ABSTRACT

Introduction:
Chronic widespread pain and long-lasting widespread pain conditions (LWP) are one of the most common contributors for sick-leave in Norway. These pain conditions impact physical, emotional and social functions, and the patients have complex problems and symptoms that require specialized treatment. The main aims of this thesis were to investigate and describe pain intensity, quality of movement and cardiorespiratory fitness in patients with LWP, and to investigate changes in these parameters after participating in a multidisciplinary pain management program lasting 6 weeks.

Methods and material:
23 patients with LWP were included in this study after being examined, interviewed and given information about participation. They participated in a multidisciplined program for 6 weeks as in-patients in a group of 8, with multiple interventions, among them cognitive behavioural therapy, physical activity in general, and individual sessions of physiotherapy. They were measured in pain intensity with self-reported pain numerical rating (NRS 0-10). Quality of movement was measured with the Standardized Mensendieck Test (SMT), videotaping the tests’ subcategories standing posture, gait, movements, sitting posture and respiration. The cardiorespiratory fitness was measured by the Åstrand test to investigate level of VO2 max indirectly on a bicycle. All measurements were done at baseline at the start of the program, and post-intervention, when the program was completed. The scores and results were then examined and analyzed to investigate what levels of pain these patients describe, to analyze their movement patterns and their level of VO2 max, and to investigate what changes occurred after interventions.

Data was analyzed with SPSS with parametric methods like the paired samples t-tests and non-parametric tests like the Wilcoxon signed rank test.

Results:
LWP patients report relatively high levels of pain with mean pain rating at baseline 6,0 and 5,9 at post-intervention. They had no significant change in reported pain intensity. The SMT test was divided into subcategories standing posture, gait, movement, sitting posture and respiration with a scale from 0-7, where 7 is optimal score. The LWP patients had significant changes and improvements in all subcategories except standing posture.

Åstrand tests measurements of VO2 max showed that the study group were close to reference values from the healthy population in general, and they had no significant change from baseline to post-intervention.

Conclusions:
LWP patients report relatively high levels of pain intensity, they have a slightly reduced quality of movement as measured by the SMT and their VO2 max when measured with the Åstrand test is close to that of the healthy population. Changes that occurred during this study were relatively small and clinically not significant, but the statistical findings suggest that the SMT could be a valuable instrument for investigating quality of movement. Using NRS for pain intensity measurements shows no change after 6 weeks, which indicates as supported by literature, that pain intensity is too uni-dimensional for LWP conditions, and more comprehensive instruments should be considered for long-lasting pain. This study suggests that LWP is complex, and investigation and treatments are challenging. A program for LWP pain patients should have targeted and individualized interventions and goals, long-term follow-up, and that instruments used in measurements should be designed for long-term pain conditions specifically.
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1 Introduction

1.1 Background
Long lasting pain (LP) conditions are one of the most common causes for sick leave amongst the working population in Norway, and this has great economical implications for the individual and the society as a whole. Musculoskeletal pain has recently been reported to be the cause of 40% of all sickleave in both the male and female working population in Norway 2007 (NAV report, 2007). Patients with long lasting widespread pain (LWP) and Fibromyalgia (FM) are found among these. Their symptoms consist not merely of pain in widespread areas of their body, but also symptoms such as fatigue, sleep disturbance, cognitive disturbances, stiffness and symptoms of depression (Spaeth & Briley, 2009; Fürst, Young, Lamoreaux, Werth and Poole, 2007; Bergman, 2007). Women are the majority of these patients, and studies seldom differentiate between the genders in their results (SBU, 2010).

Multidisciplinary rehabilitation have shown positive results with patients with LWP/FM and reduced pain scores and increased quality of life has been reported after interventions (Asenlöf, Denison and Lindberg, 2005; SBU, 2006). Patients suffering from musculoskeletal pain have often had the pain condition for a long time and return to work and normal acitivity and work has been found difficult and challenging (Kvåle, 2003). Long lasting pain seems to have multifactorial causality, thus pain relief from medication alone has often been found unsatisfactory. Earlier research has focused on cognitive interventions, with cognitive behavioral therapy being a direction with promising results (Linton, Boersma, Jansson, Svard and Botwalde, 2005; Woby, Roach, Urmston and Watson, 2007; Brunner, Herdt, Minguet, Baldew and Probst, 2013).

Haugstad, Haugstad, Kirste, Leganger, Hammel, Klemmetsen and Malt (2006a) have focused on movement quality in their approach to revealing dysfunctional movement patterns linked to pain conditions. They focused on the connection between these dysfunctional patterns and chronic pelvic pain (CPP) compared to healthy controls. In connection with this analysis of movement patterns they have also investigated a therapeutic treatment approach called the somatocognitive therapy (Haugstad et al 2006a; Haugstad, Haugstad, Kirste, Leganger, Klemmetsen and Malt, 2006b; Haugstad, Haugstad, Kirste, Leganger, Wojniesz, Klemmetsen and Malt, 2008). The Standardized Mensendieck Test has been used to identify dysfunctional movement patterns, and has been used as an outcome variable when investigating the effect of somatocognitive therapy.
Many FM patients and patients with LWP have additional problems like elevated fatigue and depression scores. It also seems plausible that that reduced physical activity often occurs with pain conditions. Holtedahl found that among 200 patients applying for disability welfare in Norway, 1/3 has musculoskeletal pain diagnoses, and 59% have never engaged in moderate physical activity (Holtedahl, 2006).

1.2 Aims of this study

The current study is a small part of a larger study on the effect of SCT on patients with LWP. The main study in this clinic is a randomized controlled intervention study where the effects of SCT and Nordic walking incorporated in a multidisciplinary program will be investigated. Both interventions are conducted as part of a multidisciplinary, in-patient pain management program organized in groups over a period of 6 weeks. The patients were included in accordance to admission criteria.

This study has focused on investigating the first 25 included patients as one group in the treatment program, and in the following there were some main assumptions and hypotheses to investigate. The base assumption springs from the hypothesis that a multidisciplinary pain management program will not have effect on pain intensity, quality of movement and cardiorespiratory capacity in patients with long lasting widespread pain in 6 weeks.

As mentioned above, studies have shown that these patients suffer from depression, fear avoidance, fatigue and disability (SBU, 2005; Bergman, 2007; Andrews, 2012), many also sick listed from work (NAV report, 2007). The complexity and long duration of their condition gives room for limited optimism for improvement in a short time span. Van Wilgen with others (Van Wilgen, Dijkstra, Versteegen, Fleuren, Stewart and van Wijhe, 2009) also point out that these patients have tried several treatment options earlier, and that these have not improved their health.

Aims of this study:

1. To investigate and describe pain intensity, quality of movement and cardiorespiratory fitness in patients with widespread pain,

2. To investigate the effect of a multidisciplinary pain management program through changes in pain intensity, quality of movement and cardiorespiratory fitness in patients with LWP after participating in a multidisciplinary pain management program over 6 weeks.
Research questions:

1. What level of pain intensity do LWP patients report by admission?
2. Do LWP patients have a lower level of cardiorespiratory fitness (VO2 max) than healthy subjects? And what possible explanations might there be in this matter?
3. Does the multidisciplinary program have effect on quality of movement; are there changes in quality of movement assessed with the SMT before and after participation in the program?
4. Does a pain management program affect pain intensity in patients with LWP?
Flow chart describing the recruitment of participants/patients in the RCT studying multidisciplinary treatment of widespread pain patients, and the further inclusion of the 25 participants in the study presented here.
1.3 Pain definitions and concepts

In this chapter, pain concepts and definitions will be presented, and perspectives on pain mechanisms and pain interpretation will be presented.

“Chronic pain with or without diagnosis is highly stigmatized. Most countries have no national policy at all or very inadequate policies regarding the management of pain as a health problem, including an inadequate level of research and education.”


1.3.1 Nociceptive pain and neuropathic pain

The International Association for the Study of Pain (IASP) defined in 1994 pain as:

"... an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage" (Arendt-Nielsen (red), Staehlin and Dahl, 2009).

Nociceptive pain is pain following stimulus to the nociceptors, and are found in visceral and somatic tissue in the body, and these signals are considered essential to protecting the organism from injury. As nociceptors are sensitive to stimuli such as pressure, temperature and chemical connections that may cause damage to the organism, they forward/transmit pain signals that are essential for protection and survival (Nijs and van Houdenhove, 2009; Brodal, 2005; Arendt-Nielsen et al, 2009). Nociceptive pain is most commonly seen as acute pain conditions when a lesion or damage is present.

Neuropathic pain is related to the nervous system, both peripheral and central. When there is injury to, or illness in the nervous system, pain from nerves can occur. This pain differs from nociceptive pain because there are conditions in the nervous system itself that causes the pain, and the area with pain may not always represent localization of the actual damage (Arendt-Nielsen et al, 2009, Dworkin, 2003). Bergman states that pain with no specific pathological process is often referred to as non-specific pain. However, he underlines the importance to view this kind of pain as “real pain” as to not deny the patients’ experience (Bergman, 2007).
1.3.2 Acute pain and long lasting/chronic pain

The recognition of both emotional and sensory implications of the experience combined with the notion of both damage and potential damage reveals the complexity of pain. In acute pain, the signal and interpretation of pain will most likely elicit a reaction to avoid or reduce the pain. Inhibition of the pain signals or a change of behavior will most likely occur (Brodal, 2005). In this way, a pain signal has a life preserving effect for the organism.

In chronic pain conditions, however, the causality between signal and reaction is more complex. The pain persists over time without a clear clinical observable organic cause for the pain and its’ possible damage to the organism. The pain persists over time and has become chronic (often referred to as chronic after 6 months), and a change of behavior like avoiding certain activities is no longer necessarily beneficial when it comes to the (potential) damage (Brodal 2005; Moseley 2003). Chronic pain can be defined as a complex experience with emotional, perceptual, physical, cognitive and social factors involved, and the pain persists longer than the expected healing time, and usually more than 6 months (Arendt-Nielsen et al 2009:337). All the factors that come into play in this definition, open for an understanding that persisting pain influences many areas of the patients’ life, as well as the pain might be influenced by the different areas of life. This is challenging when addressing how to treat these conditions. Kvåle (2003) argues for the use of long lasting pain rather than chronic, because the term chronic may refer to and give associations to a permanent condition without a “cure”. To prefer long lasting or long term rather than chronic as a definition on the population in this group is simply based on this reflection.

