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Multidisciplinary allocation of chronic pain treatment: Effects and cognitive-behavioural predictors of outcome

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Objectives. Multidisciplinary treatment approaches have been found to be effective for chronic pain patients although there are large individual differences in outcomes. To increase overall treatment effects, tools are needed to identify patients most likely to benefit from tailored, comprehensive modular treatment schemes.

Design. The present study evaluates the effects of a multidisciplinary pain treatment allocation protocol in chronic pain patients and seeks to identify cognitive-behavioural predictors of outcome. Pain intensity, functional disability, depression, and use of medication in an intervention group of 110 chronic pain patients were compared to the outcomes of a 110 strong control group.

Results. Paired pre- and post-treatment *t* tests showed that all primary outcomes had significantly decreased in the intervention group with ANCOVAs revealing a main group effect for post-treatment pain intensity levels and functional disability. Paired *t* tests demonstrated both variables to have significantly reduced after treatment relative to the levels reported by the control group. Predictor analyses further showed higher levels of acceptance to significantly predict larger reductions in pain intensity in the intervention but not in the control group.

Conclusion. The tested multidisciplinary allocation scheme for out-patient treatment of chronic pain complaints was effective in reducing pain intensity and functional disability. Findings also showed that especially those patients that are able to accept their condition are likely to profit most from the treatment in terms of pain reduction.

There is increasing evidence that chronic pain patients tend to benefit from multidisciplinary pain treatment schemes, especially programmes combining cognitive-behavioural and physiotherapy modules (Fishbain, Cutler, Rosomoff, & Rosomoff, 1997;

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Flor, Fydrich, & Turk, 1992; McCracken & Turk, 2002; van Tulder, Ostelo, & Vlaeyen, 2001). Flor *et al.* (1992) showed that multidisciplinary pain treatment was superior to monodisciplinary interventions on various outcome measures such as pain intensity, mood, functional disability, and medication consumption, with the effects remaining relatively stable over time. However, the effects reported are generally modest, frequently attributed to the large individual differences in treatment outcomes. Consequently, it is essential that patients that may benefit most from multidisciplinary treatment schemes are identified (Fishbain *et al.*, 1997).

Researchers have generally focused on the detection of relevant cognitive-behavioural factors to predict treatment efficacy. Based on the fear-avoidance model, pain-related anxiety, particularly fear of pain and worrying, have been assumed to enhance avoidance behaviour, resulting in increased pain, functional disability, and depression in the long term (Lethem, Slade, Troup, & Bentley, 1983; Vlaeyen & Linton, 2000). Recently, helplessness, that is the notion that chronic pain and its consequences are uncontrollable and unchangeable and the generalization of the consequences to daily functioning (Abramson, Teasdale, & Seligman, 1978), has additionally been shown to play a significant role in explaining the course of functional disability in chronic pain within the framework of the fear-avoidance model (Evers, Kraaimaat, van Lankveld, Jongen, & Bijlsma, 2001; Samwel, Evers, Crul, & Kraaimaat, 2006). As acceptance has been shown to be predictive of better functioning in the longer term (Evers *et al.*, 2001; McCracken, Vowles, & Eccleston, 2005), various authors have also advocated the assessment of this positive, health-promoting variable in outcome studies (Evers *et al.*, 2001; McCracken & Turk, 2002). Acceptance is defined as acknowledging that one has pain and being able to make an effort to live a satisfying life despite the pain (Evers *et al.*, 2001; McCracken, 1998).

For correct referrals, it is crucial to know whether chronic pain patients that worry about their pain and its consequences and/or feel helpless about their ability to change their situation and have accordingly developed avoidant pain behaviours, would indeed profit most from treatment modules aimed at changing pain cognitions and behaviour, as has been suggested. Perhaps patients that are unable to accept the pain and its consequences may profit from pain treatment programmes that are specifically aimed at their learning to shift their focus from pain reduction to coping with the pain as an unavoidable condition and to strive towards improving their daily functioning despite the pain (McCracken, 1998). Yet, empirical studies that have examined the relative predictive values of mentioned variables in relation to multidisciplinary pain treatment approaches are scarce. The few studies that were directed at identifying cognitive-behavioural predictors at the start of treatment either yielded non-significant or inconsistent results (Fishbain *et al.*, 1993; Haazen, Vlaeyen, & Kole-Snijders, 1994; Vlaeyen & Morley, 2005; Wessels *et al.*, 2006). Studies charting changes during multidisciplinary treatment found decreases in fear of pain, worrying, or helplessness to predict decreases in pain intensity, functional disability, depression and/or medication consumption (Altmaier, Russell, Kao, Lehmann, & Weinstein, 1993; Burns, Glenn, Bruehl, Harden, & Lofland, 2003; Jensen, Turner, & Romano, 1994; Spinhoven *et al.*, 2004; Tota-Faucette, Gil, Willliams, Keefe, & Veeraindar, 1993; Woby, Watson, Roach, & Urmston, 2004). Increase in acceptance cognitions appeared to predict better outcomes after treatment (McCracken *et al.*, 2005).

