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### Preliminary evaluation of a multidisciplinary pain management program for children and adolescents with chronic musculoskeletal pain

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RESEARCH PAPER

## Preliminary evaluation of a multidisciplinary pain management program for children and adolescents with chronic musculoskeletal pain

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### Abstract

**Purpose.** To describe the outcome of a multidisciplinary pain management program for children and adolescents with chronic musculoskeletal pain.

**Methods.** Study design: exploratory retrospective cohort study. The study sample consisted of a cohort of 70 children and adolescents (age: 8–21 years) with chronic musculoskeletal pain who completed a 3-month inpatient multidisciplinary pain management program. The program consisted of graded physical exercises, graded activities and counseling of the children and their parents. Assessed were motor and social activities, pain intensity, global assessment of physical functioning and psychosocial well-being (by patient and physician), understanding of the pain process and reduction of medical consumption. Assessments were performed at pre-admission, day of admission, day of discharge and at three months after discharge. Data collection took place over a 10-year period.

**Results.** Compared to admission, at discharge there were significant improvements in motor performances, school attendance, reduction of pain scores, understanding of the chronic pain process and reduction of medical consumption. Results remained stable at follow-up after three months.

**Conclusion.** The results of this study indicate that a multidisciplinary pain management program for children and adolescents with chronic musculoskeletal pain may be effective.

**Keywords:** Chronic pain, children, adolescents, nonspecific pain, rehabilitation, multidisciplinary treatment, pain management, disability

### Introduction

Non-organic chronic pain is a frequently encountered complaint that can lead to serious functional disabilities. Chronic pain syndromes are mostly recognized in the adult population, but are also present in children and adolescents [1]. In a Dutch study, 25% of a school sample reported chronic or recurrent pain [2]. The cause of non-organic pain is not clear.

The bio-psychosocial model is applied to assess and treat chronic pain problems in children. According to this model, patients' functioning is influenced by biological, psychological and social factors. Psychosocial factors have been acknowledged in

relation to pain-experience and pain-behavior [3–10]. Different authors have stressed the importance of the relationship between social factors and pain [3,9–13].

A rehabilitation program based on this biopsychosocial model should focus at psychosocial aspects along with physical activation [14]. In this approach patients should accept their current pain, as well as the fact that their pain may not disappear. The primary goal is to achieve functional improvement. To achieve this goal, it may be important to explain the situation to the child and the parents, the implications for them in the future, and their responsibilities in coping with pain in daily life [15,16]. It appears important that the child and his

family can relinquish purely medical oriented ideas in relation to the pain complaints. An inpatient rehabilitation program offers the child an escape from a negative spiral without losing face. After a clinical episode it is legitimate to return (to school for instance) with better functioning and motor skills. An inpatient program also creates the possibility for professionals to observe patients during the whole day. By confronting the children with these observations, they can learn about the influence of pain on behavior and can be made aware of their own role in the ongoing problems. It may be important that insight into the chronic pain problem increases, not only in the child but also in his/her parents. The parents should learn how to react to the pain behaviors of their children. In this way the child and his/her parents are given an opportunity to develop a new balance in coping with the pain syndrome [15,16].

Multidisciplinary rehabilitation programs are developed for patients with chronic pain [17]. Most of these programs are designed for adults and have been proven effective [18]. The effectiveness of these programs for children and adolescents with chronic pain remains unproven. The purpose of this study was to explore the outcome of a multidisciplinary inpatient pain management program for children and adolescents with chronic disabling musculoskeletal pain.

## Methods

### *Patients*

The inclusion criteria for treatment were: Chronic pain symptoms in the musculoskeletal system existing for at least 6 months and leading to functional disabilities; age between 6 and 21 years; living with their parents or caregivers at admission for the pain management program. Exclusion criteria were: Unwillingness to cooperate in the program; comorbidity with negative consequences for physical and/or mental functioning; insufficient knowledge of the Dutch language; treatment elsewhere.

Prior to program enrollment the child and his/her parents were submitted to a pre-admission screening conducted by a multidisciplinary team consisting of a physician, a psychologist and a social worker. All patients or their legal representatives (if < 18 years old) signed informed consent. All patients admitted to the program were included in this study. Data from 70 consecutive patients were collected.

### *Procedures*

The program was carried out during a three-month inpatient stay in the rehabilitation center. The

children spent all weekends at home with exception of the first. The program was carried out under supervision of a physiatrist and included physical training (directed by a physiotherapist), graded activity (occupational therapist), psychological counseling for the child (psychologist) and counseling for the parents (social worker). During admission the children followed regular education at a school situated next to the rehabilitation center. The general aim of the program is to improve the patient's daily functioning on the level of activities and participation of the International Classification of Functioning (ICF) [19]. More detailed aims of the program are: participation in all activities of daily life appropriate to the child's age and developmental stage; understanding of the process of development of chronic pain by the child as well as parents; control over the pain; reduction of medical consumption.