The terms chronic pain and long lasting pain are used interchangeably in research literature, and have been interpreted in this thesis as having similar meaning; pain lasting more than 6 months with no obvious organic cause or explanation.

1.3.3 “The pain neuromatrix” and central sensitization.

Several different areas of the brain are involved in pain perception and interpretation, as well as to inhibition and fascilitation. These areas have been found to be the cortical areas as gyrus singuli, insula and the sensory cortex, as well as parts of the brain stem including Periacveductal grey substance (PAG), hypothalamus and thalamus. The dorsal horn is
essential in facilitating and inhibiting pain signals to the medulla (Brodal, 2005). Melzack (1996) has called these connections “the pain neuromatrix” (Moseley, 2003), and has referred to the complexity of pain experience in the brain. Moseley has described how the brain has a somatotopic representation of the body in the dorsal insular cortex which makes it possible for the brain to “adjust” the pain experience to fit the part of the body the nociceptive signals are interpreted to belong to. Moseley has called this representation “the virtual body”. He explained further that continuous pain would “enhance this systems’ efficacy such that less input is required for activation” (ibid 2003). This phenomenon has been known as 

sensitization of the CNS. Some of the areas involved in pain mechanisms have been found to be essential in psychological operations. Gyrus cinguli is part of the pain neuromatrix, and is also an area activated when individuals experience expectations. Emotions like expectations have been studied closely and found to have an impact on pain (Brodal, 2005). When nociceptive signals reaches the brain, they elicit stress responses in the limbic system as well, which is also known for addressing functions in the autonomous nervous system, and functions like memory, emotions and motivation (ibid 2005). The limbic system is therefore connected to the pain neuromatrix. The brain is also well known for its plasticity, its ability to adapt and change, to adjust to different stimuli, and to learn, so that some areas may increase efficiency, and other areas might supplement or address tasks for other areas. These mechanisms have been found to take place in stroke patients that regain lost functions (Brodal, 2005; Carr & Shepherd, 2010)

The recognition, interpretation and reaction to pain may vary greatly with each individual. Brodal (2005) and Moseley (2003) both claim that the pain experience is influenced by an individual’s history, genes and the context of the situation. They have also, among many others, highlighted the fact that the pain neuromatrix consists of areas that have many different assignments in the brain, these include the connections to emotions, memory, the autonomous nervous system and the brain stem and that it appears to be an enhanced efficacy for pain in this system in patients with long lasting pain conditions. This can also be called sensitization of the nervous system (Brodal, 2005; Moseley, 2003; Apkarian, Bushnell and Treede, 2005; Apkarian, 2011).

The pathways and areas involved in pain signal transfer, facilitation, inhibition and perception in the central nervous system is complex, which in turn makes measurement, pain treatment and therapy accordingly challenging. A central sensitization may explain how
different modalities of treatments have evolved over the years, and enlighten the complexity of the brains’ pain management.

1.3.4 Localized and widespread pain

Pain is considered to be widespread when pain in the left and right side of the body is present, as well as pain above and below the waist. In addition axial skeletal pain must be present (Klippel, 1997). Patients with widespread pain have a heterogeneous condition with pain varying in intensity, quality and localization. Kvåle discussed the differences between localized and generalized pain conditions (Kvåle, 2003). She described that patients with pain in one localized area or region had better outcomes after treatments than those suffering from widespread pain conditions. “Patients with localized pain have been found to have less pronounced health consequences and less disability, and better outcomes” (Kvåle, 2003:19).

The patients presented in the following study have more than one diagnosis, and they have pain that vary in localization, intensity, and their pain condition is localized in more than one area. Widespread pain will be used further on in this thesis, and is to be understood as musculoskeletal pain with several locations. Fibromyalgia has become a well known pain condition that consists of widespread un-localized musculoskeletal pain. The patients included in the following will be presented and discussed in chapter two in the presentation of the participants

1.3.5 Rehabilitation options for long lasting widespread pain conditions

Over the last decade there has been an increasing focus on long lasting pain conditions, and research with increasingly good quality has been done. Pain conditions are widely represented in populations in western countries, but there are no established national or international consensuses on how to assess, diagnose or treat these conditions. Pain associations like NOSF (Norway) and IASP (world wide) have requested and elaborated on the need for such guidelines and consensus. Treatment alternatives range from pharmaceuticals, acupuncture, TENS-treatment, massage, psychological treatments, training, vocational guidance and educative courses etc. However, there is a common understanding and acceptance that multidisciplinary rehabilitation is the preferred option for long lasting pain conditions (Bergman, 2007; Arendt-
Nielsen et al, 2009; SBU, 2010). As mentioned before, these pain conditions are complex and simpler forms of treatments have failed (van Wilgen et al, 2009). A bio-psycho-social model of illness makes the conceptual basis for the multidisciplinary rehabilitation programs in the literature.

Research on multidisciplinary rehabilitation of chronic/long lasting pain conditions usually consists of physical activities and relaxation, social/vocational intervention, and psychological training and behavioural therapy (Karjalainen, Malmivaara, van Tulder, Jauhiainen, Hurri and Koes, 2009; Arendt-Nielsen, 2009; Bergman, 2007; Heiskanen Roine and Kalso, 2012). SBU reports are Swedish official reviews and reports on different topics, and in 2010 one review investigated recommendations on rehabilitation of long-lasting pain SBU, 2010). This review lists that most multidisciplinary programs consist of a combination of psychological intervention and physical activity, or psychological intervention and manual therapies/physiotherapy. Usually the patients receive 2-4 intervention modalities in the program, and skilled professionals like psychologists, physiotherapists, occupational therapists and physicians are most common in various combinations. The follow-up usually evaluate the patients after 1 year, 2 years or more. All though the number of research on multidisciplinary pain rehabilitation has increased, not all of them are of good quality. This represents a challenge when trying to compare results. Studies can lack a thorough description of the contents of the interventions, or lack descriptions of the staff and their qualifications. This can make comparisons difficult, or give reduced reliability.

Most programs reviewed in this report (SBU, 2010), have out-patient organization. This means that the patients continue their lives at home, and come regularly to a clinic, usually a hospital or pain clinic, for rehabilitation.

Conclusively; multidisciplinary rehabilitation is the recommended option on long-lasting pain conditions, and has been found to address complex pain conditions, the treatment staff consists of 2-4 professions, the programs are out-patient based, and the follow-up is usually 1-3 years after interventions.

Analyzes show that a multidisciplinary rehabilitation program reduces sick-leave and increases return to work compared to simpler treatment options, they increase activities of daily life and training after 2-5 years compared to other single standing treatment options, and finally, these programs reduce pain intensity to a very limited extent (SBU, 2010 p: 15-28).
1.4 Quality of movement: Mensendieck physiotherapy, Somatocognitive therapy and the Standardized Mensendieck Test (SMT)

One of the interventions in the multidisciplinary program this study group participates in is somatocognitive physiotherapy in a Mensendieck physiotherapy tradition. The Mensendieck physiotherapy (MP) was founded by Bess Mensendieck, an American physician in the early 20th century. This was based on functional anatomy and theories of motor learning.. Dahl-Michelsen has described MP as a system with focus on anatomical symmetri, and where there is a clear distinction between right and wrong aspects of movement and movement patterns (Dahl-Michelsen, 2007). Somatocognitive therapy (SCT) derives from the Mensendieck physiotherapy (MP). Haugstad has called it a hybrid between physiotherapy in its traditional way, and cognitive psychotherapy (Haugstad et al, 2006a, 2008). The aim of this method is to facilitate the awareness of your own body, achieved by graded task assignments involving movement patterns that are basic in every day activities. SCT also includes an empathic alliance built between the patient and the therapist. Every therapy session involves goal setting, assigning individual “homework “ for the patient and work through these tasks together to ensure mutual understanding and emotional containment (ibid 2006a, 2008). It is difficult to make a clear-cut distinction between the SCT and the MP, and Haugstad and collaborators (2006a, 2008) has not made a clear distinction between them either. They call SCT a further development of MP, which they consider to be a hybrid between physiotherapy and cognitive therapy deriving from Aaron Becks work (ibid). Brunner, Herdt, Minguet, Baldew and Probst (2013) describes how a cognitive approach is well suited for physiotherapy addressing pain and activity because of the physiotherapists competence on function and movement combined with the need for educating the patient how to achieve this both physically and mentally. They describe how physiotherapists may decrease pain behaviour by in reinforcing active coping strategies and exercise behaviour (Brunner et al, 2013).

The Standardized Mensendieck Test (SMT) has been found useful to evaluate dysfunctional motor patterns or functional anatomy (Haugstad, 2006a). In SMT the following areas are assessed and given scores dependant on the deviation from “normal” material: respiration, active movement, gait, standing posture and sitting posture. Both the SMT and the manual of scores are based on functional anatomy. SMT is time efficient and fairly easy to use, and when trained therapists use the SMT they usually complete the test within 10 minutes. The total score and sub scores within the above mentioned areas are recorded. The SMT is
validated on longstanding pain conditions in women with chronic pelvic pain (CPP) (Haugstad, 2006a).