To bridge this gap in our knowledge, with the present study we sought to examine and compare the effects of a multidisciplinary allocation protocol on the self-reported variables of pain intensity, functional disability, depression, and use of medication in a

cohort of chronic pain patients relative to a waiting-list control group and to identify cognitive-behavioural predictors (i.e. fear-avoidance factors, helplessness, and acceptance) of treatment outcome in order to gain more insight into the clinical impact of this strategy of chronic pain treatment. In this study, the consequences of the multidisciplinary pain treatment allocation protocol was the focus of study instead of the effects of different treatment modules. We hypothesized that the treatment allocation protocol would be effective on all primary outcomes relative to the control condition. In accordance with the fear-avoidance model, previous studies indicated that patients with higher levels of worrying, avoidance behaviour, and fear of pain would suffer more from pain, functional disability and depression, all predictive of inferior long-term outcomes (Asmundson, Norton, & Norton, 1999; Vlaeyen & Linton, 2000). Consequently, we hypothesized that these types of patients would profit more from a multidisciplinary treatment allocation protocol as reducing cognitive-behavioural factors was the specific focus of one of the treatment modules. In line with studies on depression (Keefe, Rumble, Scipio, Giordano, & Perri, 2004), we hypothesized that patients with higher levels of helplessness would show better treatment outcomes as one of the treatment modules aimed at decreasing levels of helplessness. In addition, we assumed that higher levels of pre-treatment acceptance would induce more favourable outcomes as acceptance might allow a more positive perception of changes in pain levels. However, based on recent studies showing that a lower level of acceptance predicts more pain and functional disability (McCracken *et al.*, 2005; McCracken & Eccleston, 2006), we further assumed that patients low on acceptance would also benefit more from a multidisciplinary treatment allocation protocol as one of the goals of one of the treatment modules specifically aimed at raising the participants' acceptance levels. This implies that superior outcomes would be predicted by these cognitive-behavioural variables, that is that patients with higher levels of worrying, avoidance behaviour, fear of pain or helplessness and lower levels of acceptance would show a more favourable outcome.

Materials and methods

Patients and procedure

Participants were recruited from chronic pain patients who had been referred for treatment to the interdisciplinary out-patient pain centre of the Radboud University Nijmegen Medical Centre, The Netherlands. To qualify for inclusion in the present study patients had to be at least 18 years old and have suffered from specified pain complaints for more than 3 months. Exclusion criteria were pathophysiological causes such as pain due to cancer, serious psychiatric disorders that could interfere with treatment, and the inability to read or write Dutch. Also patients that were scheduled for one or more treatment modalities outside the treatment centre (exercise therapy and/or individual psychological treatment) or patients that were not allocated to any treatment, were excluded from the study. The original sample comprised 286 patients. Based on the exclusion criteria a total of 35 patients was excluded. As to the demographic variables of age, marital status, education, and pain duration, there were no statistically significant differences between the study group and the non-participant group although there were significantly more women in the latter group (76.8 vs. 58.8%: $z = -2.57, p < .05$). Of the sample of 251 patients that met the inclusion criteria and initially agreed to participate, we eventually failed to obtain sufficient data for 31 patients (23%), which were subsequently excluded from the analyses (see Figure 1). Subsequent drop-out

analyses revealed that there were no statistically significant differences between the final sample ($N = 220$) and these drop-outs. We thus tested a total of 220 patients in our study of whom we obtained all required data. Based on time of referral, the first 110 patients were allocated to the intervention group and the last 110 to the control group.

The 220 patients all completed the same set of validated questionnaires (see Measures) and 7-day pain and medication diaries prior to entering the centre's standard 3-month waiting-list period (T0) and again at the end of this period, that is 1 week prior to the study's screening procedure (T1) and a third time 3 months into their respective treatments (T2). The total inclusion period was 9 months. Prior to their participation in our study, which was approved by the hospital's medical ethics committee, all patients gave their informed consent.

The demographic variables of both the control and the intervention group are presented in Table 1. There were no significant group differences in sex, marital status, or educational level: in both groups the majority of patients were women and most participants were married and had completed secondary education. The primary pain sites for the treatment and the control groups were: legs: 34 (30.9%) versus 27 (24.5%);

