid-Norway (REK). All patients were volunteers and gave their informed consent. Confidentiality was emphasized.

Treatment program

The multidisciplinary rehabilitation programme (see Table 1), based on a biopsychosocial theoretical model [29,30], consisted of a 5-week intensive period, where the participants attended approximately 6 h/day, 4 days a week, and a follow-up period of 52 weeks, where the participants attended approximately 6 h/day, 1–3 days a week. The participants were assigned to the rehabilitation programme by their medical doctor based on interviews, observations, and clinical tests. Formulation of individual training and exercise programmes is based on the mapping of the participants. All participants had a personal supervisor, and individual counselling is offered during the training period.

In cooperation with the National Health Insurance Office, Employment office, employer and other Public Health Services, an individual tailored education and coping

Table 1: Content of the multidisciplinary rehabilitation programme

Period	Intervention	Duration
Period I: Mapping of the participants resources/ intensive training period	• Introduction to the rehabilitation programme • Mapping physical-, psychological-, and social function • Individual counselling-based on the mapping; preparation of a long-term plan for the rehabilitation process in cooperation with their medical doctor, social security office and the employer. • Individual and group-based training to improve functional capacity: 1. Individual exercise programme with focus on e.g., endurance, strength, mobility, and relaxation techniques, 2. Group-based education/training in different health related subjects e.g., body structure, diet, exercise planning, coping strategies, communication, strategies for conflict negotiations, and social security system 3. Indoor and outdoor activities every day	*6 h/day, 4 days a week in 5 weeks*
Period II: Follow-up training/rehabilitation period	Functional capacity training continues (individual and group-based, indoor/outdoor activities, education), individual counselling, clarifying function and work ability, prepare a plan for work re-entry in cooperation with the employer, for example.	*6 h/day, 1–3 days a week in 52 weeks*
During/after finishing the rehabilitation period	In addition to the regular rehabilitation programme (57 weeks), the rehabilitation centre offers exercise groups e.g., endurance groups, water activity groups, and relaxation training groups in the participant's local community.	*1 h/1–3 days a week*

process was emphasized that sought to increase functional capacity, decrease affective distress, and educate patients about the positive health process. Although all patients did not receive exactly the same standardized intervention, as would be expected in a randomized controlled trial, our aim with this study was to examine individual effects in function in real clinical settings.

Instruments and procedures

Self-reporting measures were administrated individually to the participants at the rehabilitation centre. Data were collected at baseline, after the 5-week intensive period, after the 57-week rehabilitation period and at the one year follow-up after the participants finished the rehabilitation period.

The Visual Analogue Scale (VAS) [31,32] was employed to assess variables on pain (worst imaginable pain, how troublesome the pain is), physical capacity (muscle strength, endurance capacity, energy, mobility, and balance), psychological capacity (good feeling inside, mood, feeling valuable, extroverted/introverted, optimistic/pessimistic, calm, and balanced), coping (feeling of coping in daily life, control and influence in daily life), and cognitive capacity (concentration, memory, understand/evaluate information, and knowledge). The VAS is a line of 10 cm on which pain marks are scored in millimetres, representing the continuum of the symptom to be rated. Instructions about how to rate the present pain, how troublesome the pain is and the present function/capacity were given along with the scale. VAS variables were used as independent variables (predictors of outcome). Moreover, pain intensity and pain experience were used as outcome measures as well. The use of the VAS is well established in chronic pain populations, and test-retest reliability of the scale has been satisfactory with a reproducibility of 0.75–0.83 [31,33]. The scale has also been used in creative ways to further explore the phenomenon of pain perception and reporting, in addition to explore other health-related phenomena [31,34,35]. Factor analysis (varimax method) [36], extracted with eigenvalues > 1.00 as a criterion, indicated that items could be grouped according to the intended constructs presented above.

Function in daily life was measured using the Norwegian version of the Functional Health Status measurement COOP/WONCA Charts [37]. The COOP/WONCA charts, used as an outcome indicator (dependent), measure six core aspects of functional status: physical fitness, feelings, daily activities, social activities, changes in health and overall health. Each item is rated on a five-point ordinal scale ranging from 1 ('no limitation at all') to 5 ('severely limited'). The test-retest reliability of the original Dartmouth version and the Norwegian version was found satisfactory (r = 0.74–0.86) [38]. The charts of function and feelings have been reported to correlate well with other measures of physical and emotional functioning respectively, such as the Barthel Index and the Zung Depression Scale [32].

Anxiety and depression, used as predictors (independent) of function (functional health status, pain intensity and pain experience), were assessed by using the Hospital Anxiety and Depression Scale (HADS) [32,39]. HADS is a brief assessment of anxiety and depression, consisting of 14 items divided into two sub-scales for anxiety and depression, in which the patient rates each item on a four-point scale. Individual items are scored from 0–3 to 3-0, depending on the direction of the wording of the items. The scores of the items represent the degree of distress: none = 0, unbearably = 3. Tests for reliability (test-retest) of the scale have been satisfactory with a reproducibility of 0.67–0.77 [32,39]. Factor analysis (varimax method) [36], extracted with eigenvalues > 1.00 as a criterion, indicated that items could be grouped according to the two main constructs.

