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Long-term follow-up of patients with chronic musculoskeletal pain attending interdisciplinary pain rehabilitation: outcomes and predictive factors

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The long-term outcomes of interdisciplinary pain rehabilitation (IPR) in patients with chronic musculoskeletal pain (CMP) and its predictors has been studied to a limited extent. In this historical cohort study, functioning, satisfaction with life domains, and pain were assessed at baseline, discharge, and at 6–15 years follow-up. At follow-up, most patients (77%) rated the effects of the IPR as temporarily or persistently positive. The gains in functioning, satisfaction with life domains, and pain made during IPR remained for 6–15 years after the IPR. Patients who were single, retired, or not in work, and those having higher pain and lower functioning at baseline, had lower functioning at follow-up, while patients with traumatic pain disorders had higher functioning at follow-up. Gains made during IPR, particularly gains in social and mental functioning and in pain predicted functioning at follow-up. Treatments and events between discharge and follow-up also influenced the long-term

outcome. In conclusion, on average, outcomes achieved during IPR persisted at long-term follow-up. Predictors of a better long-term outcome were mainly baseline characteristics. *International Journal of Rehabilitation Research* XXX: 000–000 Copyright © 2021 Wolters Kluwer Health, Inc. All rights reserved.

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Keywords: chronic pain, interdisciplinary rehabilitation, long-term outcome, musculoskeletal pain, predictors

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Introduction

The benefits of interdisciplinary pain rehabilitation (IPR) for patients with chronic musculoskeletal pain (CMP), for example, chronic low back pain or fibromyalgia, are well established [1–4]. IPRs primarily focus on functional improvement, although patients also emphasize pain relief as an important treatment outcome [5]. Ideally, the effects of IPR should persist in the long term, and prognosis of long-term success or failure of IPR should be known. However, a limited number of studies is available [6–18], each with limited scope, leading to an inconsistent picture of long-term results and outcome predictors. A robust prediction model could be useful to estimate the long-term effectiveness of IPR in specific patient groups. If patients at risk for poorer long-term outcomes can be identified, treatment could be more accurately individualized, and booster or relapse prevention sessions could be suggested to maintain effects [19].

The primary aim of the present study was to investigate the long-term outcomes of IPR in patients with CMP. The hypothesis was that patients would maintain the gains they achieved during IPR. The secondary aim was to test whether long-term outcomes can be predicted from baseline variables.

Materials and methods

Patients

Patients with CMP who were admitted to the 'Revalidatie Friesland' rehabilitation center between 2003 and 2011, and who had participated in a research project to assess the short-term outcomes of IPR, were included in the study. Inclusion criteria were as follows: age over 18 years and CMP lasting more than 3 months. Exclusion criteria were as follows: inability to understand the questions in Dutch, current major psychiatric disorder at time of referral (e.g. active psychosis, severe depression, alcohol addiction), or unwillingness to provide data for research purposes.

Interdisciplinary pain rehabilitation

Patients with CMP-related disabilities were referred to IPR, after which their eligibility for rehabilitation treatment was assessed by a rehabilitation physician specialized in pain rehabilitation, and for some of the patients together with a psychologist. IPR was based on cognitive behavioral concepts [20]. Individual goal setting was based on the biopsychosocial analysis made by the rehabilitation team and the patients' goals, and mostly included reduction of activity limitations and participation problems. IPR was delivered inpatient or outpatient, individually and group-based. The dosage (duration and

Table 1 Demographic and clinical characteristics of the patients at baseline (T1) and follow-up (T3), and their pain symptoms

	T1 n	T3 N
Characteristics		
Age [years; mean (SD), range]	524 45.7 (12.0), 18–76	524 56.6 (12.0), 29–85
Gender (% male)	524 28	
Marital status (% single)	523 19	524 22
Education level (% high ^a)	520 17	
Occupation (% yes)	524	395
Homemaker	36	40
Employed	51	35
Self-employed	9	17
Student	2	0
Retired	2	9
Working ^b (%yes)	491 48	395 55
Adapted work ^c (%yes)	67	42
On benefit (% yes)	489 50	489 51
Psychological features		
CPQ ^d domain scores (mean, SD)	96	
Active coping	98 (35)	
Helplessness	59 (27)	
SCL-90 ^e total score (mean, SD)	98 178 (47)	
Pain		
Painkiller use (%)	499	509
Once or more a day	46	47
One to six times a week	21	18
Less than once a week	20	25
Never	13	10
Duration of current symptoms at start of the treatment (years) (mean, SD; median, quartiles)	466 5.7, 7.2; 3.0, 1.2–7.5	
Area of pain (%)	477	524
Neck	52	46
Back	80	74
Right arm	56	52
Left arm	52	48
Right leg	57	53
Left leg	57	50
Number of pain areas (median, quartiles)	477 3 (2–5)	524 3 (1–5)
Cause of pain (%)		524
Non-specific		
Widespread pain		23
Back pain		21
Other		24
Traumatic		
Neck pain		4
Other		10
Specific, not progressive		8
Combination of non-specific, traumatic and specific not progressive		9
Specific progressive, or combination of non-specific, traumatic and specific progressive		1