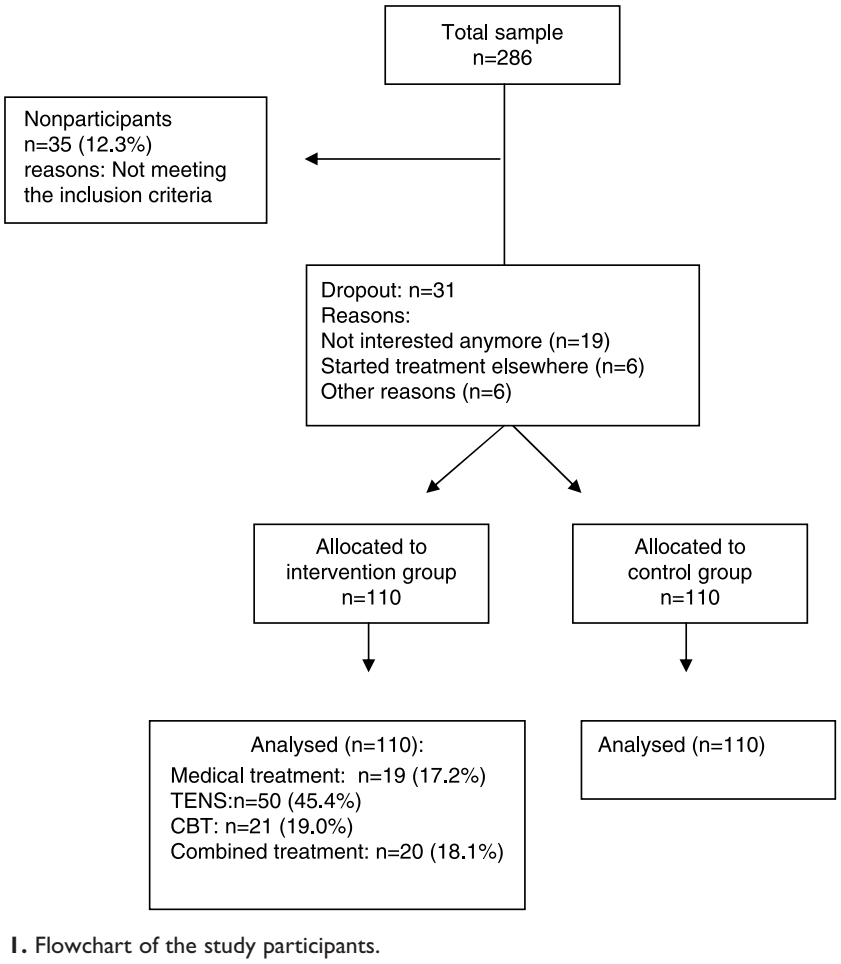

Figure 1. Flowchart of the study participants.

Table 1. Demographic variables and pain duration for the two patient groups at study entry

	Treatment group ($N = 110$)	Control group ($N = 110$)
Sex: Number of women (%)	64 (58.2)	68 (61.8)
Mean age (in years)	48.1 (*SD*: 14.3)	48.1 (*SD*: 12.4)
Married (%)	78.2	76.2
Educational level		
Primary	12.6	12.8
Secondary	83.5	85.4
Tertiary	3.9	2.8
Mean pain duration (in months)	62.8 (*SD*: 75.1)	63.5 (*SD*: 77.6)

back: 33 (30.0%) versus 38 (34.5%); neck and shoulders: 27 (24.5%) versus 19 (17.3%); arms: 16 (14.5%) versus 12 (10.9%); pelvis: 8 (7.2%) versus 7 (5.5%); head and face: 5 (4.5%) versus 8 (6.4%); belly: 3 (2.7%) versus 7 (5.5%); whole body: 3 (2.7%) versus 10 (8.8%); breast 2 (1.8%) versus 8 (6.4%). Fourteen (12.7%) and 16 (14.5%) patients, respectively, reported pain at more than one site. However, there were no patients who met the criteria for fibromyalgia. Mean pain duration was 62.8 months (*SD* 75.2, median 32.0) versus 63.5 (*SD* 77.6, median 36.0) with a range of 6–420 months in both groups. There were no significant group differences on any of the pain locations and pain duration.

Pain treatment modalities

After the regular 3-month waiting-list period an anaesthesiologist, a physiotherapist, and a psychologist screened the questionnaires of all 220 patients. Allocation to one or more of the treatment modules was based on patients meeting the inclusion criteria of the different treatment modules as inferred from the questionnaire screening (demographic variables, pain-related variables, coping, and pain outcomes) and a standardized 1-hour interview conducted either by the anesthesiologist, the physiotherapist, or the psychologist. The protocolized interview consisted of a standardized examination of anamnestic pain-related data by the anesthesiologist, physical activity and functional limitations by the physiotherapist and data concerning the aetiology of the pain episode, cognitive, behavioural, and social consequences of pain by the psychologist. There were no drop-outs in the intervention group after treatment allocation and start of the treatment.

Medical treatment. Medical treatment was aimed at pain reduction by attuning and minimizing pain medication on a time-contingent basis. The inclusion criteria for this treatment modality were high medication use without strict medical indication, medication use on a pain-contingent basis, presence of adverse drug effects or use of conflicting or resembling pain medication. The mean number of face-to-face contacts was two.

Transcutaneous electrical nerve stimulation (TENS) is a non-invasive intervention to alleviate pain. An experienced physiotherapist applies a small portable battery-powered stimulator, connected by electric wiring to self-adhesive electrodes, to the patient's skin. After proper instruction and adjustment of pulse variables and electrode placement, patients are able to manage the TENS treatment by themselves

during their daily activities. They can monitor their pain level and adjust the pulses to alleviate the pain, which hence may reduce their cognitions of helplessness and avoidance behaviour. Eligible were patients suffering from pain due to peripheral nerve-root lesions, excluded were patients reporting pain in the face or head or on several pain sites. The mean number of face-to-face contacts was five.