Each child was required to set realistic individual treatment goals at the beginning of the program. Subsequently, these goals were broken down into weekly goals and the child was expected to reach these goals regardless of pain. The program is a cognitive-behaviorally oriented activity program based on operant therapy; positive behavior is stimulated and reinforced and negative behavior is ignored [20]. Physiotherapists and occupational therapists treated the patient daily, both individually and in groups. The treatment activities and goals for these professionals concern physical activities depending on the individual goals of the child. The psychologist had weekly sessions with the child. These sessions were directed at gaining understanding into self-perpetuating pain circles and pain processes. The parents had two-weekly sessions with the social worker to reinforce the continuation of the process of change in the home situation, and to inform the parents about the way to treat their child to help him/her reach his/her goals. For the weekends the parents and child were given home-tasks that were evaluated after the weekend. The parents needed to change their interactions with the pain behavior of their child. At the end of the three months inpatient rehabilitation program, the children were discharged and they returned to home and school. If necessary, follow-up treatment or counseling by psychologist or social worker was provided. Three months after discharge the child and parents were seen in a follow-up by the same multidisciplinary team they met at pre-admission. Guiding principles of the multidisciplinary pain management program are described in Appendix 1.

### *Measures*

The physiatrist assessed *demographic data, localization of the pain* and *medical history* in a structured

interview at pre-admission and *psychosocial problems* were assessed in a structured interview by the psychologist and social worker at pre-admission.

*Pain complaints in other members of the family.* These were assessed at pre-admission by the physiatrist by verbally asking the parents about own pain and pain of brothers and sisters of the patient.

*Motor performances and participation.* These were assessed in a structured interview by the physiatrist at admission, discharge and follow-up. The motor performances were grouped into four levels with increasing complexity and intensity; subsequently sitting, walking, cycling and sports. Children were classified according to their lowest level of self reported functioning. Self reported limitations in activities of daily living (washing, clothing) and social activities (school visit and social contacts with peers) were also assessed in this structured interview.

*Pain intensity.* Pain intensity (maximum, minimum and mean during last week) was assessed using a VAS-score at pre-admission, admission, discharge and follow-up. Measuring chronic pain with VAS-scores is an accepted method in children above the age of six years [8,21–23].

*Global assessment of the patient's situation.* Scored by the patient (global assessment patient, GAP) and by the physician (global assessment doctor, GAD), this was also measured using a VAS. This global assessment score is advocated in a report in the evaluation of juvenile chronic arthritis (JCA) and has been shown to be responsive in JCA-patients [24,25]. The global assessment includes physical functioning and psychosocial well being. For all patients, one physician administered the VAS-scores. This physician was involved in the program. Neither the patient nor the physician had insight in the VAS-scores of previous assessments.

*Understanding the pain processes (bio-psychosocial model).* This was assessed by a subjective observation made by the psychologist and the physician. If a patient could recognize this explanation model of chronic pain and subsequently change the process, this was seen as a positive transition.

*Medical consumption.* The use of medication and the use of assistive devices were assessed at admission, discharge and at follow-up.

#### Statistical analysis

Descriptive statistics were used to describe the patient characteristics and the outcome measures at

different stages of the program. Differences between outcome measures before the start of the program and at the end were analyzed using the paired Student's *t*-test. For the statistical analysis the SPSS package was used;  $p < 0.05$  was considered significant.

## Results

The demographic data of the patients are presented in Table I. Out of a total of 70 children and adolescents who attended the program, 57 attended the follow-up meeting (81%).

Figure 1 shows the localization of the pain in the study sample. A total of 23 children (33%) were referred with the diagnosis Complex Regional Pain Syndrome (CRPS I). At the time of pre-admission to the program, however, CRPS-I was present in only 2 patients (3%). All other children (97%) were diagnosed with chronic musculoskeletal pain.

The medical history of the patients is presented in Table II. All patients had sought medical help prior to pre-admission. Most frequently consulted specialists were orthopaedic surgeon, neurologist and a different physiatrist. Diagnostic procedures were performed in all cases of which 27% invasive. Immobilization had been prescribed in 59 patients (84%), either by taking bed rest or by means of an orthosis, cast or corset. Some 24 children (34%) used crutches to assist in locomotion, 2 children (3%) used a wheelchair; 10 children (14%) used crutches as well as a wheelchair; 59 children (84%) used pain-medication (acetaminophen and/or NSAID).