^aHigher vocational education or university.^bIf age not over 65 years.^cIf in work; adjustments like fewer hours, slower pace, working environment adjusted, or different work.^dCoping with Pain Questionnaire, range for active coping 0–144, range for helplessness 0–108.^eSymptom Checklist 90-Revised, range 90–450.

intensity) was determined by the characteristics of the symptoms and the progress made during IPR, that is, care as usual in clinical practice.

Procedure

Measurements were performed between 2003 and 2011 at the start (baseline assessment) and completion (discharge assessment) of IPR. Discharge assessments were performed in the final week or during the first 6 weeks after completion of treatment. The baseline and discharge assessments were part of usual care. The psychological assessment was only available at baseline and of a subset of the patients, whose data were available from a different research project [21]. In 2018, all patients who had a baseline assessment received a letter explaining the current study and were asked to sign the attached informed consent form and to fill out the follow-up questionnaire. The moment enabled a minimum follow-up duration of 6 years.

Ethics

The Medical Ethics Committee of the University Hospital Groningen decided that no formal approval was needed (METc 2017/221982, trial register 201700741). The responders gave informed consent for the use of depersonalized data from questionnaires and medical files at follow-up.

Measurements

Characteristics

At baseline, demographic and clinical status were assessed: age, gender, marital status, educational level, work status, occupation, benefit, pain locations, pain duration, and use of pain medication. The cause of the pain was assessed at follow-up. Due to the change-over of medical files from paper to digital versions, the original diagnosis and exact duration of the treatment was absent in most cases.

Treatments or other events after interdisciplinary pain rehabilitation

At follow-up, patients were asked whether treatments or events had occurred that had a temporary or persistently positive or negative influence on their pain or functioning at follow-up.

Pain

The Visual Analogue Scale (VAS) pain consists of 100 mm lines, the left end labelled 'no pain' (0 mm) and the right end 'very severe pain' (100 mm). Patients were asked for the current pain, the worst pain, and the least pain during the past week [22].

Daily life functioning

Daily life functioning was assessed using the domains of the RAND 36-item Health Survey (RAND-36) [23]. This questionnaire consists of 36 items, relating to nine dimensions: physical functioning, social functioning, physical role restriction, emotional role restriction, mental health, vitality, pain, general health, and health change. The pain domain was not used because the pain was assessed by means of the VAS pain.

Table 2 Opinion of the patients about the interdisciplinary pain rehabilitation at discharge (T2) and at follow-up (T3)

	T2 N	%	T3 N	%
Result at discharge	298			
Fully restored		2		
Much improved		45		
Little improved		28		
No change		19		
Slightly worsened		3		
Much worsened		3		
Extremely worsened		0,3		
Result at follow-up			522	
No effect				20
Temporary positive effect				37
Persistently positive effect				40
Temporary negative effect				2
Persistently negative effect				2
Satisfaction	284		523	
Very satisfied		39		37
Rather satisfied		42		33
Neutral		14		21
Rather dissatisfied		5		6
Very dissatisfied		1		3

Life satisfaction

Life satisfaction was assessed with the Dutch version of Lisat-9 [24]. Lisat-9 includes one question about general life satisfaction ('life as a whole') and eight questions about specific life satisfaction for the domains of ability to manage self-care, leisure situation, vocational situation (including 'home-making'), financial situation, sexual life, partnership relation, family life, and contacts with friends and acquaintances. All nine questions were answered on six-point Likert scales (1 = very dissatisfying and 6 = very satisfying) and for the domains of sexual life, partnership relation and family life 'not applicable' was introduced in line with the original Lisat-9 [25].

