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Chronic Low-Back Pain: What Does Cognitive Coping Skills Training Add to Operant Behavioral Treatment? Results of a Randomized Clinical Trial

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This study examined the supplemental value of a cognitive coping skills training when added to an operant- behavioral treatment for chronic low-back pain patients. The complete treatment package (OPCO) was compared with an operant program + group discussion (OPDI) and a waiting-list control (WLC). After the WL period, the WLC patients received a less protocolized operant program usually provided in Dutch rehabilitation centers (OPUS). Regression analyses showed that, compared with WLC, both OPCO and OPDI led to less negative affect, higher activity tolerance, less pain behavior, and higher pain coping and pain control. At posttreatment, OPCO led to better pain coping and pain control than OPDI. Calculation of improvement rates revealed that OPCO and OPDI had significantly more improved patients than OPUS on all the dependent variables. The discussion includes findings regarding treatment credibility, compliance, and contamination bias.

Chronic pain syndromes such as chronic low-back pain (CLBP) disrupt the lives of many people and are responsible for enormous costs for health care and society. Van Tulder, Koes, and Bouter (1995) estimated the total direct medical costs of back pain in the Netherlands in 1991 at U.S.$367.6 million and the total indirect costs for the entire labor force at U.S.$4.6 billion. When traditional and biomedical treatments are unsuccessful, and back pain disability grows, CLBP patients are often referred to rehabilitation centers for interdisciplinary treatment. These centers often adopt a biopsychosocial or behavioral rehabilitation model that assumes that disability is not only determined by the underlying pathology but also (and perhaps more) by social, cognitive, emotional, and behavioral factors (Vlaeyen, 1991). Operant conditioning principles, psychophysiologic concepts, and concepts from cognitive psychology are applied to both the assessment and treatment of chronic pain (Keefe & Gil, 1986).

Several reviews on behavioral rehabilitation for CLBP (Cohen, Naliboff, & McArthur, 1989; Linton, 1986; Turner & Chapman, 1982) have shown that operant behavioral treatments lead to an increase in activity tolerance and a decrease in medication use.

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From a meta-analysis in which 65 studies on the effectiveness of multidisciplinary treatment programs for back pain were included, Flor, Fydrich, and Turk (1992) concluded that these programs are more effective than no treatment at all, a waiting list, and monodisciplinary treatments. Morley, Eccleston, and Williams (1999) concluded in their systematic review and meta-analysis of only randomized controlled trials, comparing the effectiveness of cognitive–behavioral treatments with waiting-list controls and alternative-treatment control conditions, that cognitive–behavioral treatments produced significantly greater changes in pain experience, cognitive coping, and appraisal and reduced behavioral expression of pain. Differences on the following domains were not significant: mood/affect, negative appraisals such as catastrophizing, and social role functioning. Vlaeyen, Haazen, Schuerman, Kole-Snijders, and van Eek (1995), who were also interested in the relative effectiveness of different kinds of cognitive–behavioral interventions, concluded that these differential effects are small. If differences are found at posttreatment, they usually disappear at follow-up. The authors offered three possible explanations for the lack of differential effect. The first is that the treatment ingredients are not always precisely defined and the contents are not clear. The terms *behavioral* (Nicholas, Wilson, & Goyen, 1991), *operant behavioral* (Turner & Clancy, 1988), and *operant* (Vlaeyen, Haazen, et al., 1995) refer to the operant learning principles, originally introduced by Fordyce (1976), although therapists often fail to include spouses in their program (e.g., Nicholas et al., 1991). The term *behavioral* is also used for a cognitive treatment with relaxation (Turner & Clancy, 1988) and for a multimodal treatment package (Nicholas, Wilson, & Goyen, 1992). The term *cognitive* refers to several different forms of treatment, such as attention-diversion techniques, rational–emotive therapy, stress inoculation, and multimodal treatments (Kole-Snijders, Vlaeyen, van Eek, Schuerman, & Groenman, 1990b). The second possible explanation for not finding differential effects may be the choice of dependent variables that may not be sensitive enough to detect differential effects. Most researchers use only self-report questionnaires. Only a few studies also include observational measures (Turner & Clancy, 1988; Turner, Clancy, McQuade, & Kardenas, 1990; Turner & Jensen, 1993; Vlaeyen, Haazen, et al., 1995). A third explanation could be insufficient statistical power, given the relatively small sample sizes in most of the studies.

So far, little is known about the necessary ingredients for effective cognitive–behavioral treatments. Component analyses, such as the Turner et al. (1990) study, are scarce but badly needed to isolate the active components of pain rehabilitation programs, which inevitably must lead to more efficient use of health care resources. The present study was designed as an attention-controlled randomized clinical trial that is aimed at examining the supplemental value of a cognitive program with relaxation when added to an operant treatment as described by Fordyce (1976). In addition, the supplemental value of typical characteristics of operant treatment, such as treatment contract, spouse training, group education, and fixed duration, are examined. The study also included an economic evaluation (e.g., the assessment of direct and indirect costs and quality of life measures), which is described elsewhere (Goossens et al., 1998).