The Global Physiotherapeutic Muscle Examination (GPM) was developed by Sundsvold and evaluates movements and the quality of movement (Kvåle, 2003). GPM is an extensive examination based on mainly passive elements in standing and stooping positions. The Comprehensive Body Examination (CBE) was developed by Bunkan (Bunkan, 2001), which, is quite similar to the GPM. CBE examines the resistance to passive movements in upright and supine positions. The CBE was developed in connection with Psychomotor physiotherapy, a more psychodynamic approach. Ahlsen describes elements in psychomotor physiotherapy that has a focus on symmetry, and symmetry and balance in movements are the preferred qualities (Ahlsen, 2007). Further, the Body Awareness Scale-Health (BAS-H) was developed in Sweden in connection with Body Awareness therapy as another way of measuring movement quality (Haugstad 2006a). In body awareness therapy described by Gard, the need for self awareness through focus on emotions and emotional aspects connected to the body are considered essential to increase self-help and better function (Gard, 2005). All of the above mentioned tests and scales evaluate quality of movement, and they represent a way of measuring and differentiating movement patterns in patients. With the use of such evaluation tools a therapist may differentiate patients by their scores, and if the instrument has standardized control scores for a “normal” population, it can be used to draw some comparisons to patients with the general population. This study will look into the SMT on long lasting widespread pain patients. To my knowledge based on internet searches there have been no studies containing information on the SMT and LWP patients, only on chronic pelvic pain patients (in Haugstad et al 2006a, 2008). The theories referred to above do not clearly explain the connection between movement patterns/quality of movement and pain, but might shed some light on how motor patterns look like in patients with different symptoms and problems.

1.5 Aerobic exercise, Nordic walking and patients with wide spread pain

One of the research questions address the impression that LWP patients seen in our clinic tend to have somewhat lower scores than the normal healthy population when tested in the Åstrand bicycle test, also called the Rhyming test (Bahr 1991). Many patients report low levels of
physical activity at home. As a part of the multidisciplinary program they participate in aerobic exercise, mainly by individual Nordic walking sessions with a physiotherapist, which is walking with walking sticks (staver), and participating in group based aquatic training and general aerobic training. Half of the participants received Nordic walking as their individual session with physiotherapist, the other half received SCT. The effect of Nordic walking in Fibromyalgia has been investigated by Mannerkorpi, Nordeman, Cider and Jonsson (2010), and showed to improve physical capacity (VO2 max) and functional capacity, and to decrease levels of activity limitations. Busch, Webber, Brachaniec, Bidonde, Bello-Has, Danyliw, Overend, Richards, Sawant ans Schachter reviewed different exercise therapies for Fibromyalgia patients and found that Nordic walking was well tolerated and seems promising as intervention for these patients (Busch et al, 2011).

All together the patients in the multidisciplinary program participated in 3-4 exercise sessions per week, individually and in group. These exercise interventions focused on increasing activity and providing “new” activity experiences rather than a systematic cardiorespiratory fitness program to improve capacity. Hurri, Mellin, Korhonen, Harjula, Harkapaa and Luoma conducted a study to investigate aerobic capacity in patients with chronic low back pain, including 81 inpatients, 88 outpatients and 76 controls for tests of maximum oxygen uptake on bicycle. Correlation analyses showed no connection between aerobic capacity and pain or disability caused by chronic low-back pain, and the tested subjects had VO2 max levels similar to reference levels of healthy controls (Hurri et al, 1991).

The Åstrand test is an indirect assessment of VO2 max and may give an estimation of the physical capacity and potential changes in LWP patients. A weakness in using Åstrand test is that it is performed on a bicycle, while most of the aerobic exercise in this program is not.

2. Methodology
2.1 Design
The main study from which this project is a sub-study will gather material, is a randomized controlled intervention study (RCT). Prior to the project, affirmations and approvals were gathered from Personvernombudet for helseforskning (ombudsman for health research matters) and Regional etisk komité (REK – ethic committee), monitoring all health research committed in Norwegian health institutions. The study described here was a prospective observational study, although the participants are randomized to treatment in the RCT.
mentioned above (see prior flow-chart). There were also patients randomized to a control group, but they are not included in the material in this thesis. The participants were assessed before and after their participation in the multidisciplinary pain management program. All patients were given information prior to admission and given the opportunity to accept or decline participation. They signed a written consent form and were also given a written information sheet about the project(s) and their rights as participants to take home.

2.2 Participants
The patients included in this project were included in the RCT mentioned above. Many of them were referred to our clinic and the pain management program by their physicians, or they were referred to the program after a multidisciplinary assessment with focus on function and remaining ability to work by another division within the hospital. Their main symptom was pain, but many had various diagnoses. The majority of the patients referred to, and admitted in this study were women.

Inclusion criteria:
The essential criteria were widespread pain for more than 6 months. Patients with malignant conditions and diseases that cause pain such as active inflammatory rheumatology or neurology\(^1\) were excluded. Table 2 lists main diagnoses in the population. Only M 79.0 and M 79.1 qualify as widespread pain conditions. Further, there are diagnoses such as Ankylosing spondylitis, osteoarthritis, neck and lumbar pain with radiculopathy and sciatica respectively that seem problematic according to inclusion and exclusion criteria. The diagnoses mentioned qualify for exclusion, but when patients were examined and evaluated before inclusion, their main problem or symptom of widespread pain was emphasized. What patients are diagnosed with as their main diagnose, does not necessarily give an accurate picture of their main symptom and challenge at present time.
The first 25 patients to participate in the RCT that were randomized to treatment/intervention were included in the present study.
Before admission in the program their written consent was collected after investigating their motivation for participation. They were given thorough information about the program. All

\(^1\) Active rheumatology or neurology refers to conditions or diseases that cause pain, and that were not satisfactorily investigated prior to evaluation, medically treated or controlled at the time, and that were present when including patients.
patients have been through extensive examinations and evaluations prior to admission by psychologist, physiotherapist, physician, occupational therapist, nurse and social worker to ensure they fit the program, to investigate their motivation, as well as to make sure their pain condition is adequately investigated and treated before entering the program.

**Exclusion criteria:**
Patients aged 65 or older as well as younger than 20 were excluded. Patients with medical conditions not fit for this program were also excluded (footnote 1).

**Dropouts and missing data:**
2 patients withdrew from the project during the 6 weeks program; one due to a medical condition that emerged during the 6 weeks, the other because the patient found the program to be too strenuous. These two patients were referred to other health institutions for further or alternative treatment.

The material below is based on the remaining 23 participants. The Åstrand test material was not complete according to this. Only 19 completed tests both at baseline and post-intervention. 2 patients had technical problems during the bike tests (pulse sensor failure), and results were impossible to obtain due to these technical problems. Another patient injured her leg in sports ("outside of the program") during the 6 weeks of interventions, and it was not possible for her to do the bike test at post-intervention. The last "missing" participant refused to retest because of pain and exhaustion. The SMT does not have complete sets for both baseline and post-interventions either. The participant that injured her leg did not do the retest.

**2.3 Intervention program**
The pain management program is based on a bio-psycho-social perspective on pain, and to challenge the patients’ limitations and increasing their knowledge and activity level in daily life. Literature shows that multidisciplinary treatment programs that focus on education on pain, behavioural therapy and physical activity have positive results for patients with long lasting pain conditions (SBU 2006, SBU 2010).

To ensure proper treatment for the participants, patients with medical conditions in need of complex medical treatment that differ from LWP conditions, (i.e complications like neurological and rheumatic conditions and diseases) have been excluded from the project.
The program has a multidisciplinary approach on pain management rather than pain reduction itself, and a cognitive behavioral therapy perspective. The program lasts 6 weeks. The participants enter as a group of eight persons as in-patients. Monday to Friday they go through theory on pain, and psychological and behavioural pain management, as well as participating in physical activity/aquatic training, relaxation, and group sessions with focus on their social environment. Through the program they set individual goals and make plans how to reach them in order to increase their feeling of a meaningful everyday life. The included patients were randomized into two intervention groups. One group received the multidisciplinary program as mentioned above combined with individual sessions of SCT with a physiotherapist, and one group received the multidisciplinary program combined with individual sessions of Nordic Walking together with a physiotherapist. The two groups had a similar amount of individual sessions (8 sessions) during their 6 weeks program.

The main scope of the program is to educate the participants on how pain influences their lives, and how they can deal with pain in more adequate ways. They learn how to structure their every day life in order to find meaning and balance. As many of the patients have been sick listed for long periods of time, they have not been active full-time workers for more than a year, some for several years.

The program is partially based on recommendations made by a Swedish review on effective interventions on chronic pain (SBU 2006, SBU 2010). During the 6 weeks they participate they will also receive SCT or Nordic walking with trained physiotherapists. To ensure a certain individual adjustment during the 6 weeks they participate in the group based program, they also formulate individual goals in a long-term rehabilitation plan. This plan is individually tailored and is based on their personal challenges and goals, and defines their main areas of work during and especially after the program to address a more long-term change.

The theoretical basis of the program will not be discussed in detail in this thesis, the focus will be on describing the participants and their changes in the outcome variables from admission to discharge.

The SBU reports (2006, 2010) from Sweden are reviews that list effective treatment options for long lasting musculoskeletal pain. Cognitive behavioral therapy to manage pain and adjusted physical activity are among the recommended treatment options, and are widely recommended and used in intervention studies (Bergman 2007; SBU 2006 & 2010; Heiskanen et al, 2012). Other authors and studies have also supported the benefits of multidisciplinary programs implementing CBT and physical activity (Arendt-Nielsen et al,

The staff involved in this project are all experienced in working with pain patients and complex conditions. The physiotherapists involved in testing and treating the patients are all either educated as Mensendieck physiotherapists, or/and receive mentoring by an experienced MP physiotherapist from externally. The physiotherapists were also trained in Nordic walking. Protocols describing treatments/physical activities were made prior to the project to ensure some “standardization”.

2.4 Demographic variables

Age, gender, diagnoses

Table 1 shows demographic information about included patients. The group was relatively small and consisted mainly of women. Socioeconomic status of the included patients is also presented. More than half (61%) of the population were sick-listed full-time because of their pain condition and were receiving economic support/welfare from NAV at the time of inclusion and participation in the intervention program. The main diagnoses are presented in Table 2. Twenty out of 23 patients had more than one diagnosis.

Table 1: Demographic variables at baseline, before intervention program (N=23).