Psychological factors

Coping reactions were measured with the Coping with Pain Questionnaire (CPQ) [26], a Dutch adaptation of the Coping Strategy Questionnaire (CSQ) [27]. The 'active coping' domain in the CPQ is based on the scores for ignoring pain sensations, coping self-statements, reinterpreting pain sensations, and increasing activity level, while the 'helplessness' domain is based on the scores for catastrophizing, praying and hoping, and diverting attention.

Psychosocial distress was assessed by the Symptom Checklist 90-Revised (SCL-90) [28,29]. In the SCL-90, patients are instructed to rate 90 distress symptoms on a 5-point Likert scale ranging from 'not at all' to 'extremely'. The SCL-90 includes a total score for 'psychoneuroticism', which is a global measure of distress.

Analyses

Handling of missing data

Missing data in the characteristics of the patients at the start of treatment were supplemented, as far as possible, with data retrieved from the medical files. Multiple

imputation was used to replace the missing data for variables (25 imputation data sets).

Outcome measures and predictors

Patients' physical and social functioning and life satisfaction in general were used as the primary outcomes and pain reduction as a secondary outcome. The global result of IPR was asked for, using the following answer categories: no effect, temporary positive effect, treatment still relieves symptoms, temporary negative effect, and treatment still has a negative effect. Candidate predictor variables were as follows: (1) baseline characteristics (age, gender, marital status, educational level, work status, benefits, duration of current pain, use of pain medication); (2) scores on the questionnaires at baseline (domain scores of the Lisat-9, RAND-36, VAS and CPQ, and the SCL-90 total score); (3) diagnosis; (4) differences in Lisat-9, RAND-9, and VAS scores between baseline and discharge; (5) influence of treatments and/or events occurring between IPR and follow-up.

Long-term outcome

The long-term gain was determined by analyzing the scores on the domains of functioning, life satisfaction, and the three pain measures. Differences between baseline and discharge, baseline and follow-up, and discharge and follow-up were analyzed with the Wilcoxon signed-rank test, because none of the continuous variables were normally distributed. Effect sizes were calculated with the formula $Z/\sqrt{n}$, Z being the Z -value in the Wilcoxon signed-rank test, and n being the number of observations (i.e. two times the number of patients) [30]. An effect size of >0.80 was considered large, >0.50 moderate, and >0.20 small [31].

Predictors of long-term outcome

Predictors of long-term outcome were analyzed using a generalized linear mixed model, GLIMMIX SAS, with physical and social functioning (RAND-36 domains), satisfaction with 'life as a whole' (LISAT-9) and three pain measures (VAS) as dependent variables, and the variables mentioned earlier as independent variables. The reference group for the ordinal and nominal potential predictors in the generalized mixed model was the category with the largest number of patients, except for the Lisat-9 scores. In the Lisat-9 scores, the 'satisfying' category was used as the reference group for all items, in order to obtain uniformity for the Lisat-9 scores.

Given the large number of potential predictors, stepwise analyses were performed. First, we analyzed the correlation of each candidate predictor with each dependent variable, except for the variables that could not be imputed. Second, the predictors with $P < 0.20$ in the first step were entered in a model. Third, all predictors with $P < 0.05$ in the second step were entered in the final model. The CPQ domains and SCL-90 total score could not be imputed due

Table 3 Rand-36^a, LISAT-9^b and VAS pain^c scores (mean, SE^d, 95% CL^e) with *P*-values^f and effect sizes^g of the differences between baseline (T1), discharge from interdisciplinary pain rehabilitation^h (T2), and follow-up (T3)