The participants' self-reporting about education level, type of job, financial matters, social network, sleep disturbance, tiredness, and history of childhood trauma (independent variables) was supplemented by personal interviews. The self-reporting of traumas include experiences such as; bullying, physical-, emotional-, and/or sexual abuse. Except for education, categorized in four levels, all information retrieved from the interviews was categorized in two levels of categorical variables. The internal consistency was acceptable in this study and measures such as Cronbach's alpha coefficients were calculated at 0.80–0.85.

Statistical analysis

Data were analysed using SPSS for Windows (version 14.0) software. Frequencies, percentages, mean values and standard deviation were calculated for continuous and categorical variables. Multivariate tests (single group repeated measures design) [36] of the significance of the repeated-measures effect (Pillai's Trace) were provided in order to examine the long-term improvements (variance due to passage of time) of the multidisciplinary rehabilitation programme in terms of functional health status (COOP/WONCA), pain intensity (VAS), pain experience (VAS), anxiety (HADS), and depression (HADS). T-tests were used to compare the sample (N = 143) with the HUNT population from the same geographical area, on the anxiety and depression variables. For the initial selection of potential determinants for the outcome measures pain intensity, pain experience and functional health status (physical fitness, feelings, daily activities, social activities and overall health), univariate linear regression analysis, done on the baseline, were used with of signifi-

cance level of $p < 0.05$. Subsequently, all independent variables that showed significant associations with the outcome measures (dependent) were considered for inclusion into the multivariate linear regression models. These analyses were carried out separately for the definition of outcome variables (pain intensity, pain experience, functional health status: physical fitness, feelings, daily activities, social activities and overall health). In order to identify which variables predict change over time best, all measurements across the rehabilitation period (3 times) were included in steps in the same model with effects of these variables on the estimated change of the outcome variables (functional health status, pain intensity, pain experience) over the 3 measurement periods (T1-T3). The dependent variable at Time 1 was entered first in the model to control for its effect. In addition, all measurements across all times were included in steps in the same model with effects of these variables on the estimated change of the outcome variables (functional health status, pain intensity, pain experience) over the 4 measurement periods (T1-T4). To control for the effect of the dependent variable at T1, the variable was entered first in the model. In the final multivariate models only variables with p-value less than 0.05 were retained. A *p*-value of less than 0.05 was considered statistically significant.

Results

Response and baseline characterization of the sample

All patients (N = 143) included completed the 57-week rehabilitation programme, which gave a response of 100 % at the end of the rehabilitation period. However, the response percentage decreased to 51 % (n = 72) at the 1 year follow-up questionnaire on pain intensity, pain experience, and functional health status. The non-response group reported mean pain and pain experience measured by VAS at respectively 75.4 and 68.0 at the end of the rehabilitation period. Further the mean measures on functional health status (COOP/WONCA charts) were calculated at: physical fitness; 2.87, feelings; 2.73, daily activities; 3.08, social activities; 2.23, and overall health; 3.08 at the end of the rehabilitation period in the non-response group. Back, shoulders, and neck were the most common pain locations in the sample, and 93.8 % of the participants reported pain in more than two locations. As seen in Table 2, the majority (68 %) of the sample was married, and the total per cent exposed to traumas in childhood in the present pain sample was 37 %. Sixty nine per cent reported sleeplessness and 74 % reported tiredness in everyday daily life. By comparison, the age-matched population from the same geographic area (HUNT 2) (aged 20–67) consisted of 47.5 % men and 52.5 % women, 70 % reported to have basic or secondary education, and 22.5 % of the HUNT population reported to be unskilled or skilled workers/craftspeople. The portion reporting poor social network in the chronic musculoskeletal pain sample was equal to the HUNT population (Table 2).

Functional status

Figure 1 shows the mean and standard deviations of pain intensity and pain experience (how troublesome the pain is) measured at 3 points in times during the rehabilitation period and at a one year follow-up. Pain intensity and pain experience significantly ($p < 0.01$) decreased from the start of the rehabilitation period to the one year follow-up measures at 109 weeks. Table 3 show the long-term improvements (trend over time) of the multidisciplinary rehabilitation programme with a significant improvement in cognitive- ($p < 0.001$), physiological-, ($p < 0.001$), and psychological ($p < 0.01$) capacity, measured by VAS, in the pain sample during the 57-week rehabilitation period. In addition, scores on the Hospital Anxiety and Depression Scale (HADS), seen in Table 3, showed a significant ($p < 0.01$) reduction in both anxiety and depression during the rehabilitation period. Despite this reduction, the present pain sample still scored significantly ($p < 0.001$) higher on the anxiety and depression variables at all measurement points during the rehabilitation period compared to the HUNT population.