We hypothesized that the combination of a cognitive coping skills training with an operant behavioral treatment would be more effective than operant behavioral treatment only, especially on measures of pain coping and control and negative affect. As compared with a waiting-list condition, both interventions were hypothesized to show a reduced behavioral expression of pain. Finally, we hypothesized that the protocolized treatments, which include a number of therapeutic ingredients that are often advocated in the literature (e.g., a written treatment contract, spouse training, use of group format, and preset and fixed treatment duration), would be more effective than a usual rehabilitation program that lacked these new features.

Method

Participants

The protocol was approved by our institutional ethics committee, and all patients gave written informed consent. Patients were referred to the "Hoensbroeck" Rehabilitation Center by their general practitioner or by a medical specialist. The inclusion criteria for the study were low-back pain for at least 6 months, age between 18 and 65 years, a discrepancy between objective findings and pain complaints, and cooperation of the spouse (or in the absence of a spouse, a relative or close friend) to participate in a weekly spouse training program. The following criteria were used to exclude patients: illiteracy, pregnancy, involvement in litigation concerning social disability income, alcohol or drug abuse, serious psychopathology (e.g., antisocial personality disorder, psychosis, or organic brain damage; patients with major depression were not excluded), and specific medical disorders requiring medical treatment or rendering patients unable to participate in the program. To check these criteria, we conducted interviews using a rehabilitation physician, a psychologist, and a social worker and had patients complete the Minnesota Multiphasic Personality Inventory (MMPI; Hathaway & McKinley, 1967) and the Dutch Personality Questionnaire (Luteijn, Starren, & van Dijk, 1985).

From the 237 CLBP patients who were referred to the study, 62 (26%) did not meet these criteria. The most important reason for not entering the study was severe psychopathology (44%). These 62 patients had elevated scores on all scales of the MMPI, except Hypochondriasis, Hysteria, Masculinity–Femininity, and Hypomania. Their mean T score on eight clinical scales (a general measure for psychopathology; Graham, 1977) was 71.9, which was significantly higher than that for the patients who entered the study (mean score = 66.2), $t(206) = -3.85$, $p < .001$. There were no differences in gender, pain duration, education, disability compensation, use of supportive equipment for ambulation, or the number of previous back surgeries. The patients who did not meet the criteria were older than the other patients, $t(234) = -3.07$, $p = .003$.

Because 16 patients were not willing to participate in the program, 159 patients were included in the randomization. After randomization, but before the first measurement took place, another 11 patients withdrew their consent. They were replaced by unrandomized patients from a waiting list with the same age and gender. Eventually, 148 patients participated in the three conditions. The final sample consisted of 54 men and 94 women, with a mean age of 39.8 years ($SD = 9.1$, range = 18–64), who had a mean pain duration of 9.8 years ($SD = 8.7$, range = 10 months–40 years). Most patients (78%) did not have more than 10 years of education. Of the total sample, 79% received financial disability compensation, with a mean duration of 3.7 years. Before entering the program, 39% had received back surgery and 28% used supportive equipment for ambulation.

There was considerable comorbidity, such as phobias (40% of the men and 46% of the women, as measured with the Fear Survey Schedule [FSS–III–R; Arrindell & Zwaan, 1982; Wolpe & Lang, 1964]; cutoff total scores: for men, >105; for women, >122), depressive disorder (30%, as measured with the Beck Depression Inventory [BDI; Beck, Rush, Shaw, & Emery, 1979]; cutoff total score >17), obsessive–compulsive disorder (13%, as measured with the Maudsley Obsessive Compulsive Inventory [Hodgson & Rachman, 1977; Kraaykamp, Emmelkamp, & van den Hout, 1990]; cutoff total score >11), and serious marital problems (13%, as measured with the Maudsley Marital Questionnaire [Arrindell, Boelens, &