	Baseline (T1)	Discharge (T2)	Follow-up (T3)	<i>P</i> -value T1-T2 ^g < 0.01/N 0.01 ≤ < 0.05/N ≥ 0.05/ (mean <i>r</i>)	<i>P</i> -value T2-T3 N < 0.01/N 0.01 ≤ < 0.05/N ≥ 0.05	<i>P</i> -value T1-T3 N < 0.01/N 0.01 ≤ < 0.05/N ≥ 0.05/ (mean <i>r</i>)
RAND-36 domain scores						
Physical functioning	46 (1.0, 44–48)	58 (1.1, 56–61)	57 (1.2, 54–59)	25/0/0/0/0.35*	0/0/25	25/0/0/0/0.26*
Social functioning	56 (1.2, 53–58)	66 (1.3, 63–69)	65 (1.2, 63–68)	25/0/0/0/0.23*	0/1/24	25/0/0/0/0.20*
Physical role restriction	14 (1.1, 12–16)	28 (1.7, 24–31)	38 (1.8, 34–42)	25/0/0/0/0.26*	25/0/0*	25/0/0/0/0.33*
Emotional role restriction	55 (2.0, 51–59)	64 (2.3, 59–69)	66 (1.8, 62–70)	24/1/0/0/0.12*	0/2/23	25/0/0/0/0.15*
Mental health	67 (0.8, 66–69)	72 (0.9, 70–74)	74 (0.8, 72–76)	25/0/0/0/0.18*	9/10/6	25/0/0/0/0.22*
Vitality	42 (0.9, 41–44)	53 (1.0, 51–55)	51 (1.0, 49–53)	25/0/0/0/0.33*	0/2/23	25/0/0/0/0.26*
General health	52 (0.9, 51–54)	56 (1.1, 54–58)	52 (1.0, 50–54)	25/0/0/0/0.14*	25/0/0*	0/0/25/0.01
Health change	35 (1.2, 33–38)	62 (1.4, 59–64)	45 (1.0, 43–47)	25/0/0/0/0.41*	25/0/0*	0/0/25/0.22
Lisat-9 domain scores						
Life as a whole	4.0 (0.06, 3.9–4.1)	4.4 (0.06, 4.3–4.5)	4.6 (0.05, 4.5–4.7)	25/0/0/0/0.20*	19/4/2*	25/0/0/0/0.26*
Ability to manage self-care	4.5 (0.05, 4.3–4.6)	5.0 (0.05, 4.9–5.0)	5.0 (0.05, 4.9–5.1)	25/0/0/0/0.27*	0/0/25	25/0/0/0/0.24*
Leisure situation	3.6 (0.06, 3.5–3.7)	4.3 (0.06, 4.2–4.5)	4.6 (0.05, 4.5–4.7)	25/0/0/0/0.32*	25/0/0*	25/0/0/0/0.36*
Vocational situation	3.1 (0.06, 3.0–3.2)	3.6 (0.07, 3.4–3.8)	4.0 (0.06, 3.9–4.2)	25/0/0/0/0.22*	25/0/0*	25/0/0/0/0.33*
Financial situation	4.1 (0.06, 4.0–4.3)	4.1 (0.08, 3.9–4.3)	4.5 (0.06, 4.4–4.7)	0/0/25/0.02	25/0/0*	25/0/0/0/0.18*
Sexual life	3.8 (0.07, 3.7–4.0)	4.2 (0.08, 4.0–4.4)	3.8 (0.08, 3.6–4.0)	25/0/0/0/0.15*	25/0/0*	0/0/25/0.03
Partnership relation	5.2 (0.05, 5.1–5.3)	5.2 (0.06, 5.1–5.3)	5.2 (0.06, 5.1–5.3)	0/1/24/0.02	0/0/25	0/0/25/0.02
Family life	5.1 (0.05, 4.9–5.2)	5.2 (0.06, 5.0–5.3)	5.2 (0.05, 5.1–5.3)	0/10/15/0.05	0/0/25	2/7/16/0.06
Contacts with friends and acquaintances	4.6 (0.05, 4.5–4.7)	4.8 (0.05, 4.7–4.9)	4.8 (0.05, 4.7–4.9)	19/6/0/0.09*	0/0/25	25/0/0/0/0.10*
Pain level, scores on VAS						
Current pain	53 (1.0, 51–55)	44 (1.3, 41–47)	43 (1.2, 41–46)	25/0/0/0/0.24*	0/0/25	25/0/0/0/0.22*
Worst pain last week	73 (0.9, 71–75)	64 (1.4, 61–67)	61 (1.4, 58–64)	25/0/0/0/0.24*	0/5/20	25/0/0/0/0.25*
Least pain last week	39 (1.1, 36–41)	31 (1.2, 28–34)	34 (1.2, 32–36)	25/0/0/0/0.21*	9/10/6	25/0/0/0/0.13*

^aRAND-36 item Health Survey, range 0–100 %, a higher score means less disability.^bLife-Satisfaction Questionnaire-9, range 1–6, a higher score means more satisfied.^cVisual Analogue Scale, range 0–100 mm, a higher score means a higher pain level.^dSEM.^e95% confidence limits.^fNumber (N) of 25 imputed datasets with *P*-value < 0.01 or between 0.01 and 0.05 or ≥ 0.05.^gThe effect size (*r*) averaged for the 25 imputed datasets (| mean *r* |).^hInterdisciplinary pain rehabilitation.*Most or all imputations sets showed a *P*-value < 0.01.