In Figure 2, measures of function in daily life using the COOP/WONCA charts (Functional Health Status) are presented as mean values. Functional health status significantly increased on the variables feelings ($p < 0.05$), daily activities ($p < 0.05$), social activities ($p < 0.001$), and overall health ($p < 0.01$) from baseline to the end of the 57th week of the rehabilitation period in present sample. However, a comparison of present musculoskeletal pain sample with a normative randomized sample (N = 2864) from the Ullensaker study [38] on the COOP/WONCA charts, demonstrates that the musculoskeletal pain sample (N = 143) still report significantly lower function ($p < 0.01$) on all core aspects of functional health status at the end of the 57-week rehabilitation period. A relative low response (51 %) might limit the relevance of the one year follow-up analysis, however the follow-up measures (109 weeks) on functional health status showed that the partic-

Table 2: Characteristics of present sample (*N* = 143) at baseline compared to the HUNT population (*n* = 52 186).

Characteristics	*N* = 143	*n* = 52 186
Married/cohabitant (%)	71.3	71.7
Smoking (%)	53.8	36.6
Traumas in childhood (%)[a]	37.1	-
Sleeplessness (%)	69.9	31.3
Tiredness (%)	74.8	45.5
Poor Social network (%)	17.5	17.5
Poor Economy (%)	34.3	15.5

[a]Not measured in the HUNT population

Table 3: Multivariate tests of the significance for the repeated-measures effect on functional status in the present sample (Pillai's Trace *V*)

	Baseline	5 weeks	57 weeks				
Variables (*N* = 143).	*M(SD)*	*M(SD)*	*M(SD)*	*V*	*F*	*df*	*p*
VAS							
Physiological capacity[a]	39.9(15.6)	43.6(15.6)	45.8(18.1)	.14	11.61	2	000***
Psychological capacity[b]	58.8(16.4)	59.8(16.0)	62.8(18.3)	.07	5.97	2	.003**
Coping capacity[c]	57.4(15.9)	56.8(16.2)	57.3(19.2)	.00	.12	2	.884
Cognitive capacity[d]	47.9(20.1)	50.0(17.5)	54.3(19.1)	.13	10.81	2	.000***
HAD							
Anxiety	8.83(4.29)	8.65(4.46)	7.93(4.53)	.06	5.16	2	.007**
Depression	6.03(4.16)	5.59(3.96)	5.08(4.30)	.07	5.34	2	.006**

[a]Physiological; muscle strength, endurance capacity, energy, mobility and balance, [b]Psychological; good feeling inside, mood, feeling valuable, extroverted/introverted, optimistic/pessimistic, calm and balanced, [c]Coping; feeling of not coping in daily life, control and influence in daily life, [d]Cognitive; concentration, memory, understand/evaluate information, knowledge. *$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

ipants continued to improve their function in daily activities ($M = 2.82/SD = .95$), feelings ($M = 2.55/SD = 1.27$), and overall health ($M = 3.03/SD = .77$), compared to the 57th week measures (daily activities $M = 3.10/SD = .95$, feelings $M = 2.71/SD = 1.15$, and overall health $M = 3.10/SD = .85$). However, the improvement in function was significant only in daily activities ($p < 0.05$). In addition, the participants reported a decrease in physical fitness and social activities one year after they completed the rehabilitation period, compared to the 57th week measures. The decrease in physical fitness and social activities was not significant, however.

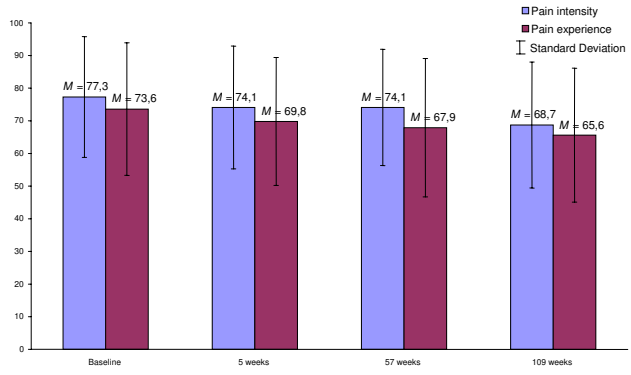

Figure 1
Mean and standard deviation of pain intensity and pain experience measured by VAS. Mean (*M*) and standard deviation (*SD*) of pain intensity and pain experience (how troublesome the pain is) measured by Visual Analogue Scale (0–100) at the start of the rehabilitation period, after 5 weeks of intensive training, at the end of the 57-week rehabilitation period ($N = 143$), and at the one year follow-up measures ($n = 72$) in present musculoskeletal pain sample.

Univariate linear regression analysis

Univariate linear regression analysis, done on the baseline, showed that a multitude of potential prognostic indicators associated significantly with our primary outcome measure functional health status (physical fitness, feelings, daily activities, social activities and overall health).