Psychosocial problems encountered in these children and their families were categorized. A total of 37 children (53%) reported problems at school, such as social exclusion; 62 children (89%) encountered problems within the family, such as poor communication or high-perceived demands for the child.

Table I. Characteristics of children and adolescents with chronic musculoskeletal pain at pre-admission for a multidisciplinary pain management program ( $n = 70$ ).

Characteristic	Descriptive statistics
Age at pre-admission (years) [mean (SD)]	15.1 (2.6)
Duration of pain (months) [mean (SD)]	19.0 (13.9)
Sickness during last school semester (months) [mean (SD)]	3.7 (3.4)
Sex female [% ( <i>n</i> )]	91 (64)
Family-situation: Broken home [% ( <i>n</i> )]	16 (12)
Number of siblings [% ( <i>n</i> )]	2.5 (1–6)
Primary school [% ( <i>n</i> )]	9 (6)
Secondary school [% ( <i>n</i> )]	85 (60)
No school [% ( <i>n</i> )]	6 (4)

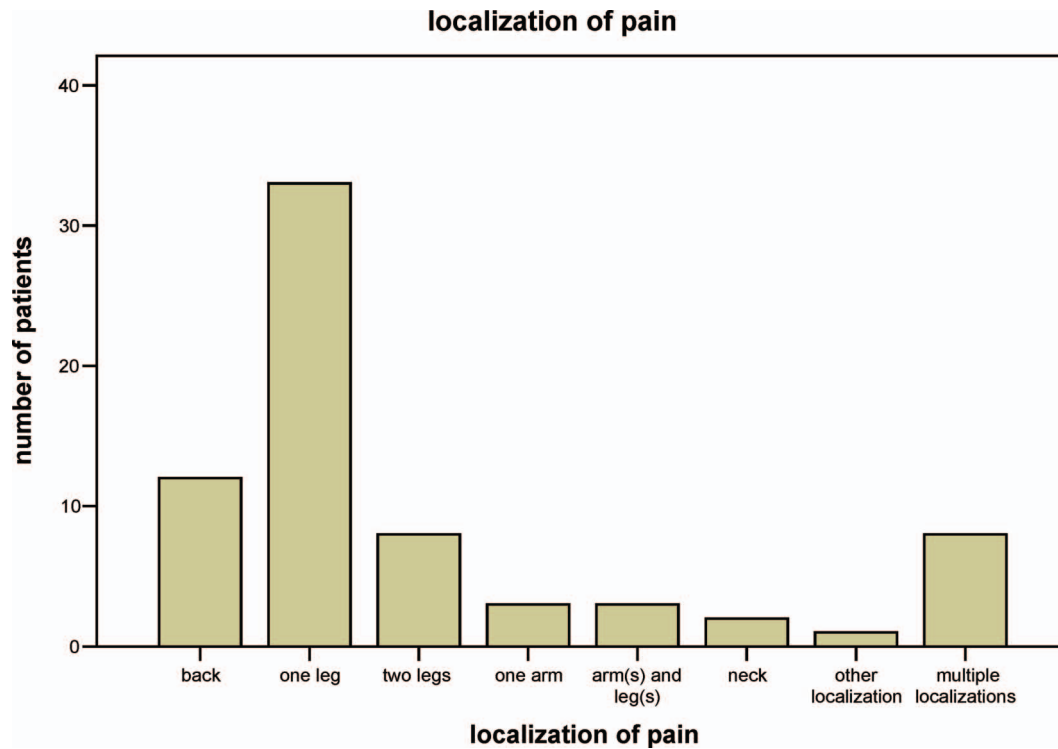


Figure 1. Localization of pain in children and adolescents with chronic musculoskeletal pain admitted for multidisciplinary pain management program ( $n = 70$ ).

Table II. Medical history of children and adolescents with chronic musculoskeletal pain admitted for treatment in an inpatient pain management program ( $n = 70$ ).

Medical history	Descriptive statistics
Number of different medical specialists consulted [mean (range)]	4.8 (2–15)
Lab and X-rays [%]	97
Invasive diagnostic procedures [%]	27
Physiotherapy [%]	96
Immobilization [%]	84
Crutches [%]	49
Wheelchair [%]	17
Surgery [%]	16
Acetaminophen [%]	49
NSAID [%]	37

Seven children (10%) reported traumatic sexual experiences. Combinations of these problems were also present.