Cognitive-behavioural group therapy (CBT) consisted of ten 90-minute sessions and was targeted at reducing the patients' functional disability and depression by reducing negative cognitions and avoidance behaviour using the following treatment components: stress-management and problem-solving techniques, cognitive therapy, and relaxation exercises. In addition, patients worked on individual goals. In the first session, every patient formulated a specific CBT goal based on their personal underlying problems (e.g. work-related conflicts or marital problems). In the subsequent sessions, patients trained and implemented their personalized problem-solving techniques. Groups consisted of minimally 5 and maximally 12 patients and were led by two psychologists both fully trained in CBT. Inclusion criteria for group CBT were untreatable pain (defined as pain that cannot be reduced by either medication and/or TENS) and severe limitations in physical or psychological functioning. Exclusion criteria were incapacity to function in a group or indications of a psychiatric disorder. The average number of attended CBT sessions was 9 out of 10.

Figure 1 provides an overview of the number of patients per treatment modality, showing that 19 patients (17.2%) received medical treatment, 50 patients (45.4%) received TENS treatment and 21 patients (19.0%) had CBT. Twenty patients (18.1%) that met the criteria for more than one treatment modality received a combination of medical treatment and TENS. Patients who already had received TENS treatment and were considered to have an optimal medication scheme only received CBT with the goal to improve functioning and reduce depression. We did not offer a combination of medical treatment or TENS with group CBT because it was expected that, due to their pain-reduction objectives, both the medical treatment and TENS would undermine CBT treatment compliance as this intervention is specifically directed at training effective, long-term pain-coping strategies.

Measures

Pain intensity

Since multiple visual analogue scale (VAS) ratings have been shown to be more reliable and valid to establish average pain intensity than a single rating (Jensen & McFarland, 1993), our participants were asked to rate their pain on a 10-centimeter VAS for 7 days at 3 points during each day. The pain VAS scale ranged from 'no pain at all' to 'the worst pain ever experienced'. The patient's average pain level was calculated based on these 21 pain ratings. Cronbach's α for pain intensity in our study was .93.

Functional disability

Functional disability was measured with the Dutch version of the pain disability index (PDI) (Jerome & Gross, 1991; Pollard, 1984). The 7-item questionnaire was developed as a brief, self-report indicator of pain-related disability (Pollard, 1984) and is scored on a scale from 0 (no disability) to 10 (total disability). The items reflect the total range of role functioning: family/home responsibilities, recreation, social activities, occupation,

sexual behaviour, self-care, and life-supporting activities. To obtain the mean disability level, the items scores were averaged. Cronbach's α for functional disability in our study was .80.

Depression

Depression was assessed using the depression scale of the Dutch version of the symptom checklist-90 (Arrindell & Ettema, 1986) measuring 16 symptoms of depression, which are rated on a 5-point scale ('not at all' to 'very much'). The depression scale of the SCL-90 has been amply validated for the Dutch population in various patient groups including chronic pain patients (Flor *et al.*, 1992). It also proved to be sensitive to change, does not contain somatic items that could interfere with other somatic complaints in chronic pain patients and is widely used to assess therapy outcomes in chronic pain (Tota-Faucette *et al.*, 1993). Cronbach's α for depression in our study was .89.

Use of medication

Consistent with the ATC/DDD guidelines (WHO, 2001) medication intake was measured by comparing the defined, average amount of drugs needed to obtain the desired effect on pain in the general population (defined daily doses: DDD) and the actual use of drugs (used daily doses: UDD). The actual use of medication is calculated by dividing the USD of a drug by the DDD of the same drug. When patients used more than one drug to alleviate their pain, the relative outcomes of the different drugs (UDD/DDD) were summed to obtain the total level of medication use (Cosentini, Leoni, & Banfi, 2000; WHO, 2001).

Avoidance behaviour

Avoidant behaviour was reflected by the composite score of the 13-item passive pain-coping scales retreating and resting of the pain coping inventory (PCI; Kraaimaat, Bakker, & Evers, 1997; Kraaimaat & Evers, 2003). The PCI measures cognitive and behavioural attempts to cope with pain on a 4-point Likert scale ('rarely or never' to 'very frequently'). Representative items are: 'When in pain and outdoors, I try to return home as soon as possible' and 'When in pain, I rest by sitting or lying down'. Cronbach's α for avoidance behaviour in our study was .84.

Worrying

Worrying was assessed by the 9-item worrying scale of the PCI (Kraaimaat & Evers, 2003; Kraaimaat *et al.*, 1997). Representative items are: 'I start worrying when I'm in pain' and 'I think that the pain will worsen'. Cronbach's α for worrying in our study was .82.