Table 4 Final prediction models with physical functioning, social functioning and satisfaction with 'life as a whole' at follow-up as dependent variables (only the independent variables with significant relationship with the dependent variables in the model or trend analysis and the possible reference categories are shown)

	Physical functioning at follow-up		Social functioning at follow-up		Satisfaction 'life as a whole' at follow-up	
	Mean (SE) ^a ; rho ^b	P-value ^c	Mean (SE); rho	P-value	Mean (SE); rho	P-value
Age (years) at baseline	−0.26	<0.0001		X		X
Marital status				X		X
Married or living together vs. single	59 (1.3) 50 (3.0)	0.0003*				
Occupation at baseline				X		X
employed vs. retired	66 (1.5) 55 (4.0)	0.007*				
Work status						X
not in work vs. in work, work not adapted	48 (1.7) 69 (2.9)	0.34	58 (1.8) 79 (2.5)*	<0.0001*		
Cause of pain						X
nonspecific, other vs. traumatic	59 (2.6)		65 (2.6)			
Neck pain	74 (5.0)	0.002*	72 (6.1)	0.11		
Other	60 (3.4)	0.15	69 (3.8)	0.0099*		
Pain at baseline		X				X
'Least pain last week'			−0.19	<0.0001*		
Satisfaction with 'life as a whole' at baseline				X		X
Satisfying vs. very dissatisfying	62 (2.2) 60 (6.3)	0.004*				
Satisfaction with 'family life' at baseline		X				X
Satisfying vs. rather dissatisfying			69 (2.1) 62 (3.9)	0.006*		
Functioning at baseline						
Physical functioning at baseline	0.45	<0.0001*		X		X
Social functioning at baseline	0.22	0.0002*	0.31	0.0002*		X
Mental functioning at baseline		X	0.26	0.0008*		X
Difference between baseline and discharge						
Social functioning	0.08	<0.0001*		X		X
Mental functioning		X	0.06	0.0002*		X
'Least pain last week'		X	−0.19	<0.0001*		X
Interpretation of factors between discharge and follow-up ^d						
Neutral	56 (1.9)		65 (1.9)		4.5 (0.08)	
vs. very negative	29 (10.8)	0.14	42 (9.6)	0.15	4.0 (0.48)	0.13
vs. moderately negative	39 (4.4)	0.04	55 (4.6)	0.26	4.3 (0.19)	0.20
vs. slightly negative	53 (4.7)	0.84	61 (5.2)	0.47	4.6 (0.19)	0.79
vs. slightly positive	60 (2.9)	0.22	65 (3.1)	0.84	4.6 (0.11)	0.62
vs. moderately positive	62 (2.6)	0.014	71 (2.5)	0.18	4.8 (0.11)	0.12
vs. very positive	84 (6.1)	0.0004*	87 (6.4)	0.003*	5.3 (0.24)	0.03

x = not in final model of the particular dependent variable.

^aSEM.^bSpearman's rho.^cP-values of the comparison of reference category vs. other categories or the relationship of continuous variables.^dIn the trend analysis, it appeared that the more negative the influence, the lower the outcome at follow-up.

*P-value < 0.01.

to the large number of missing data. Therefore, fourth, these variables were entered in the final model of step 3 as a subanalysis. Where relevant, trend analyses were performed with ANOVA linearity test.

Statistical packages and P-value

SPSS version 20 was used for descriptives, the analyses of long-term outcome and trend analyses. SAS version 9.4 was used for imputation of missing data and GLIMMIX analyses. A P-value <0.01 was interpreted as significant. The pooled results were used to interpret the results of the analyses, except for those of the Wilcoxon sign test and ANOVA linearity test, as pooled results were not given in these tests (not by SPSS or SAS). In these

tests, the number of P-values <0.01 of the 25 imputation sets were counted and the category with the majority of P-values per analysis was taken as the final result.