Here, poor physiological capacity ($F = 19.92/p < 0.000$) and high pain experience ($F = 4.06/p < 0.046$) significantly associated with poor physical fitness, while limitation on the outcome variable feelings associated with poor financial situation ($F = 13.05/p < 0.000$), experience of traumas in childhood ($F = 11.37/p < 0.001$), poor social network ($F = 9.85/p < 0.002$) and high levels of anxiety ($F = 111.61/p < 0.000$) and depression ($F = 66.42/p <$

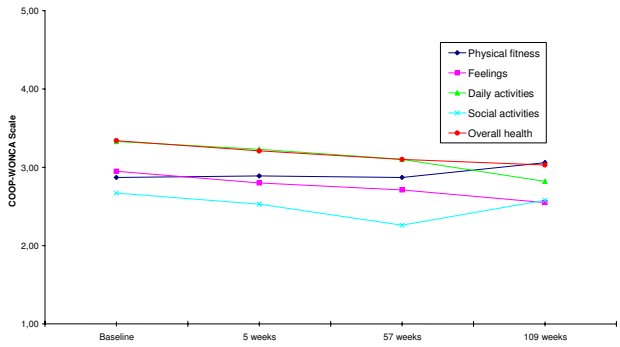

Figure 2
Repeated measures mean for Functional Health Status (COOP-WONCA) in the present musculoskeletal pain sample. Mean Functional Health status measured at the start of the rehabilitation period, after 5 weeks of intensive training, at the end of the 57 weeks rehabilitation period ($N = 143$), and at the one year follow-up measures ($n = 72$). 1 = no limitation at all, 5 = severely limited.

0.000). Moreover, there was a significant association between limitation in feelings and poor physiological ($F = 5.77/p < 0.018$)-, psychological ($F = 68.93/p < 0.000$)-, coping ($F = 12.59/p < 0.001$)-, and cognitive ($F = 13.97/p < 0.000$) capacity in present musculoskeletal pain sample.

Sleeplessness ($F = 6.73/p < 0.010$), high levels of pain intensity ($F = 18.26/p < 0.000$), pain experience ($F = 25.27/p < 0.000$), anxiety ($F = 6.58/p < 0.011$) and depression ($F = 6.52/p < 0.012$) were in the univariate analysis significantly associated with limitation in daily activities. Furthermore, limitation in daily activities associated with poor physiological ($F = 11.90/p < 0.001$)-, psychological ($F = 5.10/p < 0.025$) -, coping ($F = 6.89/p < 0.010$)-, and cognitive ($F = 5.03/p < 0.026$) capacity. Limitation in social activities was significantly associated with poor social network ($F = 4.93/p < 0.028$), high levels of anxiety ($F = 12.27/p < 0.001$) and depression ($F = 10.41/p < 0.002$), and reporting poor physiological ($F = 10.41/p < 0.002$)-, psychological ($F = 22.16/p < 0.000$) -, coping ($F = 7.79/p < 0.006$)-, and cognitive ($F = 10.57/p < 0.001$) capacity in present pain sample.

The univariate analysis, done on the baseline, also showed a significant association between poor overall health and high age ($F = 4.53/p < 0.035$), experience of traumas in childhood ($F = 7.68/p < 0.006$), poor social network ($F = 10.62/p < 0.001$), and high levels of pain intensity ($F = 7.73/p < 0.006$). In addition, limitation in overall health was significantly associated with high levels of anxiety ($F = 10.81/p < 0.001$) and depression ($F = 24.40/p < 0.000$), and poor physiological ($F = 24.77/p < 0.000$)-, psychological ($F = 16.19/p < 0.000$) -, coping ($F = 17.04/p < 0.000$)-, and cognitive ($F = 11.19/p < 0.001$) capacity in present musculoskeletal pain sample.

Poor physiological capacity was the only variable that significantly associated with high levels of pain intensity ($F = 7.88/p < 0.006$) and pain experience ($F = 11.39/p < 0.001$) in the univariate analysis, done on the baseline, in the musculoskeletal pain sample.

Multivariate linear regression analysis

Table 4 summarizes the multivariate linear regression analysis with effects of the independent variables (only significant variables included in the table) across the rehabilitation period (3 times) on the estimated change of the outcome (functional health status) over the 3 measurement periods (T1-T3). Cognitive capacity ($\beta = -.17^{*}$) was the only baseline (T1) measure that associated significantly with functional health status (overall health) in the final model (Table 4). Poor physiological ($\beta = -.24^{*}$/$-.45^{***}$) (T2 and T3)- and psychological ($\beta = -.38^{**}$) (T3) capacity, high levels of anxiety ($\beta = .59^{***}$) and depression ($\beta = .31^{*}$) (T3), as well as high levels of pain intensity ($\beta = .15^{*}$) and pain experience ($\beta = .35^{**}$) (T3), were the strongest predictors of variance of functioning (functional health status measured by COOP/WONCA) over the 3 measurement periods (57 week rehabilitation period) (Table 4).

