Multidisciplinary Treatment for Adolescents with Chronic Pain and/or Fatigue

ORIGINAL ARTICLE

Multidisciplinary Treatment for Adolescents with Chronic Pain and/or Fatigue: Who Will Benefit?

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■ **Abstract**

Purpose: The aims of this study were, first, to determine the percentage of adolescents with chronic pain/fatigue successfully treated with rehabilitation treatment for chronic pain/fatigue and, second, to identify predictors for a successful rehabilitation treatment.

Methods: Treatment success is scored based on a combination of predefined clinically relevant changes in 4 outcome measures: level of pain/fatigue, school absence, physical functioning, and psychosocial functioning. A forward stepwise logistic regression analysis with treatment success as a dependent variable is performed to identify predictors for successful treatment.

Results: A total of 172 adolescents (mean age 16.2 [SD = 2.5]; 85.5% girls) participated. Almost half (49.6%) of the adolescents had a successful treatment. The explained variance for the complete model explaining treatment success was 49% (R^2 = 0.487). Patients with a higher level of pain/fatigue and a passive coping style pretreatment improved most, and these factors could thus be indicated as predictors for successful treatment. Also, gender significantly contributed to the prediction, in favor of boys.

Conclusions: Regarding the first aim, using predefined treatment success based on clinically relevant changes, half of the participants had a successful treatment. Concerning the second aim, adolescents with a high level of pain/fatigue and those with a high passive coping style pretreatment have a better ability to change their functioning during treatment. Boys benefit more than girls. ■

Key Words: rehabilitation, musculoskeletal diseases, multidisciplinary pain centers, pain assessment

INTRODUCTION

Chronic pain and fatigue are both common complaints in childhood and adolescence. Prevalence rates vary from 4% to 40% for chronic pain and from 2% to 21% for chronic fatigue.[1–4]

Chronic pain and fatigue both have a considerable impact on the child's or adolescent's life, especially in

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important domains of functioning, such as school attendance, sports, and leisure time activities.[5,6] Various treatment modalities have been used for this group of patients to improve functioning, frequently involving cognitive behavioral treatment elements.[7–10] In the Netherlands, adolescents with a high level of disability due to chronic musculoskeletal pain or chronic fatigue are often treated in an inpatient rehabilitation setting. Adolescents, with pain and/or fatigue as their main diagnosis, receive the same treatment, whereas they both have to deal with negative symptoms (pain or fatigue) having a negative impact on their daily living and social participation. The main aim of this treatment is to increase the adolescents' level of activity and participation, despite pain or fatigue.[11]

However, it is currently unknown whether and to which extent rehabilitation treatment for adolescents with chronic pain/fatigue has the potency to result in a clinically relevant improvement in the area of activity and social participation.[12]

The results of a number of clinical studies using a pre- and post-design showed that multidisciplinary treatment resulted in an increase in physical and psychosocial functioning and a decrease in restrictions in daily life. An increase in school attendance was also reported.[13–15] However, due to this treatment's design, it is uncertain whether the changes can be ascribed solely to the treatment. Furthermore, studies into this design reveal no information on the number of patients with clinically relevant improvement in functioning.

In 2009, Hechler et al.[16] presented an alternative method that facilitates the interpretation of the individual treatment success of an inpatient pain program for children and adolescents with chronic pain. This method is based on the identification of statistically and clinically relevant changes of pain-related variables and school absence, and defines overall amelioration of the effectiveness of treatment. In this study population, 55% ($n = 77$) of the adolescents demonstrated overall amelioration.[16]

Defining the success of treatment at the individual level also enables the identification of predictors for successful treatment. This would allow the future selection of patients to be refined to those who are likely to benefit from treatment. Currently, no predictors for inpatient treatment success in adolescents with chronic musculoskeletal pain or fatigue are available in the literature.