Fear of pain

Pain-related fear was gauged with the recently adjusted version of the Tampa scale of Kinesiophobia (TSK; Roelofs, Goubert, Peters, Vlaeyen, & Crombez, 2004; Vlaeyen, Kole-Snijders, Boeren, Rubin, & van Eek, 1995), reflecting level of fear of movement due to possible subsequent pain/reinjury. The scale's 13 items are scored on a 4-point scale

('highly disagree' to 'totally agree'). Representative items are: 'My pain means there is physical damage' and 'My pain tells me to stop exercising so I do not injure myself'. Cronbach's α for fear of pain in our study was .78.

Helplessness

Patients completed the 6-item helplessness scale of the illness cognition questionnaire (ICQ). The ICQ was developed to measure illness cognitions in situations of an uncontrollable chronic condition like chronic pain (Evers *et al.*, 2001). To facilitate comparison with the other pain-related predictors, the term 'illness' in the ICQ was replaced by 'pain'. The ICQ proved to be reliable and valid in assessing illness cognitions (e.g. helplessness and acceptance) in-patients with chronic pain (Evers *et al.*, 2001) as well as in-patients with other chronic diseases such as multiple sclerosis and chronic skin diseases (Evers *et al.*, 2005; Evers *et al.*, 2001). In addition, scales of the ICQ have earlier been shown to be sensitive to change in studies evaluating CBT in chronic pain (Evers, Kraaimaat, van Riel, & de Jong, 2002). The helplessness scale measures cognitions that focus on the negative consequences of pain and to what extent the patient generalizes them to daily life functioning on a 4-point scale ('not at all' to 'completely'). Representative items were: 'My pain controls my life' and 'My pain limits me in everything that is important to me'. Cronbach's α for helplessness in our study was .86.

Acceptance

Patients rated the 6 acceptance items of the ICQ on a 4-point scale ('not at all' to 'completely') to gauge their cognitions with respect to acknowledgement of their chronic pain condition and their notions on their ability to manage the negative consequences of the pain. The items of acceptance in the ICQ are as follows: 'I have learned to accept the limitations imposed by my pain', 'I have learned to live with my pain', 'I can accept may pain well', 'I can cope effectively with my pain', 'I can handle the problems related to my pain', and 'I think I can handle the problems related to my pain, even if the pain gets worse'. These items reflect the cognition of being able to cope with the pain and the consequences of the pain, irrespective of the outcomes of the coping process. Cronbach's α for acceptance in our study was .89.

Statistical analysis

In our analyses we compared the pre- and post-treatment (T1 and T2) scores on the questionnaires and 7-day pain- and medication-diaries of the patients in the intervention group with the T0 (start of waiting-list period) and T1 (pre-screening) ratings of the patients in the control condition.

Because of skewed distributions of the pain-duration scores, square-root transformations were applied. Differences between the intervention and the control group at study entry were tested with student's *t* tests for continuous variables and chi-square analyses for categorical variables. ANCOVA was used to measure the main group effect of the pain treatment in comparison to the waiting-list control condition on the primary outcome measures (pain intensity, functional disability, depression and medication use) and the secondary outcomes (avoidance behaviour, worrying, fear of pain, helplessness, and acceptance), using the baseline score of the outcome

measure (e.g. pre-treatment pain intensity) as covariate. In the case of significant main group effects, paired *t* tests between the first and second assessments were conducted separately to gain a better understanding of the nature of the interaction. Effect sizes were obtained by calculating the difference between the means of the two assessments divided by their pooled standard deviations (*SD*) (Cohen, 1988). To help detect potential predictors of the primary outcome variables in the treatment condition we adopted Baron and Kenny's strategy for mediating effects (Baron & Kenny, 1986) and calculated correlations between all demographic variables, pain duration, and all predictors at baseline and the change scores of the primary outcome variables. In accordance with the stepwise method, when correlations were significant, the relevant predictors were included as covariates in the regression analyses. Residual gain scores were used to establish changes in outcome variables, which were calculated by regressing the outcome variable at the post-treatment assessment on the baseline score of the outcome measure (Kerlinger, 1975). To determine the predictive value of the predictor for the treatment condition, the centred interaction term of group × predictor was entered into the regression analysis as the final, fourth step after controlling for the outcome variable at T1 at step 1, the group condition (treatment vs. control condition) at step 2 and the predictor at step 3.

Results

Pre-treatment patient characteristics

Table 1 lists the means of the demographic variables and pain duration and Table 2 the means and *SD*s of the primary and secondary outcome variables at first assessment for the two study groups. Group comparisons did not yield any significant differences on any of the variables.

At first assessment, all variables are moderately correlated (range $r = .18$–$.50$), indicating that all variables were related with each other but represented different constructs. As expected, correlations were about the same at both assessments (Table 3).

Primary outcomes

Table 2 depicts the means and *SD*s of the primary outcome variables at both assessments for both groups. ANCOVA revealed a significant main group effect for pain intensity ($F(1, 215) = 7.909$, $p = .005$) and functional disability ($F(1, 214) = 6.526$, $p = .011$). Paired *t* tests showed that pain intensity had decreased significantly in the treatment condition ($t = 4.17$, $df = 106$, $p < .001$) but not in the control condition, which also applied to functional disability ($t = 6.20$, $df = 106$, $p < .001$). ANCOVA group effects were not significant for depression nor for use of medication ($F(1, 217) = 0.158$, $p = .691$ and $F(1, 218) = 1.371$, $p = .243$, respectively).