Linear regression analysis (*B* = Unstandardized Coefficients, *SE* = Std. Error, β = Standardized Coefficients derived from the final step) was also performed on all measurements across all times with effects of the independent variables on the estimated change of functional health status over the 4 measurement periods (not included in table). Variance in functioning (functional health status measured by COOP/WONCA) over the 4 measurement periods (T1-T4) were significantly predicted by experience of traumas in childhood ($B(SE) = .50(.24)$, $\beta = .29^{*}$), high levels of pain intensity ($B(SE) = .02(.00)$, $\beta = .42^{**}$) and pain experience ($B(SE) = .02(.00)$, $\beta = .37^{*}$), and poor psychological capacity ($B(SE) = .05(.02)$, $\beta = -.68^{*}$) at baseline (T1). Moreover, poor physiological capacity ($B(SE) = -.02(.00)$, $\beta = -.44^{**}$) and high levels of

Table 4: Effects of independent variables on the estimated change of functional health status over the 3 measurement periods

Variables (*N* = 143).	*B (SE)*	β	ΔR^2	R^2
Physical fitness				
Step 1: Dependent variable T-1	-	-	.23	.23
Step 2: Independent variables T-1	-	-	.08	.32
Step 3: Independent variables T2-3	-	-	.10	.42
Physiological capacity T3	-.07(.00)	-.30**	-	-
Feelings				
Step 1: Dependent variable T-1	-	-	.20	.20
Step 2: Independent variables T-1	-	-	.11	.32
Step 3: Independent variables T2-3	-	-	.40	.72
Psychological capacity T3	-.02(.00)	-.38**	-	-
Anxiety T3	.15(.02)	.59***	-	-
Daily activities				
Step 1: Dependent variable T-1	-	-	.15	.15
Step 2: Independent variables T-1	-	-	.08	.23
Step 3: Independent variables T2-3	-	-	.28	.52
Pain experience T3	.01(.00)	.35**	-	-
Social activities				
Step 1: Dependent variable T-1	-	-	.12	.12
Step 2: Independent variables T-1	-	-	.07	.20
Step 3: Independent variables T2-3	-	-	.23	.44
Depression T3	.07(.03)	.31*	-	-
Overall health				
Step 1: Dependent variable T-1	-	-	.20	.20
Step 2: Independent variables T-1	-	-	.12	.33
Cognitive capacity	-.00(.00)	-.17*	-	-
Step 3: Independent variables T2-3	-	-	.30	.64
Physiological capacity T2	-.01(.00)	-.24*	-	-
Physiological capacity T3	-.02(.00)	-.45***	-	-
Pain intensity T3	.00(.00)	.15*	-	-

B = Unstandardized Coefficients, *SE* = Std. Error, β = Standardized Coefficients derived from the final step. ΔR^2 = change in explanation rate in each step. R^2 = proportion of variance explained. *$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

anxiety ($B(SE)$ = .13(.04), β = .48**) and depression ($B(SE)$ = .16(.04), β = .58***) at the end of the rehabilitation program (T3) were found to significantly predict the variance in functioning (functional health status measured by COOP/WONCA) over the 4 measurement periods.

Variance in pain intensity over the 3 measurement periods (not included in table) was significantly associated with high levels of pain experience (T3) ($B(SE)$ = .54(.07), β = .65***) and physiological capacity (T3) ($B(SE)$ = .19(.09), β = .19*). The association between pain intensity and physiological capacity was however not significant over the 4 measurements periods. High levels of pain intensity (T3) ($B(SE)$ = .58(.08), β = .48***) was the strongest predictor of variance in pain experience over the 3 measurement periods. Moreover, the association between pain intensity (T3) ($B(SE)$ = .48(.22), β = .36*) and pain experience was significant over all 4 measurement periods.

Discussion

This study showed that a multitude of factors had an effect on pain intensity, pain experience, and functional health status over the measurement periods in a Norwegian sample, and different variables affected different aspects of daily life function. The participants were found to significantly improve several aspects related to function during the rehabilitation period. However, it still might be relevant to question in what way these changes influence the everyday life of the people in this sample. Ultimately, the consequences of chronic musculoskeletal pain for everyday function depend not only on pain intensity and pain experience, but also on the individual and on each person's unique set of earlier experiences, values, and environmental conditions. This illustrates the complexity of chronic pain conditions, where the person's perception of pain and function and his/her experiences of what it means in their everyday life might be an important way of understanding the complexity. Therefore, the relative influence of psychosocial factors on function may vary a lot depending on the activity the individuals are engaged in [40]. For the person that receives treatment the importance of the overall effectiveness of the rehabilitation programme is re-establishing function. However, the programme is also important from a broader perspective. The reduction in pain intensity and pain experience along with improved function in daily life indicate a positive effect from the extensive rehabilitation programme. This is further underlined by the increase in function in daily activities, feelings, and overall health from the 57th week of the rehabilitation period to one year after the participants finished the rehabilitation programme. However, it is important to note that although the participants improved function during the rehabilitation period, they still report significantly lower function on all core aspects of functional health status compared to a normative sample from the Ullensaker study (N = 2864) [38] at all points of measurement. In addition, the significant decrease in self-reported physical fitness and social activities from the 57th week of the rehabilitation period to one year after the participants finished the rehabilitation programme give rise for concern. Lack of physical fitness and participation in social activities might later on influence several aspects of function in daily life and might not be beneficial to the individuals or to the society. Future studies should therefore try to clarify the long-term effect of multidisciplinary rehabilitation programmes for individuals with chronic musculoskeletal pain in terms of function in daily life. Non-specific musculoskeletal pain is an increasing health problem in the Norwegian population. The increased study of individual rehabilitation in a formal rehabilitation programme must not reduce focus on primary prevention programmes at a population level and on the social- and economic policy implications of the present findings.