25 patients were included, 2 patients withdrew

<table>
<thead>
<tr>
<th>Age</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Median</td>
<td>44</td>
</tr>
<tr>
<td>Range (min-max)</td>
<td>22-62</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gender (%)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Women/Men</td>
<td>17/6 (74/26)</td>
</tr>
<tr>
<td>Work</td>
<td>%</td>
</tr>
<tr>
<td>------</td>
<td>-----</td>
</tr>
<tr>
<td>0*</td>
<td>14</td>
</tr>
<tr>
<td>1-49</td>
<td>4</td>
</tr>
<tr>
<td>50-99</td>
<td>5</td>
</tr>
<tr>
<td>100</td>
<td>0</td>
</tr>
</tbody>
</table>

*these patients were mainly sick-listed
Table 2: Main diagnoses* (N=23)

Translated from the Norwegian ICD-10 manual

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>M 50.1</td>
<td>Condition in cervical disc with radiculopathy</td>
<td>1</td>
</tr>
<tr>
<td>M 79.0</td>
<td>Unspecified rheumatism (Fibromyalgia)</td>
<td>5</td>
</tr>
<tr>
<td>M 50.2</td>
<td>Other shift of cervical disc</td>
<td>1</td>
</tr>
<tr>
<td>M 45</td>
<td>Ankylosing spondylitis</td>
<td>1</td>
</tr>
<tr>
<td>M 54.4</td>
<td>Low back pain with sciatica</td>
<td>2</td>
</tr>
<tr>
<td>M 35.7</td>
<td>Hypermobility syndrom</td>
<td>1</td>
</tr>
<tr>
<td>M 51.1</td>
<td>Condition in lumbar disc and other discs and radiculopathy</td>
<td>1</td>
</tr>
<tr>
<td>F 33.1</td>
<td>Recurrent depressive condition</td>
<td>1</td>
</tr>
<tr>
<td>M 79.1</td>
<td>Myalgia</td>
<td>4</td>
</tr>
<tr>
<td>M 54.2</td>
<td>Neck pain</td>
<td>4</td>
</tr>
<tr>
<td>G 43.9</td>
<td>Unspecified migraine</td>
<td>1</td>
</tr>
<tr>
<td>T 93.2</td>
<td>Condition following fracture in lower extremity</td>
<td>1</td>
</tr>
</tbody>
</table>

*20 patients had more than one diagnosis

Table 2 shows that the group was heterogeneous with several different diagnoses, and most of them had more than one diagnosis (Table 3). During inclusion of patients, the focus was put on long lasting widespread pain as the main symptom rather than diagnose. Diagnoses listed in tables 2 and 3 show the diversity and heterogeneity of this population of patients when it comes to categorization.

During the intervention program they have all received the same treatment(s), and there has been individualized treatment such as SCT/NW and their individual set goals in their rehabilitation plan. The patients were diagnosed before the inclusion in the program.

---

2 Diagnoses in table 2 and 3 has been translated from the Norwegian ICD-10 classification system, 10th edition, 2005, Sosial-og helsedirektoratet.
### Table 3: Secondary diagnoses

*All secondary diagnoses listed connected to all participants (some had more than one and several had the same secondary diagnosis). Translated from the Norwegian ICD-10 manual.*

<table>
<thead>
<tr>
<th>Code</th>
<th>Diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>M 47.2</td>
<td>Cervical spondylosis with radiculopathy</td>
</tr>
<tr>
<td>M 50.3</td>
<td>Degenerative condition of cervical disc</td>
</tr>
<tr>
<td>F 41.2</td>
<td>Combined anxiety disorder and depressive condition</td>
</tr>
<tr>
<td>F 32.0</td>
<td>Mild depressive episode</td>
</tr>
<tr>
<td>M 54.2</td>
<td>Neck pain</td>
</tr>
<tr>
<td>M 18.9</td>
<td>Osteoarthritis</td>
</tr>
<tr>
<td>M 54.5</td>
<td>Low back pain</td>
</tr>
<tr>
<td>G 43.9</td>
<td>Unspecified migraine</td>
</tr>
<tr>
<td>E 03.9</td>
<td>Unspecified hypothyriosis</td>
</tr>
<tr>
<td>G 44.2</td>
<td>Tension related headache</td>
</tr>
<tr>
<td>R 52</td>
<td>Pain in neck/shoulder/back/both legs</td>
</tr>
<tr>
<td>M 36</td>
<td>Rupture of Bakers cyst</td>
</tr>
<tr>
<td>M 76.6</td>
<td>Extremity pain</td>
</tr>
<tr>
<td>F 41.1</td>
<td>General anxiety disorder</td>
</tr>
<tr>
<td>F 45.3</td>
<td>Somatoform autonomous dysfunction</td>
</tr>
<tr>
<td>M 25.56</td>
<td>Knee pain</td>
</tr>
<tr>
<td>M 25.51</td>
<td>Pain in the shoulder joint</td>
</tr>
<tr>
<td>F 40.8</td>
<td>Other specified fobic anxiety disorder</td>
</tr>
</tbody>
</table>

### 2.5 Outcome measurements

The participants were tested and assessed before interventions at the inclusion in the study, which will be the baseline score for all instruments/tests. After 6 weeks, post-intervention and before they were discharged, they were retested.
2.5.1 NRS and pain intensity

Numerical Rating Scale (NRS) was used to assess pain intensity on a 0-10 scale. The patients rated their pain intensity on a NRS scale from 0-10 where 0 is absence of pain and 10 is intolerable pain. The Norwegian Association for the Study of Pain (NOSF) have concluded that numerical rating scales (NRS) are just as sensitive to changes in self assessment of pain as Visual Analogue Scales (VAS), which are widely used in studies (Breivik, Borchgrevink, Allen, Rosseland, Romundstad, Breivik-Hals, Kvarstein and Stubhaug, 2008; Williamson & Hoggart 2005). In a unidimensional numerical rating like this the patients will have to choose the appropriate value for their pain. Childs, Piva and Fritz concluded that a 2-point change on a numerical rating scale is clinically significant when used on low back pain patients (Childs et al, 2004), and this was supported by Farrar and Young (2001). Huber, Suman, Rendo, Biasi, and Marcolongo also concluded that NRS scales in chronic musculoskeletal pain were adequate and valid, but also highlighted the fact that unidimensional pain ratings can give limited information about the pain conditions, and that several different unidimensional pain ratings were recommended. In addition to pain intensity, dimensions like the pain character (prickling, stinging, burning etc) and localization are mentioned (Huber et al, 2007). Arendt-Nielsen and collaborators states that pain intensity scales based on patients’ reports make patients relate to their pain and analyze it. More advanced scales give can information about intensity, the tolerability and the patients affections and evaluations on the pain they experience. An example of this kind of instrument is the McGill Pain Questionnaire (Arendt-Nielsen et al, 2009) and the NOSF Minimum Assessment Scale (Norsk Smerteforening, 2012)

The patients in this study rated their own pain intensity every day for the last 7 days pre intervention. Then they rated their last 7 days post intervention or during the last days of intervention. A mean score was estimated from the last 7 days at baseline and last seven days at post intervention.

2.5.2 Quality of movement and the Standardized Mensendieck Test

The SMT consists of one total score and 5 subscores in 5 different categories: standing posture, sitting posture, gait, active movement and respiration. In each of these categories there are several items with scores, and the patient is evaluated and scored by a trained therapist (see appendix 2).
**Standing posture:** Global line of gravity, ankle, knee, pelvis, back, shoulder, neck.

**Movement:** Global, frontal arm lift, vertical arm lift, hip flexion, sagittal arm swing, diagonal arm swing.

**Gait:** Global, foot roll, propulsion, rotation.

**Sitting posture:** Global, support, pelvis, back.

**Respiration:** Global, pelvic lift, arm lift.

In all 5 categories an average score is estimated from all the subscores. (Haugstad et al, 2006a). These average scores have been used and analyzed in this study.

The SMT and the mensendieck tradition are based on assumptions that there are some movement patterns that are optimal and symmetrical, and patterns that are dysfunctional (Dahl-Michelsen, 2007). The SMT scores range from 0-7 on every item where 0 is highly abnormal, and 7 is optimal function (Haugstad et al, 2006a).

In the SMT manual the description of the scores 0-7 are divided into 4 categories: 0-1, 2-3, 4-5, 6-7. Clinically significant change was estimated to be 1.8. Haugstad with collaborators presented scores of healthy controls consisting of 15 female students and employees at the Oslo University College (HiO) and The National Hospital (RiH), and these controls were matched with the CPP patients in age, educational level and where they live geographically. There was no further description of how the process of recruiting these controls was done. These are the only published normative data on the SMT that was found. The SMT sessions were videotaped in order to secure a possibility to evaluate the patients repeatedly, or to have the opportunity for more than one therapist to evaluate the patient. These tapes were anonymized regarding name and birthdate, but patients could be identified by face recognition. The videotapes were stored according to national research regulations (Personvernombudet for forskning, REK), and was only available for the research personnel. The SMT was used to identify features of movement quality. Haugstad with collaborators (Haugstad et al, 2006a) has used the SMT to evaluate somatocognitive treatment (SCT) on women with chronic pelvic pain, and found the psychometric properties to be satisfactory, and the SMT sensitive to change as a consequence of therapy. It is therefore of interest and relevance to use the SMT to evaluate patients with widespread pain of both genders.
### SMT manual (here in a shortened and simplified form by T. Brustad)

<table>
<thead>
<tr>
<th>Score</th>
<th>Quality description</th>
</tr>
</thead>
<tbody>
<tr>
<td>7-6 points</td>
<td>Optimal position, angle or movement</td>
</tr>
<tr>
<td>5-4 points</td>
<td>Position, angle or movement has a slight deviation</td>
</tr>
<tr>
<td>3-2 points</td>
<td>Position, angle or movement has markedly deviation</td>
</tr>
<tr>
<td>1-0</td>
<td>Position, angle or movement has very markedly deviation</td>
</tr>
</tbody>
</table>

(From Haugstad et al, 2006a p. 189-205)

### 2.5.3 Cardiorespiratory fitness and the Åstrand bike Test/Rhyming Test

The Åstrand bike test was used to measure VO$_2$ max before and after 6 weeks program. This test is an indirect calculation of the VO$_2$ max based on the fixed relationship between heart rate and oxygen uptake needed for certain workloads (Bahr, 1991; Heywood, 1998; Andersson, 2004). The test has been found appropriate for assessing VO$_2$ max, and for detecting changes in VO$_2$ max within the same tested individual (ibid 1991). There are also normative scores for comparison available (Heywood, 1998). There are some uncertainties regarding the possibility to detect changes in VO$_2$ max as a result of a six weeks training period. The learning and adaptation effect to the bike and test situation may also influence the results. The average heart rate during the last 2 minutes are recorded, and together with the pedal resistance in watts, gender and age, the VO$_2$ max is estimated from a table (appendix 1).
The Åstrand test provides a score of VO$_2$ max either in liters per minute or ml per minute per kilo body weight. The latter is used in this study.