A review of predictors for treatment outcome for adult patients with chronic low back pain showed consistent evidence for the finding that more pain (pain intensity) negatively affects outcome and, in addition, that a high level of satisfaction (work-related factor) and less active coping lead to a better outcome.[17] Paananen et al.[18] identified the following predictors for the persistence of multiple pains in female adolescents with chronic musculoskeletal pain: internalizing problems, short sleeping time, high physical activity level, and smoking. In addition, Hoftun et al.[19] showed a positive association between parental chronic pain and chronic nonspecific pain in adolescents and young adults.

Taking everything into consideration, our primary study aim is to identify the percentage of adolescents with chronic pain/fatigue successfully treated in a rehabilitation setting. Our second aim is to identify predictors for a successful rehabilitation treatment for adolescents with chronic musculoskeletal pain or chronic fatigue.

Based on currently available literature, we hypothesize that a higher pain/fatigue intensity pretreatment, lower active coping, and parental chronic pain are negative predictors for treatment success.

METHODS

Design and Population

This prospective cohort study included adolescents in the age range from 10 to 20 years who received an inpatient rehabilitation treatment for severe chronic musculoskeletal pain or chronic fatigue during the period between 2001 and 2005. All patients consulted a rehabilitation physician and were offered an inpatient treatment in case of:

1. moderate to severe disability in daily activities, leisure and sport, or social activities;
2. perceived chronic musculoskeletal pain or fatigue;
3. being absent from school for more than 20% over the past 3 months;
4. the presence of psychological and/or social factors associated with the persistence of the chronic pain/fatigue;
5. the patient being motivated to participate in treatment; and
6. participation of parents during the treatment.

Treatment

The inpatient rehabilitation treatment as provided for adolescents with pain/fatigue was based on cognitive

behavioral treatment principles, including elements such as modules of physical training, graded activity, cognitive behavioral therapy, relaxation, and education for the adolescent combined with training/education for parents. Most of the modules are given individually, whereas the relaxation and education modules were given in groups. During treatment, the weekend leaves were progressively extended to facilitate school reintegration. The outline of the treatment was comparable in all participating centers.[20] Patients were treated in 5 rehabilitation centers in the Netherlands. The average duration of the treatment program was 14.6 weeks (SD = 9.5; range 0.6 to 50.3).

Procedure of Assessment

Patients entered the study consecutively. Before the start and directly after the end of the clinical treatment, the adolescent and one of the parents filled out a booklet with several questionnaires. The questionnaires were part of the clinical assessment and treatment procedure. In addition, the rehabilitation physician assessed demographic data, including gender, age, living situation, life events, education level, and school absence, by filling out a registration form before treatment. School absence was again registered by the physician at the end of treatment on a registration form. In the first week of treatment, a psychological screening assessment was performed for diagnostic purposes. The procedure of assessment was the same in all participating centers.

Outcome Measures

Primary Outcome Measure: Outcome Rehabilitation Treatment. The primary outcome measure is treatment success. The score for treatment success is based on a combination score of the result of 4 outcome measures: (1) level of pain/fatigue, (2) school absence, (3) physical functioning, and (4) psychosocial functioning.

According to the method of Hechler et al.,[16] overall treatment success was defined as clinically relevant changes in at least 2 out of 4 outcome measures combined with no deterioration of the post-treatment score compared to the pretreatment score for the other measures. Additionally, our rationale for the definition is explained into the aim of rehabilitation treatment to increase the adolescents' level of activity and participation, despite pain or fatigue. Therefore, the focus of treatment success is on these concepts of activity and participation. All outcome measures, including definitions of clinically relevant changes, are described below.

Pain/Fatigue. *Outcome measure* – The intensity of either pain or fatigue, depending on the type of diagnoses/complaints, was measured before and after treatment with a visual analog scale (VAS). The patient was asked to indicate on a horizontal line of 100 mm the average level of pain/fatigue over the previous 2 weeks. The line covered the range from "no pain at all" (0) to "worst possible pain" (100).