Secondary outcomes

The ANCOVAs yielded a significant main group effect for acceptance ($F(1, 214) = 9.145$, $p = .003$). Paired *t* tests showed that acceptance had increased significantly in the treatment condition ($t = -5.56$, $df = 106$: $p < .001$) but not in the control condition. ANCOVA group effects were not significant for worrying

Table 2. Mean outcomes at first and second assessment and main group effect

	First assessment		Second assessment		
Primary outcome variables	*M*	*SD*	*M*	*SD*	*F*
Pain intensity					
TC	52.44	18.18	45.35	19.41	7.909 ($p = .005$)
CC	55.45	17.55	52.70	17.56	
Functional disability					
TC	4.93	1.69	4.32	1.68	6.526 ($p = .011$)
CC	5.01	1.88	4.78	1.99	
Depression					
TC	28.45	10.82	26.4	10.8	0.158 ($p = .691$)
CC	27.05	10.11	25.90	10.49	
Medication use					
TC	0.63	0.82	0.53	0.67	1.371 ($p = .243$)
CC	0.76	0.94	0.64	0.94	
Secondary outcome variables					
Avoidance behaviour					
TC	2.11	0.47	2.02	0.46	0.129 ($p = .721$)
CC	2.14	0.49	2.03	0.53	
Worrying					
TC	20.15	5.52	18.02	5.18	1.045 ($p = .308$)
CC	19.22	4.79	17.96	4.84	
Fear of pain					
TC	28.27	8.81	26.15	7.83	0.158 ($p = .801$)
CC	27.16	7.58	25.25	7.66	
Helplessness					
TC	14.72	4.42	13.84	4.44	0.548 ($p = .460$)
CC	15.14	3.70	14.27	4.11	
Acceptance					
TC	12.83	3.75	14.31	4.11	9.145 ($p = .003$)
CC	13.08	4.06	13.57	4.07	

Means (*M*) and standard deviations (*SD*) of the primary and secondary outcome variables at first and second assessment for the treatment condition (TC: T1 and T2) and control condition (CC: T0 and T1); $N = 110$ for both conditions; main group effect of all outcomes between treatment condition and control condition (*F*).

($F(1, 217) = 1.045$, $p = .308$) or for avoidance behaviour ($F(1, 217) = 0.129$, $p = .721$), fear of pain ($F(1, 210) = 0.158$, $p = .801$), or helplessness ($F(1, 216) = 0.548$, $p = .460$).

Effect sizes

For the intervention group the effect sizes for the primary outcome measures of pain intensity and functional disability and for the secondary outcome measure of acceptance were close to medium (Cohen, 1988) (0.37, 0.36, and 0.38, respectively). In contrast, the effect sizes for the control condition revealed almost no changes (0.15, 0.06, and 0.12, respectively).

Table 3. Cross-sectional correlations in the treatment condition between the study variables at first and second assessment (T1 and T2; correlations at T2 are in italic)

Study variables	Pain intensity	Functional disability	Depression	Medication	Avoidance behaviour	Worrying	Fear of pain	Helplessness
Functional disability								
T1	.42***							
T2	*.50***							
Depression								
T1	.23**	.39***						
T2	*.28***	*.34***						
Pain medication								
T1	.22**	.16*	.11					
T2	*.18***	*.29***	*.20***					
Avoidance behaviour								
T1	.21**	.51***	.40***	.12				
T2	*.22**	*.58***	*.36***	*.17***				
Worrying								
T1	.15*	.33***	.60***	.15*	.39***			
T2	*.21***	*.44***	*.60***	*.23***	*.46***			
Fear of pain								
T1	.21**	.40***	.24***	.19**	.29***	.44***		
T2	*.11*	*.35***	*.27***	*.15**	*.40***	*.43***		
Helplessness								
T1	.33***	.58***	.50***	.09	.50***	.48***	.49***	
T2	*.41***	*.64***	*.44***	*.24***	*.57***	*.63***	*.50***	
Acceptance								
T1	−.12	−.16*	−.23***	−.10	−.21**	−.40***	−.18**	−.29***
T2	*−.26****	*−.26****	*−.40****	*−.19***	*−.23****	*−.51****	*−.19***	*−.48****

*$p < .05$, **$p < .01$, ***$p < .001$.