2.6 Statistical analysis

All data has been analyzed in Statistical Program for Social Sciences (SPSS version 19). The data collected in this study consisted of both categorical and continuus variables. The data have been checked for normal distribution and thereafter analyzed with parametric and non-parametric methods. Continuus variables with normal distribution have been analyzed with the parametric paired sampled t-test. Those without normal distribution ahave been analyzed with the non-parametric Wilcoxon signed rank test. There are two points of measurement; pre-and post intervention. Significance has been set to $p=0.05$. (Altman, 1991; Aalen, Frigessi, Moger, Scheel, Skovlund and Veierød, 2008).

NRS and SMT are treated as continuus variables and have been found to have normal distribution, while Åstrand test results (also continuus variable) were found not to have normal distribution.

The patients’ pain scores have been analyzed as a group, but a presentation of the individual NRS scores pre-and post-intervention has also been estimated with a drop line chart (Table 3.2.2). Furthermore the population was split into two at baseline to check their distribution on the NRS scale below and above the mean score (6,0) of the total group, one group with scores 0 - 6,0, and the other with scores from 6,1 - 10. The NRS scores were found to have normal distribution, and were therefore analyzed for significant change from baseline to post intervention with paired samples t-tests.

The SMT is divided into 5 subcategories, with several items and subscores in each category, scores ranging from 0-7. In each category, a mean score was estimated, making up 5 different scores. These data was treated as continuus variables and analyzed for significant changes with paired samples t-tests as they were found to have normal distribution. Individual scores are shown in a drop line chart (Table 3.3.1-5 A-E)

The Åstrand test results were continuus variables and were checked for normal distribution, which they did not have. A non-parametric method, the wilcoxon signed rank test has been used to analyze this material. There is well documented control material, or normal scores on VO$_2$ max both for both genders, making comparisons possible (Appendix 1, from Heywood 1998).
Correlation for pain intensity and cardiorespiratory fitness was checked with a scatter plot diagram with linear regression in SPSS, and no correlation was found. Further analyses on correlation were not made in this study.

3.0 Results

3.1 Aim 1: Description of pain intensity, quality of movement and cardiorespiratory fitness at baseline in patients with LWP.

Table 4: Baseline results in pain intensity, quality of movement and VO2 max

<table>
<thead>
<tr>
<th></th>
<th>Mean/ SD</th>
<th>Range/variation</th>
<th>Ref</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NRS (n=22)</strong></td>
<td>6.0 (1,7)</td>
<td>2,71-8,57</td>
<td></td>
</tr>
<tr>
<td><strong>SMT (n=22)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standing posture</td>
<td>5.68 (0,22)</td>
<td>5,45-5,85</td>
<td>5,72</td>
</tr>
<tr>
<td>Movement</td>
<td>4.93 (0,66)</td>
<td>4,2-6,2</td>
<td>5,25</td>
</tr>
<tr>
<td>Gait</td>
<td>5.17 (0,73)</td>
<td>3,75-6,0</td>
<td>5,58</td>
</tr>
<tr>
<td>Sitting posture</td>
<td>5.39 (0,70)</td>
<td>3,25-6,0</td>
<td>5,66</td>
</tr>
<tr>
<td>Respiration</td>
<td>4.65 (0,40)</td>
<td>4,0-5,4</td>
<td>4,93</td>
</tr>
<tr>
<td><strong>Åstrand (n=19)</strong></td>
<td>30,3 ml/min/kg (8,3)</td>
<td>20,0-54,3ml/min/kg</td>
<td>w 29,0-32,8*</td>
</tr>
<tr>
<td>Median</td>
<td>27,5 ml/kg/min</td>
<td></td>
<td>m 39,0-43,7*</td>
</tr>
</tbody>
</table>

*Normative scores from age group 40-49 because of median age 44.

Mean scores, standard deviation, variation/range of scores and reference values (controls) for NRS (0-10), SMT (0-7) and Åstrand (0-100). NRS and Åstrand show the greatest variation of scores. Åstrand scores have not been divided according to gender, and the median score is more relevant because of not having normal distribution.
3.1.1 NRS pain intensity
Table 4 shows the patients pain intensity ratings (NRS) at baseline. The numerical scale is from 0-10. 0 is absence of pain, and 10 is intolerable pain. The range in baseline scores were 2,71 at the lowest, and 8,57 at the highest. Standard deviation was calculated to be 1,70. Mean score 5,96=6,0.

3.1.2 SMT quality of movement
The maximum SMT score is 7, which is considered to be an optimal score of motor function in the different subcategories and items. As shown in table 4, the patients with widespread pain had a mean score on the upper part of the scale, from 4,65-5,68 at baseline in the different subcategories of the SMT. The table also shows that the range of the scores is relatively small, the biggest range at baseline is found in gait and sitting posture (2,25 and 2,75 respectively).

3.1.3 Åstrand test and cardiorespiratory fitness
The median score in the Åstrand test at baseline revealed 27,5 ml/min/kg for the whole group. The variation of scores was at the lowest 20,0 ml/kg/min and the highest was 54,3 ml/kg/min. Scores for all age groups of healthy subjects can be found in appendix 2. The reference values mentioned in Table 4 are only scores for age group 40-49 years old estimated to “good” cardiorespiratory fitness (Heywood 1998). The variation in the study group ranges from very poor to superior compared to healthy subjects. The scores have not been divided according to gender, and it must be taken into consideration that men have relatively higher scores than women when interpreting the scores. Holtehdahl described the physical capacity in patients applying for disability welfare in Norway (Holtedahl, 2006). These patients stated musculoskeletal pain and fatigue as main subjective factors/symptoms, and literature shows that pain conditions like these are well known in the welfare system in western countries, but the population Holtedahl describes has other diagnoses and symptoms as well. Out of 94 subjects that conducted an indirect VO2 max estimation bicycle test, he estimated a median score of 20 ml/kg/min VO2 max, with a variation from 9 ml/kg/min to 44 ml/kg/min.
3.2 Aim 2: Investigation of changes in pain intensity, quality of movement and cardiorespiratory fitness from baseline to post-intervention.

Table 5: Baseline and post-intervention results in NRS pain intensity, SMT quality of movement and Åstrand VO2 max. Mean scores NRS 0-10, SMT 0-7, Åstrand 0-100.

|                      | Baseline Mean (SD) | Post-intervention Mean (SD) | Diff  | P *  
|----------------------|--------------------|-----------------------------|-------|-------
| **NRS**              | 6.0 (1.7)          | 5.9 (1.4)                   | 0.1   | .667  
| **Range min-max**    | 2.7-8.6            | 2.1-8.0                     |       |       
| **SMT**              |                    |                             |       |       
| Standing posture     | 4.93 (0.22)        | 5.25 (0.23)                 | 0.32  | .110  
| Movement             | 5.17 (0.66)        | 5.58 (0.61)                 | 0.41  | .009  
| Gait                 | 5.68 (0.73)        | 5.72 (0.73)                 | 0.04  | <.001 
| Sitting posture      | 5.39 (0.70)        | 5.66 (0.58)                 | 0.27  | .036  
| Respiration          | 4.65 (0.40)        | 4.93 (0.39)                 | 0.28  | .006  
| **Åstrand ml/kg/min  | 30.3 (8.3)         | 30.8 (7.5)                  | 0.5   | .407* 
| **median**           | 27.5               | 30.2                        |       |       

*Åstrand test analyzed with Wilcoxon, all other categories t-tests.

Mean scores show small changes from baseline to post-intervention (≤ 0.5). There was no significant change in mean pain intensity, standing posture and Åstrand (p>.05). Significant change was found in categories movement, gait, sitting posture and respiration (p<.05) from baseline to post-intervention. Åstrand median value most representative because of not having normal distribution.
3.2.1 NRS pain intensity

Table 5 shows that there was no significant change in NRS pain intensity before and after the intervention. Baseline and post-intervention scores in NRS were analyzed with paired samples t-tests, p-value set to 0.05.

The tables 3.2.1-3.2.2 show individual results from baseline to post-intervention on pain intensity, subcategories in quality of movement through the SMT (standing posture, movement, gait, sitting posture and respiration) and last the scores in VO2 max, Åstrand test. The green circle always represents the post-intervention measurement. In the table showing pain intensity, a reduction in pain would mean the green circle at the lower end of the individual lines. On all the other tables, a green circle on top of the individual lines would mean an improvement after intervention. In the tables some of the individuals measurements show only one circle, which means they have practically no change in their measurements.
Table 3.2.1: Individual scores on NRS pain intensity from baseline to post-intervention

Blue circle at baseline, green circle at post-intervention N= 23

Blue circle on top demonstrating reduction in pain

11 patients show pain reduction, but 10 have an increase in pain intensity. 2 have close to no change at all.
3.2.2 SMT quality of movement

The SMT mean scores are listed in Table 5 with subcategories. The subcategories gait, movement, sitting posture and respiration were found to have significant statistical changes, all with p-values below 0.05. Standing posture was found to have no significant change. The following tables shows individual scores in the 5 subcategories standing posture, movement, gait, sitting posture and respiration. Maximum score is 7, lowest score is 0, and all individuals are measured at baseline (blue circle) and post-intervention (green circle).
Table 3.2.2: Individual scores in SMT categories at baseline/post-intervention

A

STANDING POSTURE, individual scores baseline and post-intervention N= 22 (no 8 missing)

Blue circle at baseline, green circle at post-intervention

The figure shows that 6 patients increased their score in standing posture, 2 had reduced their score at post-intervention, and the rest had very small or no change.
B

MOVEMENT, individual scores baseline and post-intervention N=22 (no 8 missing)

*Blue circle at baseline, green circle at post-intervention*

12 patients had an increase in SMT subcategory movement at post-intervention. 3 had reduced score and 7 small or no change.
C

GAIT, individual scores baseline and post-intervention N=22 (no 8 missing)

Blue circle at baseline, green circle at post-intervention

14 patients had an increase in their post-intervention measurement in gait, 1 had decreased score and the remaining no change. Those that change, change for the better.
SITTING POSTURE, individual scores baseline and post-intervention N=22 (no 8 missing)

Blue circle at baseline, green circle at post-intervention

12 patients had improvements in sitting posture measurements, 2 had reduced score and 8 had no change.
E

RESPIRATION, individual scores baseline and post-intervention N=22 (no 8 missing)

Blue circle at baseline, green circle at post-intervention

9 patients show improvement in respiration, the rest show no change. Those that change, change in a positive respect.
3.2.3 Åstrand test and cardiorespiratory fitness
The results from the Åstrand tests were not found to have normal distribution, and have been analyzed with the Wilcoxon signed rank test. No significant change in VO2 max was found in the group from baseline to post-intervention.