Clinically relevant change – Ostelo and de Vet[21] identified the minimal clinically important change (MCIC) for pain on a VAS scale as 20 mm for chronic low back pain. Lee et al.[22] showed that a reduction on a VAS scale of 30 mm corresponds with adequate pain control and is therefore the minimal clinically important difference (MCID). Pouchot et al.[23] showed an MCID for normalized fatigue numeric rating scale (NRS) score of 19.7 in rheumatoid arthritis (RA) patients. Furthermore, Wolfe[24] indicated that the use of a single-item VAS for fatigue is sensitive to change and suitable for use in clinical care in RA patients compared to longer fatigue questionnaires. For the current study, we defined a decrease of 30 mm on the VAS scale for pain/fatigue as a clinically relevant change.

School Absence. *Outcome measure* – Based on information of the adolescent and/or his/her parents, the physician scored the level of school absence in 1 of 3 categories: (1) normed school attendance, (2) partial absence, and (3) complete absence from school. This was done before the start of treatment and at the end of treatment.

Clinically relevant change – Each of the following improvements in school attendance was defined to be a clinically relevant change: from complete absence to partial absence, from complete absence to normed school attendance, and from partial absence to normed school attendance.

Physical and Psychosocial Functioning. *Outcome measure* – Physical and psychosocial functioning was measured by the Child Health Questionnaire – Parent Form (CHQ-PF50). The parent who filled out the questionnaires before treatment was again invited to fill out the questionnaires after treatment. For the CHQ-PF50, "Physical" (PhS) and "Psychosocial" (PsS)

summary scores were calculated. The mean normed score in general populations is 50 (SD ± 10),[25] which applies cross-culturally. According to the method of Landgraf et al.,[25] PhS and PsS summary scale scores are calculated by aggregating and transforming the 11 multi-item scale scores using a linear T-score transformation method. We used both the PhS and PsS CHQ-PF50 summary score for data analysis in this study.

Clinically relevant change in physical functioning – Based on the method of Jacobson and Truax,[26] a cutoff score for clinically significant change was determined for the summary scale of PhS CHQ-PF50 according to the following formula: $c = \frac{s0M1+s1M0}{s_0+s_1}$. In this formula, M_0 is the mean score, s_0 is the standard deviation of the pretest, M_1 is the mean score of a normed population, and s_1 is its standard deviation. The mean score for the pretest physical scale was 19.7 (SD = 10.1) and the mean score of the normed population is 56.4 (SD = 5.7),[27] resulting in a calculated cutoff point score of 43.2. Hence, a PhS score after treatment higher than this cutoff point was defined as a clinically relevant change.

Clinically relevant change in psychosocial functioning – The calculated cutoff point for the psychosocial scale is determined in a similar fashion to the method described for physical functioning. Based on the mean score for the pretest psychosocial scale of 42.4 (SD = 9.6) and for the normed population of 53.2 (SD = 6.4),[27] this results in a calculated cutoff point for the psychosocial scale of 48.9. Hence, a PsS score after treatment higher than 48.9 was defined as a clinically relevant change.

Table 1 provides details on the 4 outcome measures included to define treatment success.

Table 1. Definition of Clinical Relevant Change for Each of the Four Outcome Variables and Successful Treatment

Outcome Variable	Definition Clinically Relevant Change
Pain/fatigue	Decrease of 30 mm on the VAS
School absence	Change from complete to partial absence or normed school presence OR change from partial absence to normed school presence (expert opinion)
Physical summary scale (CHQ-PF50)	A higher score than the calculated cutoff score (43.2) on the summary scale of PhS CHQ-PF50
Psychosocial summary scale (CHQ-PF50)	A higher score than the calculated cutoff score (48.9) on the summary scale of PsS CHQ-PF50
Successful treatment	A clinically relevant change on at least 2 out of 4 outcome measures and no deterioration on the other measures between pre- and post-treatment has to be seen

VAS, visual analog scale; CHQ-PF50, Child Health Questionnaire – Parent Form; PhS, physical functioning; PsS, psychosocial functioning.

Potential Predictors or Confounders

Because of the limited availability of literature about predictors for treatment success in adolescents, consultations were held with 5 clinical experts (rehabilitation physicians and psychologists) with at least 5 years of experience in the field of rehabilitation of adolescents with chronic musculoskeletal pain or chronic fatigue. These experts identified the following potential predictors: duration of complaints, presence of life events, anxiety, and problems with peers.