Several studies [5,10,41] suggest that the impairment of function in daily life is associated with several psychosocial factors. The intent of this study was to study the long-term improvements of a multidisciplinary rehabilitation programme, by focusing on interactions and the influence of a broad range of socio-demographic and psychosocial factors in pain intensity, pain experience, and functional health status. In order to do that, the predictors of change in pain intensity, pain experience, and functional health status over time were studied. The relationship between emotional distress, chronic pain and function in daily life has been shown before [13]. In this study experience of traumas in childhood, emotional distress, high levels of pain intensity and pain experience, and poor physical capacity, measured at baseline, were significantly predicting lack of improvement in functional health status over all measurement periods. In terms of emotional distress, it is also relevant to notice the relative high percentage (37 %) of traumas in the present pain sample. The participants report significantly higher levels of anxiety and depression before, during, and after the treatment period compared to the normative population from the same geographical area (The HUNT Study). Taken together, and supported by previous studies as well [2,10,13], this illustrates the complexity and the relative importance of emotional distress in chronic musculoskeletal pain conditions.

A study by Palermo and Kiska [42] suggested that sleep disturbance is closely linked to mood disturbance. However, less is known about the complex interrelationship between emotional distress, sleeplessness and function in daily life among adults with chronic musculoskeletal pain

conditions. More than 69 % of our sample reported sleep disturbance in daily life. However, sleeplessness adjusted for emotional distress like anxiety and depression, was not found to be useful in the prediction of function. The results in this study confirm the physical capacity and coping aspects in multidisciplinary rehabilitation found in past research as well [43-45], suggesting that physical exercise, behavioral and cognitive-behavioral treatment for chronic pain reduces pain, pain distress, and improves daily functioning. Moreover, in accordance with a study by Lame, Peters, Vlaeyen, Kleef and Patijn [46], our study indicates the relevance of pain experience in predicting function, and that function in daily life might be associated with beliefs about pain.

The participants in this study are not randomly sampled; they represent all patients participating in the rehabilitation programme at a given period. The drop-out rate on long term follow-up might limit the power of the follow-up analysis and results. However, the participants are representative for people with chronic musculoskeletal pain seeking help at a rehabilitation clinic with respect to age, sex, pain conditions, working ability and sick leave. The sample and the general population from the same geographical area are almost identical with regard to age distribution, family situation, social network, and education level. This allows scrutinization of differences between the sample and the general population without taking the factors mentioned above into consideration as an explanatory variable. Even with a 100 % response at the end of the rehabilitation period, a relatively small number of participants could lead to a reduction in the power of the analysis and decrease the possibility of generalization. Another limitation of the results is the possibility of bias related to the self-reported data [47]. However, multidimensional rehabilitation, as in present study, represents an approach that has the potential to effectively focus on function in daily life, not necessarily on rendering the individual symptom free, which might provide potentially greater reliability in the self-assessment of function. Some might possibly argue that improvement over time is not very surprising since pain patients often are selected close to their worse status. The participants in present study are long-term chronic pain patients, in some cases reporting pain duration of more than 10 years. Due to the chronicity considerable improvements in function may therefore not be anticipated. The VAS scale has been used in creative ways to explore the phenomenon of pain perception and reporting in addition to exploring other health related phenomena [32,34,35]. However, the VAS measures used in present study should be further validated. Despite several shortcomings, the study highlights important perspectives in a real clinical setting that should be taken into account in rehabilitation of chronic musculoskeletal pain, and in primary prevention at a population level.

Conclusion

This study has evaluated a complexity of factors that have theoretical or empirical relationships to function in daily life in a sample with persisting musculoskeletal pain. The results of this study highlight important individual perspectives in chronic musculoskeletal pain. These results are important to better understand which variables are most useful in helping patients re-establish function during a rehabilitation programme and they show how to address the variables that affect the outcome. In a broader perspective, and as seen in relation to the high prevalence of people with chronic musculoskeletal pain conditions, it is also important to pay attention to the underlying causes of incidence and primary prevention at a population level.

Competing interests

The author(s) declare that they have no competing interests.

Authors' contributions

ML, SK and GAE designed the study, ML collected the data, ML analysed and wrote up the manuscript. ML, SK, GAE revised the manuscript. All authors read and approved the final manuscript.