Table 3.2.3: Individual scores in Åstrand test at baseline and post-intervention
*Blue circle at baseline, green circle at post-intervention*  N=21 (no 8 and 21 missing)

12 patients had improved their Åstrand result at post-intervention, 5 had a reduced score and 4 had no change or missing test data.
4.0 Discussion

The scope of this chapter is to discuss the findings in this study according to the aims and research questions presented in chapter 1.2.

4.1 Discussion of results aim 1 and 2

Aim 1 was to investigate and describe pain intensity, quality of movement and cardiorespiratory fitness in patients with long-lasting widespread pain.

Aim 2 was to investigate the changes in pain intensity, quality of movement and cardiorespiratory fitness in the study group after participating in a 6 weeks multidisciplinary pain management program. The research questions will be addressed in the following discussion.

The discussion in chapters 4.1.1-4.1.3 will explore the results found in the baseline measurements and the changes that were found from baseline to post-intervention as shown in table 5.

After looking into the research and literature in the area of complex pain conditions such as fibromyalgia and LWP and interventions, it could seem overwhelming to reach conclusions. What effects could be expected from multidisciplinary programs and different interventions? Literature and research shows both pain reduction and no significant reduction in pain. There is research that recommends Nordic walking as means to increase physical capacity, and there are studies that find improved quality of movement after physiotherapy with a cognitive perspective. In this study, pain reduction was expected to have a very limited or no change at all. We did not expect to see significant changes in Åstrand because of the diversity of interventions and lack of targeted physical capacity training. The somatocognitive intervention consists of a cognitive approach to body awareness and activity, and we did expect this to have influence on the group receiving this intervention. However, because analyzes were done on the data material with the group as a whole, we were prepared to find little statistical significance.

4.1.1 NRS pain intensity

The pain rating at baseline showed a mean score of 6.0 in the whole group, with a standard deviation of 1.7. This is relatively high when the value 10 represents intolerable
pain. Studies that measure pain intensity usually include patients with FM or musculoskeletal pain conditions, and their mean pain levels are reported as moderate (5-7) on a pain intensity scale of 0-10 (Haugstad et al, 2006b; Karjalainen et al, 2009; Ruau, Liu, Angst and Butte, 2012).

The CPP patients in the Haugstad et al (2006b) study had an average VAS pain score of 5.60 at baseline. Karjalainens’ (2009) review also investigated pain intensity outcomes. In this review patients suffering from FM, reported baseline scores of 7.0 on pain intensity (Burckhardt 1994 in Karjalainen 2009).

Ruau with co-workers investigated pain ratings divided into diagnosis sections (ICD sections) in 11 000 electronic patient files and compared gender differences in these scores. The diagnosis groups from Ruau and co-workers’ study that are reasonable to compare with the study group of LWP, had pain ratings from 3.9-6.0. Unspecified disorders of back, unspecified disorders of joint and unspecified disorders of soft tissue were all in the range 4.88-6.03 in mean pain ratings (Ruau et al, 2012).

The studies listed above all measured included patients on pain intensity, and baseline scores are moderate pain intensity (5-7 on a 0-10 scale).

The diagnoses listed under demographic variables in chapter 2 also show that there are many different diagnoses used to categorize the patients with pain participating in this study. Criteria for inclusion were widespread pain, but the diversity of diagnoses must be taken into consideration when comparing these pain intensity levels.

Research question 1: What level of pain intensity do LWP patients report?

LWP patients in this study report moderate levels of pain intensity at baseline, mean score in this group being 6.0 on a scale from 0-10.

This is similar to scores in other studies (Ruau et al, 2012; Karjalainen et al, 2009).

Considering that numerical pain rating scales (0-10) means no pain at 0, and intolerable pain at 10, an average of 6.0 is substantial even though it is categorized as moderate. These patients experience implications in many areas of life, and also report sleep disorders, depression, anxiety, reduced daily function and many are sick-listed from work. The complexity of widespread pain patients’ symptoms may be an explanation to their high levels of experienced pain intensity.
Research question 4: Does a pain management program affect pain intensity in patients with LWP as measured at baseline and post-intervention when they were discharged?
The study group showed no significant change in NRS pain intensity from baseline to post-intervention in the statistical analyzes. The whole group reported almost the same intensity of pain (6,0) before and after intervention.

Reviews and research on fibromyalgia patients show inconsistent findings. Some find pain reductions, other no significant reduction in pain. The study here shows no significant reduction in pain.

The scores in table 3.2.1 show individual scores at baseline and post-intervention. The pain scores ranged from 2,7-8,6 at baseline, and from 2,1-8,0 at post-intervention. These individual scores showed how there were great individual variation in scores, as well as it showed that some had a relatively big decrease in pain, others had pain increase.

This might suggest that the program had little effect on pain intensity, and could raise doubt if the pain management program like the one they participated in had achieved its’ intention or purpose. An important side to this is the uni-dimensional character of a self-reported pain intensity measurement. Farrar et al (2009) and Arendt-Nielsen et al (2009) both highlighted the need for a more complex investigation of pain that uni-dimensional ratings could not give. LWP patients report relatively high levels of pain, and these levels do not seem to decrease in this study. This is also concluded in the Swedish SBU review (2010) where it is stated that multidisciplinary programs have little effect on pain intensity. There are however studies that show pain decrease after completion of multidisciplinary intervention programs.

Explanations to a lack of pain reduction could be that when participating in the multidisciplinary pain management program described here, patients increase their activity level, and this could in turn make pain decrease difficult. Further, the program focused on pain management in daily life, not reducing pain. Throughout the program, the pain intensity did not decrease, but their understanding of pain and quality of life might have changed. The instruments used in this study do not address this question. Perhaps the patients experience a change in how they master their life and their pain even though the pain persists. Other instruments could give more information than pain intensity ratings, both on the pain and the patients’ quality of life. Breivik and collaborators (2008) concludes that “chronic pain assessment and its impact on physical, emotional, and social
functions require multidimensional qualitative tools and health-related quality of life instruments” (Breivik et al, 2008 p:17). Studies that are mentioned by them have instruments that investigate the factors Breivik and co-workers point to; instruments that investigate quality of life, every day functions and activities and coping.

In a long term perspective knowledge about pain and how to master it might stimulate a lower score on self reported pain intensity. This might also be seen in follow-up investigation of pain intensity scores after 6 months and 12 months. When looking at the VAS scores in Haugstad et al (2007), there was a reduction in VAS pain intensity from baseline to 1 year later; from 5,60 to 2,00. This suggests that there is a need for long term follow up on longstanding pain conditions. Other studies have shown decreases in pain intensity in measurements 1-3 years after intervention (Heiskanen, 2012). A precaution must be made in terms of Haugstads’ study, the patients there had localized pain (pelvic pain), whereas patients in this study have widespread pain. As Kvåle (2003) pointed out; patients with widespread long-lasting pain conditions seem to have greater negative impacts on their health than patients with localized pain.

The limited effect on pain intensity suggests that more knowledge is needed on pain as a concept. We have limited knowledge on how patients with long lasting pain conditions understand their pain. A research approach that address how patients understand their pain, what they express with their pain ratings, evaluations and their behaviour would be very interesting and might offer even better interventions and measurements in future treatment and rehabilitation.

Also, the patients have a number of different diagnoses, and therefore it is likely that they have several factors contributing to their reduced function in life. Conditions like depression and anxiety are common comorbidities (Bergman 2007; Spaeth and Briley, 2009) with chronic pain, and both are closely connected to the pain experience and pain interpretation in the brain (Melzack 1996; Moseley 2003; Brodal 2005, Arendt-Nielsen et al, 2009). A characteristic of a multidisciplinary program is several interventions, and the complexity of such a program might give the individual interventions less impact. This could raise the question whether pain reduction suffers in the program described here, or to put it another way: Maybe pain intensity reduction is of small interest as a measurable goal compared to pain management in this program.

Other studies have shown that cognitive behavioural therapy, SCT, individually tailored interventions all have an effect in reducing pain (SBU 2006; Martinsen 2011; Heiskanen et al, 2012; Asenløf et al, 2005; Haugstad et al 200b; Brunner et al, 2013), so there could
be incentives for evaluating and revising the multidisciplinary program in this study. The Heiskanen et al (2012) study also points out that more individualized multidisciplinary program approaches are necessary, with increased emphasis on analysis and treatment of psychological symptoms and patient beliefs, to develop better results.

4.1.2 SMT quality of movement
SMT is an instrument to evaluate quality of movement, as judged by the observing therapist. The instruments consist of subcategories standing posture, movement, gait, sitting posture and respiration. The instrument has not been used in many studies to this point, so the results from Haugstad et al (2006a, 2008) will make up the basis for some comparisons and discussions in the following. The mean scores of the present study group are listed in table 4, together with the mean scores of healthy controls from Haugstad and collaborators’ study (Haugstad et al 2006). There were only small differences between the study group with LWP and the healthy subjects in the Haugstad study. The optimal or maximum score that can be obtained in the different categories is 7. Mean scores in the LWP study group is at the lowest 4.65 in respiration and the highest is 5.68 in standing posture.