In the clinical test battery, which included the questionnaire and psychological screening, the following outcome measures were available: pain or fatigue severity assessed based on a VAS, duration of complaints, family member with pain/fatigue history, Utrecht Coping List (UCL)[28] for coping style, Youth Self-Report (YSR)[29,30] for competence, emotional, and behavioral problems, Achievement Motivation Test (PMT)[31] for personality traits regarding attitude to school, and Personality Questionnaire for Youth (NPV-J)[32] for personality traits.

Based on the literature search, the expert opinion, and availability in the database, potential predictors were identified and used to build a predictive model for clinically relevant improvement of inpatient pain rehabilitation. Besides the potential predictors, we indicated age and gender as potential confounders in the prediction model. These potential confounders can affect both treatment success and the potential predictors.

To describe a person's individual level of functioning in the rehabilitation setting, the International Classification of Functioning, Disability and Health (ICF) is often used.[12] For the eventual prediction model, we therefore used the ICF model as a framework to assign potential predictors to a category within the ICF model and entered each ICF category separately in the analysis. The potential confounders of age and gender were first added in the analysis, before entering the following ICF blocks with potential predictors:

ICF block "body functions and structures"

- Pain or fatigue severity pretreatment (VAS 0 to 100)
- Duration of complaint pretreatment (in months)

ICF block "environmental factors"

- Family member with pain/fatigue history (present/not present)

ICF block "personal factors"

- Presence of life events (presence of life events related to one's family [divorce, death, removal], to school [to repeat a class, bullying, difficulties with social relations], or other, present/not present)
- Avoidance (run its course or out of the way) as coping style (UCL; range: 8 to 32 points)[28]
- Passive reaction (not able to do anything about the situation, mulling over the past; a higher score for passive coping reaction means a more negative sight on life-related topics) as coping style (UCL; range: 7 to 28)[28]
- Internalization (depressive, anxious, bodily complaints) (Dutch YSR; range: 0 to 52 points)[29,30]
- Positive anxiety (fear that brings someone in an optimal stress state, in which functioning is better than in normed circumstances) (Dutch PMT; range: 0 to 18). The scores for Children-PMT (PMT-K) and Adolescent-PMT (PMT) were standardized.[31]
- Negative anxiety (fear that leads to dysfunction) (PMT; range: 0 to 26). The scores for Children-PMT (PMT-K) and Adolescent-PMT (PMT) were standardized.[31]
- Social inadequacy representing problems with peers (Dutch NPV-J; range: 0 to 26 points)[32]

Statistical Analyses

To gain insight into the research population, descriptive analyses were performed. To answer the first research question, the number of significant changes and clinically relevant changes of the outcome measures between pre- and post-treatment was computed.

Statistical Significance. To determine whether the changes pre- and post-treatment for the 4 outcome measures of pain/fatigue severity, school absence, physical functioning, and psychosocial functioning were statistically significant, paired sample *t*-tests were performed for the continuous variables that were normally distributed, and the Wilcoxon matched-pair signed rank test was used for non-normal distributed and categorical variables. The level of significance was set at $P < 0.05$.

Clinically Relevant Change. On the basis of the above-mentioned criteria, the pre- and post-treatment changes for the 4 outcome measures were assessed for clinical relevance. For each of the 4 outcome measures, the percentage of the study population showing a clinically relevant change was calculated separately. To define treatment success, the percentage of amelioration and deterioration of each outcome measure were computed.

Prediction. A forward stepwise logistic regression analysis was performed with treatment success as a dependent variable. In the first step, the potential confounders' ages and genders were introduced in the model. In the following steps, the ICF blocks were individually entered in the model. For the regression analysis, standardized beta coefficients and their significance were tested under the null hypothesis that the coefficients differ from 0. To check for colinearity, variable inflation factors (VIFs) were checked and had to be below 10.[33] Outliers, if any, with a Cook distance above 1 were removed from the model.[34] All statistical analyses were performed using SPSS (software version 20.0) (SPSS Inc., Chicago, IL, U.S.A.).