Cognitive-behavioural predictors of treatment outcomes

To facilitate the identification of predictors of the primary outcome variables, we computed correlations between all demographic variables, pain duration and all predictors at baseline (avoidance behaviour, worrying, fear of pain, helplessness, and acceptance) and the change scores of the outcome variables in the treatment condition. For pain intensity, no significant correlations were found apart from a correlation with acceptance, which proved statistically significantly related to a decrease in pain intensity in the treatment ($r = .20, p = .038$) but not in the control condition ($r = .05, p = .551$). To examine the effect of group on the predictive value of acceptance, the centred interaction term of group × acceptance was entered into the regression analysis as the fourth step after controlling for the outcome variable at step 1, group (treatment vs. control condition) at step 2 and acceptance at step 3. Table 4 shows that, after having controlled for baseline pain level (explaining 34%: F − change = 111.55, $df = 214$, $p < .001$), condition (treatment vs. control, explaining another 2%, $df = 213, p = .007$) and acceptance (not explaining any significant additional variance), the regression analyses with pain intensity at T2 as the dependent variable revealed that the interaction of acceptance and condition at step 4 significantly predicted another 1% of the pain intensity at T2 (F − change = 4.29, $df = 212, p = .024$). Beta coefficients of the full model demonstrated that the interaction of acceptance and condition contributed significantly to the patients' post-treatment level of pain ($p < .05$), indicating that after therapy those patients that had reported higher degrees of pre-treatment acceptance also had larger pain reductions than the patients reporting lesser degrees of pre-treatment acceptance (see Figure 2). With regard to functional disability, depression, and use of medication, avoidance behaviour proved associated with changes in depression and helplessness significantly correlated with change in medication intake. However, regression analyses failed to yield significant predictors. For illustration purposes, we split the sample into two groups (acceptance ≥ 13 and acceptance < 13) to show that patients with a higher pre-treatment level of acceptance profited more from treatment with respect to pain reduction.

Table 4. Regression analysis of change in pain intensity after multidisciplinary pain treatment

Order of entry	R^2 change	β
Dep. Variable: Pain T2		
1. Pain T1	.34***	0.57***
2. Group	.02***	0.10
3. ZCL Acceptance	.00	−0.08
4. Group × acc	.01*	−0.12*
Total R^2	.37	

*$p < .05$; ***$p < .001$.

Discussion

With the current study we sought to determine the effects of a multidisciplinary outpatient allocation protocol of chronic pain treatment on the physical and psychological outcomes of chronic pain patients and to trace process variables that could have a predictive value for treatment efficacy. Our findings showed that the participating patients tended to benefit from our pain allocation approach with regard to

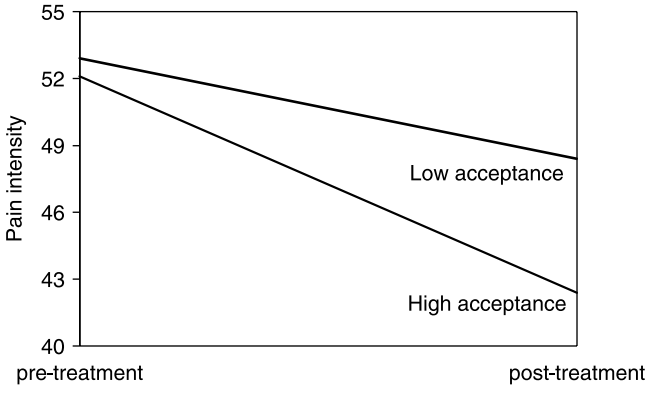

Figure 2. Change in pain intensity for patients with high/low acceptance (median split) in the treatment group between pre-treatment and post-treatment.

pain intensity and functional disability. As regards cognitive-behavioural treatment predictors, we established that patients reporting higher pre-treatment levels of acceptance benefited more from treatment in terms of pain reduction than patients indicating lower levels of acceptance.

In line with other studies on multidisciplinary treatment approaches (Fishbain *et al.*, 1997; Flor *et al.*, 1992; McCracken & Turk, 2002; van Tulder *et al.*, 2001), the treatment effects for pain and functional disability were significant although generally not more than small to medium. In contrast, depression did not diminish beyond natural course. This lack of effect may be due to negative mood not being the main focus of the treatment modalities delivered, which is especially the case in pharmacological and TENS programmes. As only a relatively small percentage of our patients received treatment specifically aimed at reducing their depressive symptoms, it would be worthwhile if future studies were to also evaluate such targeted treatment modules. We also did not find any significant reductions in medication consumption beyond the natural course, which is congruent with Becker *et al.*'s findings (Becker, Sjogren, Bech, Olsen, & Eriksen, 2000). Before being referred to our pain centre many of the patients had already had their medication regimen revised in a regional pain centre. Moreover, our centre's pharmacological intervention was not exclusively aimed at reducing the patients' drug intake. It also targeted elimination of the uncontrolled, pain-contingent use of medication through which in many cases stabilization was obtained but no overall reduction. Clearly, an adequate delineation of treatment effects on medication intake merits a different operationalization. The overall moderate effects may also be attributed to large individual differences in outcomes, underscoring the need for reliable predictors of treatment effects (Evers *et al.*, 2002; Keefe *et al.*, 2004).