Pain by other members of the family was frequently reported. In the records of 52 children (74%) a specific note regarding pain complaints by other members of the family were found. In 17 of these 52 records (33%) a positive history of pain was present regarding the parents, in 6 families (12%) pain with regard to another child and in 9 families (17%) pain was experienced by both (one of) the

parents and another child. Twenty families (38%) of these 52 subjects reported no pain complaints made by other family members. Thirty-one children (44%) could recall a specific incident or moment that marked the start of their pain. Examples of such events were a car accident, a fall or pulled muscles.

In Table III (differences in) motor performances and participation are presented. An improvement in motor performances was achieved by 64 children (94%). Except for 4 children who showed no improvement in motor performances, all other children improved to a class of less motor limitations or to no motor limitations. Most children started to attend participation in sports and all children returned to a regular school program. At completion of the study two children were still in the program.

Analyses of the pain and global assessment scores are presented in Table IV. These scores were assessed in the last 42 patients only. From pre-admission to admission there is a significant improvement in both GAD and GAP. There is a significant improvement in all scores between admission and discharge. This improvement lasted to the time of the follow-up. Differences between the VAS scores at discharge and at follow-up were non-significant. Of the last 34 patients, VAS-scores were obtained from all four measurements.

A better understanding of the chronic pain process was seen in 56 children (82%); all of these children

showed an improvement in motor performances as well. In 12 children (18%), there was no improvement in understanding of the pain process at discharge or follow-up. Psychosocial counseling as a follow-up treatment was chosen by 17 families. The use of pain medication was reduced in all patients to the level where no pain medication was subscribed by the rehabilitation staff. The use of assistive devices is presented in Table V.

**Discussion**

The results of this study indicate that a multi-disciplinary pain management program for children and adolescents with chronic musculoskeletal pain

may be effective. After completion of the program, the overall level of functioning had improved, as demonstrated by assessments of motor activities, activities of daily living and global assessment by the physician and the patients. Motor performances had improved significantly. The majority of the participants had taken up physical activities, either in a gym or other sport facilities. All patients who attended a regular school beforehand returned to their school program. Although pain reduction was not the primary goal of treatment there was a significant decrease in pain scores. A better understanding of the chronic pain process was seen in the majority of the children (82%). The use of assistive devices and analgesic drugs was minimized. All improvements

Table III. Limitations in motor performances, activities of daily life (ADL) and social activities (school and social level) at admission, discharge and follow-up in a multidisciplinary pain management program for children and adolescents with chronic musculoskeletal pain (n = 70 – 57).

Number of patients	Admission (n = 70)	Discharge (n = 68)	Follow-up (n = 57)	Discharge versus Admission*	Follow-up versus Admission*
<i>Limitations in motor activities</i>					
Limitations reported (total)	68	26	21	<0.001	<0.001
• Limitations in sports	10	12	12		
• Limitations in bicycling	4	2	1		
• Limitations in walking	33	9	5		
• Limitations in standing/sitting	21	3	3		
No limitations reported	2	42	36	<0.001	<0.001
<i>Limitations in ADL</i>	12	0	1	<0.001	<0.001
<i>Limitations in social activities</i>	65	17	10	<0.001	<0.001

\*p value Chi square; ADL, activities of daily living.

Table IV. Mean (SD) pain and global assessment scores from pre-admission to follow-up in children and adolescents with chronic musculoskeletal pain admitted for an inpatient multidisciplinary pain management program.

	Pre-admission (n = 42)	Admission (n = 40)	Discharge (n = 40)	Follow-up (n = 34)	Discharge versus Admission*	Follow-up versus Admission*
Pain minimum	30.3 (19)	35.6 (20)	23.5 (22)	17.1 (16)	<0.008	<0.001
Pain maximum	77.6 (17)	80.9 (14)	61.3 (31)	60.7 (29)	<0.001	<0.001
Pain mean	57.4 (15)	58.9 (17)	39.8 (23)	35.6 (21)	<0.001	<0.001
GAP	61.5 (20)	52.7 (23)	32.2 (25)	24.7 (21)	<0.001	<0.001
GAD	65.6 (13)	54.5 (21)	28.3 (22)	25.6 (19)	<0.001	<0.001

GAP, Global Assessment Patient; GAD, Global Assessment Doctor; \*p-values.

Table V. Use of assistive devices at admission, discharge and follow-up in children and adolescents with chronic musculoskeletal pain, treated in an inpatient multidisciplinary pain management program.

	Admission (n = 70)	Discharge (n = 68)	Follow-up (n = 58)	Discharge versus Admission*	Follow-up versus Admission*
Crutches	34	6	3	<0.001	<0.001
Wheelchair	12	2	2	<0.001	<0.001

\*p value Chi square.

lasted three months. Whether the effects of the program lasted beyond the follow-up is unknown.