RESULTS

Population

A total of 172 adolescents (mean age 16.2 years [SD = 2.5]; 85.5% girls) participated. In total, 90.5% of the patients were mandatory school attenders, and of these, 38.9% were in high school. In total, 86.9% lived in a 2-parent family. Almost one-third (29.5%) had a family member with pain/fatigue complaints. The use of medication for chronic pain/fatigue before treatment was 35.2%, and 28.3% used aids, mostly for walking (eg, a wheelchair, walker, or walking stick). Table 2 presents a detailed description of the different types of diagnoses/complaints.

Significant Change

Statistically significant differences ($P < 0.001$) between pre- and post-treatment were found for all 4 outcome

Table 2. The Distribution of the Variety in Complaints in the Research Population in Number and Percentage

Description of Complaints	Number (%)
Nonspecific neck complaints	13 (7.6)
Nonspecific back complaints	20 (11.6)
Fibromyalgia	8 (4.7)
Complex regional pain syndrome	22 (12.8)
Chronic fatigue syndrome	76 (44.2)
Other nonspecific musculoskeletal complaints (whole body)	33 (19.2)

variables: level of pain/fatigue, school absence, physical functioning, and psychosocial functioning. Table 3 presents changes and 95% confidence intervals for the outcome variables.

Clinically Relevant Change and Successful Rehabilitation Treatment

Table 3 presents for each outcome variable the pre- and post-treatment scores and the number of participants who showed a clinically relevant improvement according to the definition. Therefore, based on our criteria, 49.6% of the participants achieved a successful treatment.

Predictors for Successful Treatment

A forward stepwise logistic regression analysis was performed for the dependent variable successful treatment. No colinearity (VIF > 10) was found, and no outliers could be identified.

The explained variance for the complete model was 49% ($R^2 = 0.487$), indicating that the relation between the dependent variable and independent variables is moderate. In Table 4, the change in explained variance per block of variables into the analysis is presented. The level of pain/fatigue (β [SE] = 0.85 [0.41]; $P = 0.037$) and a passive coping reaction (β [SE] = 0.37 [0.17]; $P = 0.032$) pretreatment appeared to be predictors for a successful treatment. This means that the chance of a successful treatment outcome increases by 0.85 with every mm higher on the VAS scale for the level of pain/fatigue and by 0.37 with every point higher on the passive coping scale. Also gender significantly contributed to the prediction (β [SE] = −3.99 [1.62]; $P = 0.013$). This variable was defined beforehand as a confounder. The chance of a successful treatment outcome for boys is 4 times higher than for girls. A complete overview of the results is shown in Table 5.

DISCUSSION

This study assessed the percentage of treatment success among adolescents who underwent inpatient rehabilitation treatment for chronic musculoskeletal pain or chronic fatigue associated with severe disability and was aimed at gaining insight into predictors for this success.

Our results show that, following the defined description of a successful treatment, almost half of the participants (49.5%) were successfully treated for their chronic musculoskeletal pain or chronic fatigue complaints. The level of pretreatment pain/fatigue and passive coping reaction predicted this treatment success. Higher levels of pain/fatigue and a passive coping style pretreatment increased the chance for a successful treatment outcome. Furthermore, gender was found to be an important confounder, meaning that boys had a higher chance of treatment success.

In our study, the definition of a successful rehabilitation treatment is based on statistically significant as well as predefined clinically relevant changes for at least 2 of 4 outcome measures and without deterioration in any of these 4 measures. We believe we described our method to define treatment success thoroughly and were strict in our criteria. Despite these rather strong and strict criteria, still around 50% of the patients were treated successfully.