Results

Patients

Baseline questionnaires were available for 1212 patients treated between 2003 and 2011, and for 197 of them, the data on psychological factors were also available. As far as could be ascertained, 46 patients had died between treatment and follow-up, and the addresses of 41 patients were unknown at follow-up. Of the remaining 1125 subjects, 524 returned the questionnaire with written consent (response rate 47%). The mean time between

Table 5 Final prediction models with 'current pain', 'worst pain last week', and 'least pain last week' at follow-up as dependent variables (only the independent variables with significant relationship with the dependent variables in the model or trend analysis and the possible reference variables are shown)

	'Current pain' at follow-up		'Worst pain last week' at follow-up		'Least pain last week' at follow-up	
	Mean (SE ^a); rho ^b	P-value ^c	Mean (SE); rho	P-value	Mean (SE); rho	P-value
Occupation at baseline		X				
Employed vs. homemaker			56 (2.0)		29 (1.5)	
vs. retired			68 (2.1)	0.003*	41 (1.9)	0.006*
			64 (4.2)	0.03	39 (4.0)	0.006*
Cause of pain						X
Nonspecific, rest vs. traumatic	45 (2.3)		63 (2.5)			
Neck pain	30 (7.1)	0.0101	42 (7.5)	0.002*		
Number of areas with pain at baseline ^d		X				X
Six areas			73 (2.6)			
vs. one			43 (3.9)	0.0009*		
vs. two			57 (3.4)	0.17		
vs. three			60 (3.3)	0.11		
vs. four			66 (3.3)	0.67		
vs. five			65 (3.6)	0.36		
Duration of current symptoms at baseline (years)	0.19	0.001*		X	0.19	0.004*
Pain at baseline						
'Current pain'	0.37	<0.0001*	0.33	0.0015*		X
'Worst pain last week'	0.26	0.012	0.32	<0.0001*		X
'Least pain last week'		X		X	0.40	<0.0001*
Satisfaction with 'ability to manage self-care' at baseline						
Satisfying	45 (2.0)			59 (2.2)	35 (1.9)	
vs. dissatisfying	42 (5.8)	0.0099*	0.04	63 (7.0)	35 (5.6)	0.06
Satisfaction with 'vocational situation' at baseline			X			X
Satisfying	34 (3.2)					
vs. very satisfying	48 (5.5)	0.008*				
Difference between baseline and discharge						
'Worst pain last week'	0.09	0.0002*	0.07	<0.0001*		X
Interpretation of factors between discharge and follow-up ^e						
Neutral	44 (1.9)		61 (2.1)		35 (1.7)	
vs. very negative	62 (6.0)	0.03	80 (5.9)	0.12	54 (8.0)	0.045
vs. moderately negative	59 (3.9)	0.04	78 (3.5)	0.09	49 (4.0)	0.04
vs. slightly negative	48 (4.8)	0.39	69 (5.1)	0.34	40 (4.7)	0.14
vs. slightly positive	40 (3.2)	0.72	59 (3.5)	0.28	35 (1.7)	0.17
vs. moderately positive	38 (2.5)	0.13	57 (2.8)	0.09	29 (2.9)	0.19
vs. very positive	18 (8.4)	0.0008*	24 (10.2)	<0.0001*	30 (2.5)	<0.0001*

x = not in final model of the particular dependent variable.

^aSEM.^bSpearman's rho.^cP-values of the comparison of reference category vs. other categories or the relationship of continuous variables.^dIn the trend analysis it appeared that more pain areas at baseline correlated with more 'worst pain last week' at follow-up.^eIn the trend analysis it appeared that the more negative the influence, the lower the outcome at follow-up.

*P-value < 0.01.

baseline and discharge assessments was 19.2 weeks (SD 12.1) with a median of 15.9 weeks (quartiles 11.0–22.9). The difference between mean and median was caused by some patients who had a long gradual reduction of treatment intensity. The mean follow-up time was 10.9 years (mean time between baseline and follow-up assessments with SD 2.5 years, range 6.4–15.3 years).

The results of baseline measurements are presented in Table 1. At follow-up, at least 49 (9.4%) patients had taken part in another IPR, and 66% reported other treatments, some but not all related to their pain, and/or events after the IPR. These treatments and/or events were perceived as having a persistently (very) positive effect in 37% and a persistently (very) negative effect 14% of the cases. The assessments of the IPR by the patients are presented in Table 2.

Long-term outcome

Most patients improved during IPR, and the improvements persisted at follow-up. Effect sizes were small (Table 3). At follow-up, most patients (77%) rated the effects of the IPR as temporarily or persistently positive, 20% as no effect, and 3% as temporarily or persistently negative.