The beneficial effects of the pain management programs in children and adolescents are relevant and are also reported by others. These effects are relevant because the outcome without intervention appears to be poor. In a study with a 9-year follow-up in children with chronic musculoskeletal pain a poor outcome was found, especially in children with generalized pain [26]. Other studies showed beneficial effect of therapy programs for children with chronic pain, for example a study in children with chronic pain patients, diagnosed as fibromyalgia. An active exercise program seemed to correlate with better outcomes [27–30]. Clinical evidence was found suggesting that cognitive behavioral therapy programs have a positive effect on pediatric pain, however controlled studies are needed [31]. This was also stressed in a systematic review of randomized controlled trials of psychological therapy for chronic pain in children and adolescents. Most trials reported interventions for children with headache. We lack sufficient evidence to judge the effectiveness of psychological therapies in improving mood, function, or disability associated with chronic pain in children and adolescents [32].

Only a very few studies have been performed to investigate the results of multidisciplinary treatment in children and adolescents with chronic musculoskeletal pain. This preliminary study indicates that the results of a multidisciplinary pain management program may be positive. However, this study has a number of limitations. It is recommended that future studies use prospective designs, a control group, and validated outcome measures that include objective performance based measures as well. Assessors should be blinded and independent, and follow-up measurements should last longer than 3 months. Also more study is needed to develop standardized assessment and treatment for children and to establish the results of these multidisciplinary pain management programs as clinically effective and cost-effective approaches [33,34].

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### Appendix 1. Contents of the multidisciplinary pain management program for children and adolescents

The pain management program can be divided into five phases [20]:

1. Starting phase (week 1):  
Aims are: Set treatment goals (as outlined below), set base-level and set start-treatment-level (mean base-level minus 20%)
2. Treatment phase (week 2–8):  
Used techniques in this phase are: Positive reinforcements, extinction of pain behaviour, time contingency, verbal instruction, modelling and imitation, prompting, shaping and feedback on the progression of the rehabilitation process (physiatrist with patient, weekly)
3. Generalization phase (week 8–12):  
The aim is that the child learns to incorporate the learned principles and activities in daily (home) situation
4. Discharge phase (week 10–12):  
In this phase the aim is that the child becomes more and more independent of the professionals
5. Follow-up phase:  
Three months after ending treatment the child is seen by the members of the team. Main aim of the follow-up is to prevent relapse.

In the starting phase of the program, treatment goals are set by each child individually (supported by the team). They can be, for example [14]:

1. To improve the management of the pain and related problems
2. To improve the level of physical functioning
3. To reduce the use of pain medication
4. To become less dependent upon the health-care system
5. To reduce the use of the health-care system
6. To reduce the level of depressive/anxiety symptoms
7. To improve the level of self-confidence and self-efficacy
8. To reduce fear and avoidance of activity that may be painful
9. To return to useful and gainful activities.

Interdisciplinary treatment takes place when every professional cooperate with the other members of the team to achieve shared treatment goals. The techniques are adapted to and aimed at the specific problems of the child and can be, for example [14]:

Physiotherapy and occupational therapy:

- a. Overcome the effects of physical deconditioning (aerobic conditioning, strengthening and endurance exercises, hydrotherapy etc.),
- b. Challenge and reduce fears of engaging in physical activity,
- c. Reduce physical impairment and capitalise on recoverable function,
- d. Safe and graded approach to re-engagement in physical activity,
- e. Increasing functional capacity (lifting and handling exercises, ergonomics, etc.).

Psychology:

- a. Defusing anger, hostility and resentment,
- b. Introducing a biopsychosocial model of pain management,
- c. Relaxation techniques,
- d. To improve the coping with pain (stress, psychosocial arousal),
- e. To improve cognitions,
- f. Problem-solving to enable to use effective coping strategies to deal with problems,
- g. To improve assertiveness and communication.

Social work:

Family members' (parents') behaviour is likely to influence the pain behaviour and coping of the child. The family members need to have an understanding of the rehabilitation approach. The social worker explains the content of the treatment and gives advice on how to

cope with the chronic pain problem of the child and its consequences for daily life.

**Nursing and school staff:**

The nursing staff has a role in observing the child in the rehabilitation centre. School staff has a role in observing the child and in time-contingent progressing of school-activities.

**Physiatrist:**

The physiatrist consults with the child weekly and monitors the progression of the rehabilitation process as a whole. He/she pays also attention to the reduction of pain medication.