The finding that pre- and post-treatment outcomes differed significantly is in line with findings in other studies on multidisciplinary treatment for children and adolescents with chronic pain showing positive changes

Table 3. Pre- and Post-Treatment Scores for the Four Outcome Variables When Available Within the Study Sample (*N* = 172)

Outcome Variable	Pretreatment Score (SD)	Post-Treatment Score (SD)	Difference Between Pre-/Post-Treatment [Confidence Interval]	Number of Patients with a Clinically Relevant Improvement (%)
Pain/fatigue (on 0 to 100 mm VAS)	67.8 (19.9)	31.1 (24.2)	−36.7 [−42.0 to −31.4]*	77 (61.6)
School absence				70 (54.7)
Normed attendance	16.9%	43.6%	26.7%*	
Partial absence	45.9%	34.9%	−11.0%	
Complete absence	30.8%	1.2%	−29.6%	
Physical functioning (CHQ-PF50)†	19.2 (10.4)	39.7 (14.3)	20.5 [17.7 to 23.2]*	56 (51.4)
Psychosocial functioning (CHQ-PF50)†	42.1 (9.7)	50.2 (8.6)	8.1 [6.2 to 10.2]*	71 (65.1)
Successful treatment	—	—		68 (49.6)

*$P < 0.001$ for differences between pre- and post-treatment.
†The mean population scores for the physical and psychosocial functioning scale of the CHQ-PF50 are 50.
VAS, visual analog scale; CHQ-PF50, Child Health Questionnaire – Parent Form.

Table 4. The Explained Variance, R^2, Change in R^2, and the Increase of the Explained Variance per Added Block in the Forward Stepwise Logistic Regression Analysis

Added Blocks into Forward Stepwise Logistic Regression	Explained Variance	Nagelkerke R^2	Change in Nagelkerke R^2 (After Adding the Next Block)	Gradual Increase of Explained Variance
Block confounders:	20%	0.204		
Age				
Gender				
ICF Block "body functions and structures":	35%	0.346	0.142	69.6%
Level of pain/fatigue				
Duration of complaints				
ICF Block "environmental factors":	36%	0.362	0.016	4.6%
Family pain/fatigue history				
ICF Block "personal factors":	49%	0.487	0.125	34.5%
Life events				
Avoidance coping				
Passive coping reaction				
Internalization				
Positive anxiety				
Negative anxiety				
Peer problems				

ICF, International Classification of Functioning, Disability and Health.

Table 5. The Results of the Linear Regression Analysis (Beta and *P*-value) (N = 172) with the Potential Predictor Variable Baseline Scores (Representing the Situation Pretreatment)

Variable	Baseline Score (SD)	Beta (*P*-value)
Age (mean)	16.2 (2.5)	0.306 (0.135)
Gender (% girls)	85.5	−3.991 **(0.013)**
Pain/fatigue pretreatment (VAS 0 to 100 in mm)	68.7 (19.6)	0.851 **(0.037)**
Duration of the complaint pretreatment (months)	36.0 (28.2)	−0.270 (0.415)
Family pain/fatigue history (% present)	29.5%	0.528 (0.455)
Life events (% present)	50.0%	−1.295 (0.095)
Coping style—avoidance (% above average)	30.9%	0.052 (0.656)
Coping style—passive reaction (% above average)	36.5%	0.372 **(0.032)**
Anxiety—internalization (mean)	18.1 (8.9)	−0.092 (0.096)
Anxiety—positive anxiety (mean)	9.3 (4.5)	−0.137 (0.202)
Anxiety—negative anxiety (mean)	14.0 (6.8)	−0.001 (0.988)
Social inadequacy—peer problems (% under average)	38.0%	−0.073 (0.303)

P-values below 0.05 are boldfaced in the table. VAS, visual analog scale.