Of all possible cognitive-behavioural predictors of treatment outcome, only acceptance predicted pain reduction. Contrary to our expectations, the patients with higher pre-treatment levels of acceptance proved to show more reduction in pain. Several earlier studies had indeed supported the importance of acceptance in chronic pain. Cross-sectional and prospective studies evaluating various chronic pain populations showed that acceptance was consistently associated with lower pain intensity, superior daily functioning, and fewer depressive symptoms (Evers *et al.*, 2001; McCracken, 1998; McCracken, Spertus, Janeck, Sinclair, & Wetzel, 1999; Viane, Crombez, Eccleston, Devulder, & de Corte, 2004; Viane *et al.*, 2003). In their recent

correlational study of chronic pain patients, McCracken and Eccleston (McCracken & Eccleston, 2006) reported that acceptance accounted for more variance in functional disability and depression than any of the other cognitive-behavioural factors. Pain treatment studies have reported similar findings. Geiser (1993), for instance, found that increases in acceptance during multidisciplinary pain treatment predicted a decrease in post-treatment functional disability. Vowles, McNeil, and Gross (2005) showed that in chronic back-pain patients an acceptance-based pain treatment reduced impairment more than a control-based intervention did. Although in our study higher acceptance only modestly predicted pain reduction, the results are a first indication of acceptance as a predictor of treatment outcome and as an instrument to optimize patient selection and subsequent treatment outcomes. Cognitions of acceptance may thus reflect that a patient's focus is more directed towards (augmenting) adaptive coping behaviour, which positively affects treatment outcome, supporting previous findings correlating acceptance with less attention to pain (Viane *et al.*, 2004) and active coping behaviour (Evers *et al.*, 2001). These and the current findings underscore the contribution of acceptance as an adaptive coping strategy, thus extending our understanding of the mechanisms of improvement in multidisciplinary chronic pain treatment approaches such as goal adjustment and preparing to live with the pain. The current support for acceptance as a predictor of superior treatment outcome provides a new theoretical starting-point for future studies of pain treatment outcomes that are achieved with acceptance-based approaches (McCracken *et al.*, 2005). The lack of significant predictive power of the other cognitive-behavioural factors is generally in line with earlier chronic pain treatment studies (McCracken & Turk, 2002; Vlaeyen & Morley, 2005) that also yielded inconsistent results. Evidently, the interaction between the various cognitive-behavioural factors and pain treatment might be more complex, requiring more in-depth studies into potential reciprocal effects of cognitive-behavioural predictors for short-term treatment effects.

Several aspects warrant a cautious interpretation of the results reported. Firstly, it cannot be excluded that there was some selection bias due to non-randomized treatment allocation. However, patients were allocated to the intervention or control condition on a consecutive basis so the investigators had no influence on the allocation of individual patients, one of the preconditions for randomization. In addition, the two groups did not differ with respect to demographic or pain-related data. In future studies, propensity score matching (McCaffrey, Ridgeway, & Moral, 2004) may be applied if the patient characteristics in the intervention and control groups do differ due to non-randomized allocation. Secondly, the patients in the control condition were evaluated after a waiting-list period of 3 months. A randomized controlled trial or an active control condition (e.g. a support group) would have allowed elimination of a possible bias in treatment effects. Thirdly, as the allocation to the intervention or the control group was based on time of entry, a time bias (e.g. seasonal effects) cannot be excluded. Fourthly, all our participants were acknowledged chronic pain sufferers referred for treatment to our specialized, academic pain centre and had, on average, experienced pain in excess of 5 years. Most of the participants indicated to have received previous medical treatment comprising one or more comparative treatment modules in recent years. Hence, we cannot exclude a selection bias. In addition, the anticipation of imminent pain treatment may have raised treatment expectations in the control group, which may have positively affected their pain cognitions and subsequent course of pain behaviour. Moreover, our search for outcome predictors was based on the short-term

effects of various, patient-tailored chronic pain treatment modules and the reported results cannot be generalized to long-term outcomes. A follow-up study might provide more insight into the stability of treatment effects (Maruta, Swanson, & McHardy, 1990). At this moment we know of only one study on the long-term natural course in chronic pain patients that showed that acceptance predicted a decrease of pain and depression after 1 year (Evers *et al.*, 2001). Finally, it can be argued that in daily life the multidimensional problems of chronic pain, functional disability, depression, and use of medication are interrelated such that it hampers most attempts at out-patient interventions aimed at changing one or more of these modalities as the patient's contacts are limited and treatment conditions can only marginally be controlled. This is confirmed by the findings of de Williams *et al.* (1996) and Härkäpää, Jarrikoski, Mellin, and Hurry (1989) showing that a multidisciplinary in-patient pain treatment was superior to an out-patient programme in terms of pain reduction and improvement of functional ability. Possibly, the treatment intensity in time and frequency of in-patient interventions might be more important for treatment success than the content of specific (multidisciplinary) treatment schemes.

Despite these limitations, our study has provided further evidence that patients suffering from chronic heterogeneous pain tend to profit from pain treatment schemes in that the tailored interventions reduce their pain levels and functional disability. We also found preliminary support that patients who are accept their condition are most likely to benefit from treatment in terms of pain reduction.

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