Predictors of long-term outcome

The results of the final models are presented in Tables 4 and 5. Several predictors were found for the different outcome variables, whereby some overlap was present. Treatments and events between discharge and follow-up were significant predictors for four of the six outcome variables. In the trend analysis, it appeared that the more negative the influence, the lower the outcome

at follow-up. This was confirmed for all six outcome variables. This variable, that is, treatments and events between discharge and follow-up, was the only predictor of the satisfaction with 'life as a whole'. For the other five outcome variables, their baseline scores were significant predictors. The short-term gain (difference between baseline and discharge) was no predictor of the long-term outcomes, with a few exceptions. Having only one pain area at baseline was predictive for 'worst pain last week' at follow-up. A look at the results suggests that more pain areas at baseline correlated with more 'worst pain last week' at follow-up. This was confirmed by a trend analysis. The subanalyses of the psychological variables (CPQ domains and SCL-90) showed that these variables were not predictive.

Discussion

Overall results of this study show that the gains in functioning, satisfaction with life and pain persisted 6–15 years after the IPR. For some aspects, for example, physical role restriction and leisure situation, we found that the patients even functioned better after some years, compared to IPR discharge, while for other aspects, for example, sexual life and pain levels, the situation had deteriorated after discharge. Pain levels decreased significantly during IPR, and these levels remained lower in the long term. The prediction models for long-term functioning showed that some baseline characteristics were predictive, viz. patients who were single, retired, or not in work, those having higher levels of 'least pain last week' and poorer functioning, had lower functioning scores at follow-up, while patients with traumatic pain disorders had higher functioning scores at follow-up. The prediction models for the pain levels at follow-up showed that patients who were homemakers, those who reported a longer duration of current pain at baseline, and those reporting greater gains in 'worst pain last week' had more pain at follow-up, while patients with pain due to traumatic neck disorder and those having only one pain area at baseline had less pain at follow-up. Treatments and events between discharge and follow-up predicted the functioning and pain levels at follow-up.

Higher levels of functioning at discharge can be explained as being a result of the IPR, which focused on better functioning and better mental health. As was already known [4,20], IPR can positively influence pain levels, even though the IPR is not primarily focused on pain reduction. An interesting finding is that gains in social functioning during the IPR favorably influenced the long-term outcome. Focusing even more on increasing social activities rather than on activities in general might help patients maintain their IPR gains better.

Based on the observation that most patients (77%) in the present study rated the effects of the IPR as temporarily or persistently positive, one would expect larger effects than the ones reported. The small effects sizes might be

explained by the experienced discrepancies between standardized outcome measures, such as the ones used in the present study, and outcomes that are relevant for individual patients [32]. The effect sizes in our study are hard to compare with those in other studies. However, the small effect sizes seem consistent with almost all studies about long-term outcome, as well as the finding that the gains achieved during the IPR remained during follow-up [2,8,10,11,15,33–35].

The different methodologies and outcome measures make it difficult to perform comparisons about predictors for long-term outcomes. Few studies have involved long-term follow-up and predictors for patients with mixed causes of pain. A look at these studies [9, 11,12,36] suggests that there is no clear pattern to be distinguished in the results of their studies and our study about predictive factors for long-term effects.

Strengths and limitations of the study

One of the strengths of the current study is the large number of included patients. Another strength is the long follow-up period after the IPR. However, this strength may also be regarded as a weakness. A total of 6–15 years is a lengthy period, and multiple factors unrelated to IPR may have affected the results, making it even more difficult to draw conclusions. We tried to overcome this weakness by asking the patients about treatments and events since the IPR. However, many of these may have been forgotten, and moreover, patients found it difficult to interpret the influence at follow-up. It was especially the treatments and events interpreted as very positive that seemed indeed to influence their functioning, life satisfaction and pain levels at follow-up. Another main limitation is that we cannot rule out an effect of the natural course of functioning and pain symptoms on the outcome at follow-up. The response rate at follow-up (47%) and differences between responders and nonresponders at baseline (selection bias) may also have influenced the results of the study, although it is unclear in which direction.

Conclusion

On average, patients with CMP maintained their gains from IPR even after 6–15 years. Most patients reported a positive effect of IPR. Effect sizes were mostly small. Predictors of a better long-term outcome we found concerned mainly baseline characteristics. Treatments and events between discharge and follow-up also influenced the long-term outcome and therefore future studies should document these factors more in detail.

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Conflicts of interest

There are no conflicts of interest.

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