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Appendices

Pasientens navn: _____ f. nr. _____

Dato: _____

PASIENTSKJEMA

Funksjonsmåling (COOP/WONCA)

Norsk bearbeidelse: Prof. B.G. Bentsen
Institutt for allmennmedisin og samfunnsmedisinske fag, Universitetet i Oslo

For å kunne følge din generelle helsetilstand før, under og etter en behandling trenger vi å vite "hvordan du har det". Det kan måles ved hjelp av svarene på noen enkle spørsmål. Vi ber deg derfor å svare på de seks spørsmålene på de seks skjemaene (A) til (F) nedenfor.

Du ser seks skjemaer som har som mål å angi din fysiske, psykiske og sosiale tilstand. Skjemaene besvares ved på hvert enkelt skjema **å slå en ring rundt** ○ det tallet til høyre for tegningen som best beskriver din nåværende situasjon.

A. FYSISK FORM

De siste 2 uker....
Hva var den tyngste fysiske belastningen du greide/kunne greid i minst to minutter?

MEGET TUNGT (f.eks.) Løpe fort		1
TUNGT (f.eks.) jogge i rolig tempo		2
MODERAT (f.eks.) Gå i raskt tempo		3
LETT (f.eks.) Gå i vanlig tempo		4
MEGET LETT (f.eks.) Gå sakte - eller kan ikke gå		5

B. FØLESESMESSIG PROBLEM

De siste 2 uker...
Hvor mye har du vært plaget av psykiske problemer som indre uro, angst, nedforhet eller irritabilitet?

Ikke i det hele tatt		1
Bare litt		2
Til en viss grad		3
En god del		4
Svært mye		5

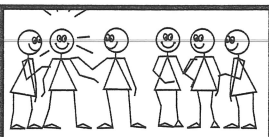
C. DAGLIGE AKTIVITETER

De siste 2 uker...
Har du hatt vansker med å utføre vanlige gjøremål eller oppgaver enten innendørs eller utendørs, p.g.a. din fysiske eller psykiske helse?

Ikke vansker i det hele tatt		1
Bare lette vansker		2
Til en viss grad		3
En god del vansker		4
Har ikke greid noe		5

D. SOSIALE AKTIVITETER

De siste 2 uker...
Har din fysiske eller psykiske helse begrenset dine sosiale aktiviteter og kontakt med familie, venner, naboer eller andre?

Ikke i det hele tatt		1
Bare litt		2
Til en viss grad		3
Ganske mye		4
I svært stor grad		5

E. BEDRE ELLER DÅRLIGERE HELSE

Hvorledes vil du bedømme helsen din idag, fysisk og psykisk, sammenlignet med for 2 uker siden?

Mye bedre	↑↑ ++	1
Litt bedre	↑ +	2
Omtrent uforandret	←→ =	3
Litt værre	↓ –	4
Mye værre	↓↓ – –	5

F. SAMLET HELSETILSTAND

De siste 2 uker...
Hvorledes vil du vurdere din egen helse, fysisk og psykisk i allminnlighet?

Svært god		1
God		2
Verken god eller dårlig		3
Dårlig		4
Meget dårlig		5

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FOR HELSE OG LIVSKVALITET

Hvordan føler du deg

Her kommer noen spørsmål om hvordan du føler deg. For hvert spørsmål setter du kryss for et av de fire svarene som best beskriver dine følelser den siste tiden. Ikke tenk for lenge på svaret – de spontane svarene er best.

168	Jeg føler meg nervøs og urolig
	3 - Mesteparten av tiden
	2 - Mye av tiden
	1 - Fra tid til annen
	0 - Ikke i det hele tatt

169	Jeg gleder meg fortsatt over ting slik jeg pleide før
	0 - Avgjort like mye
	1 - Ikke fullt så mye
	2 - Bare lite grann
	3 - Ikke i det hele tatt

170	Jeg har en urofølelse som om noe forferdlig skulle skje.
	3 - Ja, og noe svært ille
	2 - Ja, ikke så veldig ille
	1 - Litt, bekymrer meg lite
	0 - Ikke i det hele tatt

171	Jeg kan le og se det morsomme i situasjoner
	0 - Like mye nå som før
	1 - Ikke like mye nå som før
	2 - Avgjort ikke som før
	3 - Ikke i det hele tatt

172	Jeg har hodet fullt av bekymringer
	3 - Veldig ofte
	2 - Ganske ofte
	1 - Av og til
	0 - En gang i blant

173	Jeg er i godt humør
	3 - Aldri
	2 - Noen ganger
	1 - Ganske ofte
	0 - For det meste

174	Jeg kan sitte i fred og ro og kjenne meg avslappet
	0 - Ja, helt klart
	1 - Vanligvis
	2 - Ikke så ofte
	3 - Ikke i det hele tatt

175	Jeg føler meg som om alt går langsommere
	3 - Nesten hele tiden
	2 - Svært ofte
	1 - Fra tid til annen
	0 - Ikke i det hele tatt