in disability, level of pain, and anxiety after treatment.[7,13,15] However, it was unclear whether the changes presented in those studies were also clinically relevant. The study of Hechler et al.[16] was the first study that focused on the clinical relevance of changes during treatment by applying clearly defined rules for clinical relevance. Based on our adapted set of rules, we found comparable results: 50% of the patients had a successful treatment, compared to 55% in the Hechler et al.[16] study. The difference in treatment success could be due to a difference in study population. The percentage of boys in the population of Hechler et al.[16] was considerably higher (38% vs. 15%) than in our research sample. This might have caused a higher success rate as boys in our study had a better chance of treatment success. Furthermore, the diagnoses of the study population of Hechler et al.[16] consisted of 63% of adolescents with headache and abdominal pain, whereas these complaints are not treated within the rehabilitation setting in the Netherlands and are therefore not included in our sample. Considering that we used a very strict definition for treatment success and that these patients had already been experiencing complaints during a considerable amount of time (mean: 36 months before treatment), we may conclude that a multidisciplinary rehabilitation treatment of adolescents with severe chronic musculoskeletal pain or fatigue is worthwhile since it positively influences the level of complaints, activity, and participation for a considerable part of this population.

We identified 2 predictors for treatment success: pretreatment level of pain/fatigue and passive coping style. In addition, gender was identified as a confounder. First, the predictive value of pretreatment pain/fatigue can be explained by the fact that a higher level of pain/fatigue offers more possibility to improve during treatment. Our definition of clinically relevant change on the level of pain/fatigue supports this because we defined a specific amount of reduction (30 mm) as clinically relevant instead of a percentage of change.

Regarding the second predictor, the treatment seemed indeed to be more successful for patients with

an originally passive coping reaction, possibly because during treatment these patients were coached to concur and/or restructure their negative thoughts about the impossibility of being physically active because of musculoskeletal pain or severe fatigue. It might be that patients with a higher tendency to cope in a passive way benefit more from this cognitive behavioral treatment.

Third, gender was identified as a confounder. The chance of boys having a successful treatment is much higher than for girls. If we look at the outcome measures of treatment success, there is a remarkable difference between boys and girls in terms of physical functioning; in contrast to the other outcome measures, where no differences between genders were shown. The average PhS score for boys (48.6) is 5 points above the cutoff point for clinically relevant change (43.2), and the average score for girls (38.2) five points below this cutoff point. This difference in physical functioning, with more boys being in the successful treatment group, might explain the higher chance of boys having treatment success. This corresponds with the idea that, during puberty, the focus for boys is more on physical activity and for girls more on social activities.[35]

LIMITATIONS

Our study was performed in a clinical rehabilitation setting in the Netherlands without the presence of a control group. Therefore, it is not possible to correct the results for the natural course of the severity of complaints and perceived disability. However, because of the long duration of complaints pretreatment, the improvement is unlikely to be caused by spontaneous improvement alone. The effectiveness of multidisciplinary treatment is also confirmed based on the recently published randomized controlled trial (RCT) of Hechler et al.[36] Using the same definition as the study of Hechler et al.[16] in 2009, it was shown that intensive multidisciplinary pain treatment is successful in 55% of the participants vs. 14% in the waiting-list control group. Future RCTs are necessary to confirm these positive effects of generalizable multidisciplinary treatment for this population. However, as long as the resources for performing RCTs are limited, clinical studies like ours using clear definitions of successful outcome are the best available alternative. Likewise, the search for predictors of treatment success can also be more developed.

A second limitation in this study is the choice for the potential predictors in the regression analyses. The choice of potential predictors was limited by the availability of the instruments within the clinical database of this cohort. Due to the size of the study sample and the questionnaires available, it was possible to include 12 potential predictors, which offered us the opportunity to test the hypothesized prediction model for treatment success. To test the validity of the model, the model has to be tested on other adolescent populations.

IMPLICATIONS FOR CLINICAL PRACTICE AND RECOMMENDATIONS FOR FUTURE RESEARCH

The predictors as identified might contribute to a better preselection of patients for rehabilitation treatment. The level of pain/fatigue and passive coping style as significant predictors for treatment success needs to be taken into account in this preselection. With this information, the rehabilitation physician can better manage the expectations regarding treatment results.

CONCLUSION

Treatment will be most successful for adolescents with a high level of pain/fatigue and those with a high passive coping reaction before multidisciplinary rehabilitation. Boys will benefit more than girls.

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CONFLICT OF INTERESTS

The authors state that they have no conflict of interest.

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