The differences in SMT scores between the healthy controls and the CPP patients in the study performed by Haugstad et al (2006) were significant after interventions.

When comparing the scores of LWP patients in the present study with the healthy controls in Haugstad et al’s (2006) study, the scores do not differ much. At first glance it seems that the SMT scores of LWP patients suggest that their quality of movement is similar to that of healthy controls in the Haugstad study (2006), which was an interesting finding.

There are some methodological considerations to this that will be addressed in the chapter discussing the methods used in this study.

However, the fact that this instrument is not validated for LWP patients at this point, and the fact that the experience the researchers in this study have with the SMT has some limitations, might bias the results and therefore make comparisons weakly based.

Table 5 lists the SMT scores at baseline and post-intervention. Movement, gait, sitting posture and respiration all showed significant change. Standing posture was the only subcategory with no significant change. Clinically this might be explained by the fact that little change can be expected in 6 weeks in an individuals’ standing posture. The
individual line scores in table 3.2.2 confirms this, many of the subjects show no change at all.

As seen in table 5, the changes in mean score in subcategories movement, gait, sitting posture and respiration are small, all being lower than 0.5. The smallest change in mean score is found in gait (0.04), and this has interestingly the highest significance level (p< .001). If we look at the scores for each individual in the subcategory gait in table 3.2.2, this could be explained by the fact that those individuals that change, mainly increase their scores by close to 1 point, while the others have a relatively small, but “positive” changes. In conclusion, those that change, do so in respect of improvement, which could explain the high significance. When focusing on clinically relevant change, Haugstad et al (2006a) estimated a change of 1,8 points. This is a substantial change on a scale with 8 levels (0-7). When compared to this estimation, the patients in this study group had very small changes even if statistically significant. Using the criteria from Haugstad, the changes in the present study was clearly not clinically relevant. Another question that remains is whether the same criteria used in the CPP group could be applied to the LWP group.

A possible explanation to the small changes in this study group compared to the Haugstad-study might be that the LWP group had much higher scores at baseline, and thus a smaller possibility to gain improvements, and had a smaller range in the group as a whole.

The scale in the SMT ranges from 0-7 where 7 is the optimal and highest attainable score. A significant increase in the mean scores of the subcategories suggest an improved quality of movement. The intervention of somatocognitive treatment aims to improve movement patterns and cognitions connected to movement, and to improve the subjects’ body awareness (Dahl-Michelsen, 2007; Klemmetsen, 2005; Haugstad et al, 2008). Body awareness is central in approaches like the BAT, mensendieck physiotherapy (MP/SCT) and psychomotor physiotherapy. A main assumption is that increased body awareness improves their quality of movement, and this has benefits for the individual in daily functioning (Klemmetsen, 2005; Kvåle, 2003; Haugstad et al, 2008; Dahl-Michelsen, 2007).

**Research question 3: Has there been changes in the quality of movement when measured with the SMT in the study group from baseline to post-intervention?**
There were significant changes in gait, sitting posture, respiration and movement. Other studies have shown that especially respiration is affected in patients with long lasting pain conditions (Kvåle, 2003, Haugstad et al, 2006).

When looking at the SMT scores (and the Åstrand scores), there is one particular important point to remember. In this population, the participants are recruited after randomization into either SCT treatment or Nordic walking as individual physiotherapy treatment. This means that half of the subjects received a treatment that address body awareness, while the other half receive treatment that are more a traditional physical capacity exercise. The scores have not been divided according to these differences, and it is likely that this could affect the results. This might be revealed and analyzed in the upcoming RCT.

4.1.3 Åstrand and cardiorespiratory fitness

The Åstrand tests at baseline have a median score of 27,5 ml/min/kg as a measure of VO2 max in the whole study group. The scores have not been divided according to gender, mostly because of the small population size of 19, of the original 23 participants. The scores in Åstrand for healthy subjects were according to gender, and this limits the grounds for comparison. However, the scores achieved at a good level in healthy subjects in the age group 40-49 are also listed in table 4.

Research question 4: Do LWP patients have a lower level of cardiorespiratory fitness (VO2 max) than healthy subjects? And what possible explanations might there be in this matter?

The impression that LWP patients have substantial lower VO2 max score than a healthy population has not been supported by findings in this study. The scores in the population of LWP patients vary from 20-54 ml/kg/min, median score being 27,5 ml/kg/min. Heywood (1998) lists that a good level of cardiorespiratory fitness lies between 29-32,8 ml/kg/min for women and 39-43,7 ml/kg/min for men. Holtedahl (2006) looked at the physical capacity in patients with musculoskeletal pain and fatigue, symptoms that are very relevant for the population in this study. His findings after testing these patients in a bicycle test were a median VO2 max of 20 ml/kg/min, and a variation from 9-44ml/kg/min.
The study group had no significant change in their oxygen uptake during the 6 weeks in the program. As mentioned before, the hypothesis that they had a low capacity was discussed under aim 1. Not adjusted for gender, their VO2-scores were not far from material in the healthy population when adjusted for age group. However, men and women differ quite substantially in capacity, and this accounts as a substantial bias, so no reliable conclusion can be made from these results. The lack of significant change in VO2 max can possibly be explained by the fact that the program did not consist of interventions that had physical capacity and cardiorespiratory fitness increase as their goal. To improve cardiorespiratory fitness the physical activity in the program must have been targeted to do just that, both when it comes to intensity and frequency. Nordic walking has been shown to increase VO2 max by Mannerkorpi et al (2010) and Busch et al (2011), but that was in a systematic training programs to investigate if NW could affect VO2 max. Even though the participants in the study presented here might have increased their daily activity level during the 6 weeks as in-patients, they did not have a structured and targeted physical capacity fitness program. It is therefore unlikely that their level of VO2-max would improve significant. The program had a goal of letting the participants have regular and frequent physical activity, but there was not a defined goal to improve VO2 max. Also they participated in different forms of activity during the 6 weeks program. Emphasis was put on body awareness and education on pain, health and daily function. The patients reported that NW was a useful and easy way of exercising, and it was well tolerated, as seen in other studies (Busch et al, 2011; Mannerkorpi et al, 2010).

Another factor that is to be taken into consideration here, is the randomization into two different treatment groups. The participants in this study consists of both “Nordic walkers” and SCT patients. In addition to group based exercise 3per week, they either received Nordic walking or SCT individually with a physiotherapist every week. When looking into the scores of the Åstrand test (and the SMT), this bias might be of particular importance to keep in mind.

In this study group it was interesting to see that their median scores as a group did not differ much from “normal” (Heywood, 1998), and so these findings describe this population and their physical capacity. A preliminary assumption that LWP patients are less physically active and therefore have a reduced VO2 max compared to normal, seems
to be weakened after this study. However, more specific studies with gender separated and intervention specific measures are needed in the future to address this.

4.2 Discussion of methodology

There are a number of factors that could bias the results and possible conclusions for this study. I will in the following discuss some of the methodological considerations and limitations of this study.

Design:

There is no long term follow up in this study. The LWP patients are measured at baseline and post-intervention (6 weeks later). But these patients have so many contributing factors in their life that adds to their experience of pain and reduced function, that it might take longer time than 6 weeks to have the desired effect. It would be very interesting to see if changes occur after 12 months and maybe 2 years, according to other research that show that some pain reductions can be seen in 1-3 years follow-up (SBU, 2010).

Some studies have measurements of pain intensity after 1 year that show significant pain reductions (Haugstad et al, 2008). Also, the researchers contributing in this study might be a source of bias when they take part in selecting participants, do all the tests baseline and post-intervention, and they also conduct all treatments related to the physiotherapeutic interventions investigated in this study. It is a possibility that the therapists’ expectations and knowledge of all participants may influence their judgement during the programs interventions and tests, and also in their approach to each individual patient. However, this will be the same for all participants in this material.

The therapists were not blinded for testing at baseline and post-intervention and participants were not blinded for what intervention they received. The fact that this study group consisted of the first 23 (25) patients included in a larger study (the RCT), one could say they were partially randomized. The population was divided in two groups of interventions. One group received Nordic walking, the other somatocognitive therapy. NW is shown to be an effective tool to improve VO2 max, while SCT has been shown to increase quality of movement. It is likely that these differences have influenced results when the group scores have been analyzed as a whole and not been divided according to intervention. This can be addressed in the upcoming RCT where the groups will be analyzed separately.
There were no controls in this study.

Participants:
The sample was relatively small and selected from patients already referred to the hospital with pain conditions, which makes them not fully representative. Generalizations to a pain population in general are difficult to make. The gender distribution is also not representative for the general population, and the groups’ results have been treated as a whole, rather than dividing them into gender. Pain conditions seem to be more common among women (Arendt-Nielsen et al 2009), and important information might be found when investigating the genders’ data separately.

There were also some missing data in this material, especially in the Åstrand test. Out of the original 25 participants, 23 completed the program, so there were 2 drop-outs. In the Åstrand test, only 19 subjects had baseline and post-intervention scores. 1 person did not do post-intervention SMT.

The multidisciplinary program:
The program this study group participated in consisted of many interventions which together comprise substantial challenge for the LWP patients. Just entering the program for 6 weeks as in-patients in a hospital is very different than their everyday life. The hospitalization may also have an impact on how the participants evaluate themselves and their function. Very little research investigated in relevance to this study has in-patients, most offer interventions through out-patient programs. Although several interventions are described when it comes to treating pain conditions, very few studies can describe optimal combinations of interventions. It is widely accepted to have cognitive behavioural therapeutic interventions and physical activity, but guidelines on how to combine and recommended amounts are rarely described. Also, the instruments used in this study may not have the optimal match for evaluating the interventions and aims of the program. They may not be targeted and tailored well enough. The criteria for inclusion and exclusion have not been discussed in any depth here, but the variety of the diagnoses and symptoms might suggest a need for narrowing them down or targeting them further. The program is made to fit the complexity of the problems and symptoms the LWP patients have, and is therefore multidisciplinary. But it remains to be investigated whether the composition of the programs’ interventions is optimal. The participants are also treated as a group except in physiotherapeutic interventions, which may
also affect the recommended focus on individual tailoring during the program (Heiskanen et al, 2012, Aasenløf et al, 2005).