176	Jeg føler meg urolig som om jeg har sommerfugler i magen
	0 - Ikke i det hele tatt
	1 - Fra tid til annen
	2 - Ganske ofte
	3 - Svært ofte

177	Jeg bryr meg ikke lenger om hvordan jeg ser ut
	3 - Ja, jeg har sluttet å bry meg
	2 - Ikke som jeg burde
	1 - Ikke så veldig mye
	0 - Bryr meg som før

178	Jeg er rastløs som om jeg stadig må være aktiv
	3 - Uten tvil svært mye
	2 - Ganske mye
	1 - Ikke så veldig mye
	0 - Ikke i det hele tatt

179	Jeg ser med glede fram til hendelser og ting
	0 - Like mye som før
	1 - Heller mindre enn før
	2 - Avgjort mindre enn før
	3 - Nesten ikke i det hele tatt

180	Jeg kan plutselig få en følelse av panikk
	3 - Uten tvil svært ofte
	2 - Ganske ofte
	1 - Bare lite grann
	0 - Ikke i det hele tatt

181	Jeg kan glede meg over gode bøker, radio og tv
	0 - Ofte
	1 - Fra tid til annen
	2 - Ikke så ofte
	3 - Svært sjelden

Del 5

SOC-13 (OAS - Opplevelsen av sammenheng) spørreskjema – 13 punkts versjon.

Her er en serie med spørsmål som omhandler ulike aspekter i livet vårt. Hvert spørsmål har 7 ulike svaralternativer. Vennligst merk av det nummeret som utrykker ditt svaralternativ. Nummerene 1 og 7 er ytterpunktene av svaralternativene på aksen. Hvis ordene under 1 er rett for deg, sett kryss i nummer 1. Hvis ordene under 7 er rett for deg, sett kryss i nummer 7. Hvis du føler det annerledes, sett kryss på det nummeret mellom 1 og 7 som best beskriver det du føler. Vennligst gi bare ett svar på hvert spørsmål.

5.1 Opplever du at du er likegyldig til det som skjer i omgivelsene dine?

1	2	3	4	5	6	7
☐	☐	☐	☐	☐	☐	☐

veldig sjelden eller aldri — veldig ofte

5.2 Har du opplevd at du er blitt overrasket over oppførselen hos personer du trodde du kjente godt?

1	2	3	4	5	6	7
☐	☐	☐	☐	☐	☐	☐

det har aldri hendt — det hender alltid

5.3 Har det hendt at personer du stoler på har skuffet deg?

1	2	3	4	5	6	7
☐	☐	☐	☐	☐	☐	☐

det har aldri hendt — det hender alltid

5.4 Inntil nå har livet mitt:

1	2	3	4	5	6	7
☐	☐	☐	☐	☐	☐	☐

vært helt uten mål og mening — hatt mål og mening

Løpenummer: ☐☐☐☐☐

Må ikke brettes

5.5 Føler du deg urettferdig behandlet?

1	2	3	4	5	6	7
☐	☐	☐	☐	☐	☐	☐

veldig ofte — veldig sjelden eller aldri

5.6 Opplever du ofte at du er i en uvant situasjon og at du er usikker på hva du skal gjøre?

1	2	3	4	5	6	7
☐	☐	☐	☐	☐	☐	☐

veldig ofte — veldig sjelden eller aldri

5.7 Er dine dagligdagse aktiviteter en kilde til:

1	2	3	4	5	6	7
☐	☐	☐	☐	☐	☐	☐

glede og tilfredsstillelse — smerte og kjedsommelighet

5.8 Har du veldig motstridende tanker og følelser?

1	2	3	4	5	6	7
☐	☐	☐	☐	☐	☐	☐

veldig ofte — veldig sjelden eller aldri

5.9 Skjer det at du har følelser som du helst ikke vil føle?

1	2	3	4	5	6	7
☐	☐	☐	☐	☐	☐	☐

veldig ofte — veldig sjelden eller aldri

5.10 Selv mennesker med sterk personlighet føler seg som tapere innimellom. Hvor ofte føler du deg slik?

1	2	3	4	5	6	7
☐	☐	☐	☐	☐	☐	☐

aldri — veldig ofte

5.11 Hvor ofte opplever du at du over eller undervurderer betydningen av noe som skjer?

1	2	3	4	5	6	7
☐	☐	☐	☐	☐	☐	☐

du over eller undervurderer det som skjer — du ser saken i rett sammenheng

5.12 Hvor ofte føler du at de tingene du foretar deg i hverdagen er meningsløse?

1	2	3	4	5	6	7
☐	☐	☐	☐	☐	☐	☐

veldig ofte — veldig sjelden eller aldri

5.13 Hvor ofte har du følelser du ikke er sikker på at du kan kontrollere?

1	2	3	4	5	6	7
☐	☐	☐	☐	☐	☐	☐

veldig ofte — veldig sjelden eller aldri