The outcome measurements:
The NRS for pain intensity is uni-dimensional, and it has already been mentioned how this limits the information about the patients understanding of their pain. Also, the complexity of long-lasting pain is well known, and Breivik et al (2008) underlines the need for complex measurement tools accordingly. A more comprehensive questionnaire that captures the diversity of the character of pain conditions might give better grounds for understanding pain as a concept and pain patients. This might also give more information on differences between the two genders. In this material, there are mostly women with pain. The question whether this is because women have more pain, or if this is a result of methods of inclusion or/and can be explained by other factors in health care traditions is still unanswered. Maybe the criterias used in health care favours pain conditions in women, or maybe men express pain in other ways that open for other treatment choices? These are questions that are unanswered here.

The SMT is an instrument for evaluating quality of movement. The SMT is not yet validated for LWP patients, and a solid comparison is impossible. There is a need for evaluating this instruments’ sensitivity and validity concerning LWP patients in the future. This study also suggests that the SMT manual might be difficult to use for (somewhat un-experienced) researchers when looking at the descriptions of the scores. The possibility of a learning effect must also be taken under consideration in a test like this.
The SMT is a categorical scale divided into 8 items (0-7), but the description in the manual is divided into 4 categories (0-1, 2-3, 4-5, 6-7). The relatively high mean scores in the SMT subcategories in the LWP group compared to the healthy controls in Haugstad et al (2006) might suggest the need for a closer examination of the interpretation and use of the descriptions in the manual. However, the evaluation made by the SMT did show statistically significant changes in the LWP patient group, and could be considered for further research on this matter. It is a weakness that NW and SCT patients scores were not analyzed separately when interpreting the changes in SCT scores and VO2 max.

The Åstrand test for VO2-max seemed adequate to give an impression of the physical capacity in LWP patients. The conclusion after investigating the results is that LWP patients as a group had a cardiorespiratory fitness close to that of the healthy population. When
considering the connection between pain conditions and kinesiophobia and fear avoidance known from literature on pain, it was expected that they might have lower capacity than “normal”. However, this could also suggest that other measurements than using a bicycle test could be indicated. The 6 minute walking test could be an interesting alternative.

4.3 Ethical considerations

All patients who participated in this study have given their written consent to participation in accordance to national research regulations set by Regional Etisk Komité (REK), who also approved the study. The study has also been approved by Personvernombudet for forskning. Because this is a study that is part of a more comprehensive randomized controlled intervention study, I will shortly discuss ethical considerations also related to the RCT study. Participants have been included after being referred to our clinic, and this may have put a certain pressure on them to participate. Also, the Norwegian welfare system sets certain demands on patients to undergo treatment in order to achieve economical rights, and this might be an important factor when considering the patients motivation for participation, completing the program and evaluating their process. Some might have felt pressured to participate even though their right to choose was pointed out to them. As mentioned earlier, these patients have tried several treatment options over the years, and this might also make expectations high to a program like this, and in this way influence their ratings.

Criticism on the bio-psycho-social model also states that this perspective can make programs too complex and demanding for groups of patients that have low socioeconomic status (White, 2005).

The RCT study divided patients into intervention groups and controls. The controls have 6 months of waiting and cannot receive other similar treatments during this period. It is a matter of ethical discussion to put patients in a position that might prolong their suffering, or to “withhold” treatment that could be helpful for them. However, these patients were all given the option to be included for participation in a full treatment program after the study was completed. The RCT study, and the study described in this thesis have both focused on the importance of the participants continuing with their lives and activities as normal as possible during the research period in order to prevent the feeling of putting their lives “on hold”. The controls are not part of the study analyzed here, and the RCT study could further look into considerations on the design of the RCT in that study. However, it is also important to analyze how representative a waiting list group is in this matter.
4.4 Conclusive comments aim 1 and 2

The results in this study show that the LWP patients in this study report moderate levels of pain intensity, and they have no significant change in NRS pain intensity rating after 6 weeks intervention. They have small but statistically significant changes in quality of movement in SMT’s subcategories gait, movement, sitting posture and respiration, but no significant change in standing posture, all evaluated by the SMT. Research mentioned in this thesis has not thoroughly explained or examined how quality of movement is important and transferred to activities and daily functions, even though a connection seems plausible.

Their level of VO2-max evaluated with the Astrand test showed no significant change after 6 weeks program, and their scores seem close to normal levels, not adjusted for gender.

Pain investigation in LWP patients needs to be multidimensional in order to capture the complexity of their pain condition, and their pain management seen in their experience with pain and function. The SMT is an instrument that needs to be investigated further in terms of validity for LWP patients, and the manual might be clearer on distinctions between scores and how to instruct the patients when conducting the test.

It is a matter of discussion whether the criteria for inclusion and exclusion have been met during inclusion of patients. Patients were evaluated and included on the basis of widespread pain as their main symptom and challenge. The lists of multiple different diagnoses show the diversity of LWP patients. The multiplicity of diagnoses could be a limiting factor when it comes to address the challenges and goals each individual patient have in a group based program. The need for guidelines in examining, diagnosing and treating patients with long term or chronic pain conditions have been uttered several times, and sums up many of the elements discussed in this thesis as well. The complexity of a multidisciplinary program seems to be necessary for a challenging group of patients that are very heterogeneous, but there are few guidelines on how to design such programs. Criticism on and weaknesses of such programs emphasise the need for more extensive clarifications on the interventions contents and the qualifications of the staff. It is not clear which interventions should be combined, what qualifications the staff should have, or what duration or amount of interventions that are recommended. In a qualitative study on what fibromyalgia patients consider to have been important to their recovery, patients have described life changing and profound changes in their lives and their way of living (Mengshoel and Heggen, 2004), and such factors are difficult to describe, control for and measure in research.
After completion of the study presented here, it is clear that there is a need for a more long term follow-up for patients with LWP, short term effects are rarely described. The complexity of both the program and the participants conditions suggest that changes that would occur will take longer time than 6 weeks. Also, it is apparent that quality of life, coping, psychological factors and a self evaluation on general health and functioning are important factors to measure on patients with long term conditions.

4.5 Further research
There are numerous questions remaining after this study, as in the field of long-lasting widespread pain conditions. Some of the methodological challenges and weaknesses of this study could possibly be eliminated in the upcoming RCT. A study with a more solid design; with controls, and with a larger population analyzed according to interventions and groups (NW and SCT combined with multidisciplinary treatment) and gender, might give more answers. More comprehensive instruments that look into kinesiophobia (Lundberg, Styf and Carlsson, 2003), depression, anxiety, quality of life, coping/sense of coherence in a long-term follow-up could give better descriptions of possible improvements of these patients’ lives.
During this study it has also become clear that it would be of great interest to have qualitative research on how these patients understand the treatments and programs they enter, what they consider to be most effective, useful and important to them, what they consider to improve their lives the most, and finally, how they understand their pain and its implications.
5.0 References


working age adults (Review). The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.


SBU 2006 Offentlig utredning Sverige: *Metoder för behandling av långvarig smärta.* Nr 177 1+2


Appendix 1

**VO₂ max**

**Normative data for VO₂ max menn (verdier i ml/kg/min)**

<table>
<thead>
<tr>
<th>Age</th>
<th>Very poor</th>
<th>Poor</th>
<th>Fair</th>
<th>Good</th>
<th>Excellent</th>
<th>Superior</th>
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<td>36.5-44.2</td>
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</table>

**Normative data for VO₂ max kvinner (verdier i ml/kg/min)**

<table>
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<tr>
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<td>&gt;31.4</td>
</tr>
</tbody>
</table>

Heywood 1998
Appendix 2

**SMT**  
**Optimal score 7, poorest score 0**

<table>
<thead>
<tr>
<th>Posture</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global/line of gravity</td>
<td></td>
</tr>
<tr>
<td>Ankle</td>
<td></td>
</tr>
<tr>
<td>Knee</td>
<td></td>
</tr>
<tr>
<td>Pelvis</td>
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</tr>
<tr>
<td>Back</td>
<td></td>
</tr>
<tr>
<td>Shoulder</td>
<td></td>
</tr>
<tr>
<td>Neck</td>
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</tr>
<tr>
<td><strong>Average</strong></td>
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</table>

<table>
<thead>
<tr>
<th>Gait</th>
<th>Score</th>
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<tbody>
<tr>
<td>Global</td>
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</tr>
<tr>
<td>Foot roll</td>
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</tr>
<tr>
<td>Propulsion</td>
<td></td>
</tr>
<tr>
<td>Rotation</td>
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</tr>
<tr>
<td><strong>Average</strong></td>
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<table>
<thead>
<tr>
<th>Movement</th>
<th>Score</th>
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</thead>
<tbody>
<tr>
<td>Global</td>
<td></td>
</tr>
<tr>
<td>Frontal armlift</td>
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</tr>
<tr>
<td>Vertical armlift</td>
<td></td>
</tr>
<tr>
<td>Sagital armswing</td>
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</tr>
<tr>
<td>Diagonal armswing</td>
<td></td>
</tr>
<tr>
<td>Balance/hip flexion</td>
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</tr>
<tr>
<td><strong>Average</strong></td>
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<table>
<thead>
<tr>
<th>Sitting posture</th>
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<tbody>
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<tr>
<td>Support</td>
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<tr>
<td>Pelvis</td>
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</tr>
<tr>
<td>Back</td>
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</tr>
<tr>
<td><strong>Average</strong></td>
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<table>
<thead>
<tr>
<th>Respiration</th>
<th>Score</th>
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<tbody>
<tr>
<td>Global</td>
<td></td>
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<tr>
<td>Armlift</td>
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</tr>
<tr>
<td>Pelvic lift</td>
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<tr>
<td><strong>Average</strong></td>
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</table>