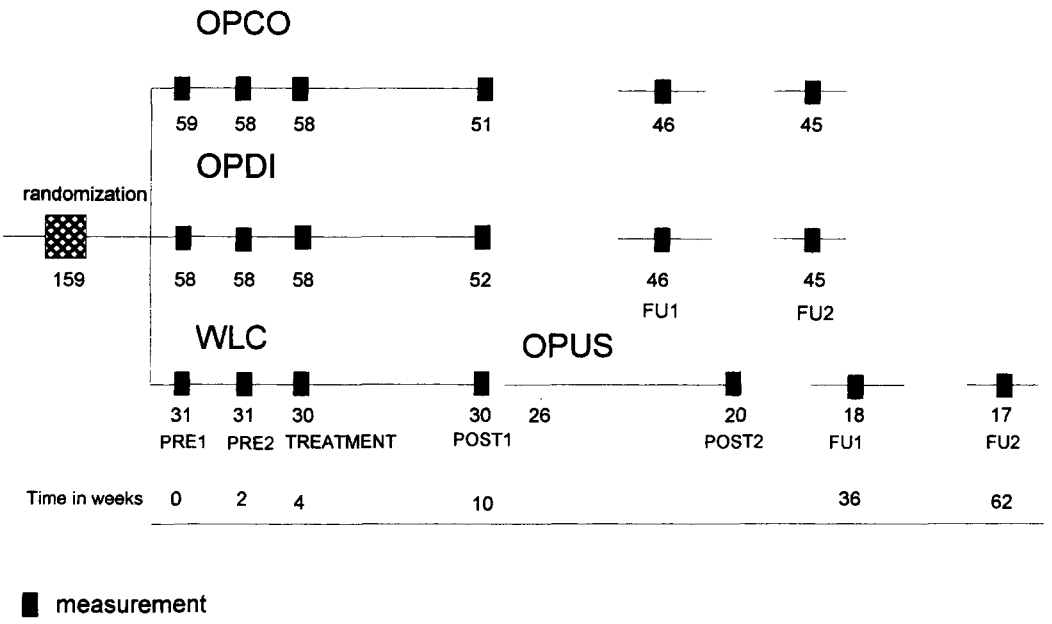

Figure 1. Design. Numbers refer to the number of patients at each measurement. OPCO = operant behavioral treatment and cognitive coping skills training; OPDI = operant behavioral treatment and group discussion; WLC = waiting-list control condition; OPUS = operant behavioral treatment as usual; PRE1 = Pretreatment 1; PRE2 = Pretreatment 2; POST1 = Posttreatment 1; POST2 = Posttreatment 2; FU1 = 6-month follow-up; FU2 = 12-month follow-up.

Lambert, 1983; Crowe, 1978]; cutoff score on the first subscale [Marital Dissatisfaction] >20).

Study Design

A randomized controlled design was chosen consisting of two measurements before treatment (Pretreatment 1 and Pretreatment 2, with a 2-week interval), one during treatment, one after treatment (posttreatment), and two follow-up measurements, 6 (Follow-Up 1) and 12 months (Follow-Up 2) after termination of treatment. In the analyses, the mean score of the two pretreatment measurements was used because there were no significant differences between the two assessments. After completing the second pretreatment assessment, patients immediately received an operant behavioral treatment with cognitive coping skills training (OPCO) or an operant behavioral treatment with a group discussion program (OPDI) or they were assigned to the waiting-list control (WLC) condition. Both OPCO and OPDI consisted of 5 weeks of inpatient treatment and 3 weeks of outpatient treatment 3 days a week. WLC consisted of patients who were measured four times before treatment (Pretreatments 1 and 2, treatment, and posttreatment) with the same time intervals as the patients in OPCO and OPDI. After these four measurements, these patients received an operant behavioral treatment as usual (OPUS) and were also measured after treatment (Posttreatment 2) and at follow-up (Follow-Ups 1 and 2). The posttreatment measurement from the WLC condition served as the pretreatment measurement for OPUS. The design is illustrated in Figure 1. The physician, psychologist, and social worker who participated in the screening procedure to check the inclusion and exclusion criteria were unaware of the randomization scheme and did not know to which condition the patient would be assigned.

To achieve comparable patients across conditions, we prestratified the patients on the basis of gender and age (<40 or ≥40 years). Each of the three conditions was filled by groups of 5 patients at a time. Allocation to the three conditions occurred following a randomization procedure. Before the first pretreatment measurement, each patient was given a number that an independent researcher blindly drew and assigned to one of the three conditions. This procedure was repeated after each 15th eligible patient completed the initial screening process. If a patient dropped out before the first pretreatment assessment, he or she was replaced by a new patient with the same gender and age who had not yet been included in a randomization procedure. To avoid contamination, we never provided OPCO and OPDI simultaneously; instead, OPCO and OPDI were provided sequentially according to a fixed schedule. The research assistant responsible for the measurements and observations and the treatment staff (except for the behavior therapist who gave the cognitive treatment and group discussion) were unaware of this schedule. If the number of patients screened was too small to fill three groups by the time one of the groups needed to start, patients were randomly assigned to OPCO and OPDI only. A WLC condition was then included in the next randomization. This occurred only twice throughout the study.

Treatments[1]

Operant behavioral treatment. Based on program descriptions by Fordyce (1976) and Roberts (1986), the operant behavioral treatment was aimed at increasing healthy behaviors and decreasing pain behaviors. It was provided by the entire rehabilitation team using a manualized treatment protocol. During the first 2 weeks, baseline levels of activities and pain behaviors were registered. Patients were asked to engage in activities until pain or other physical discomfort prevented them from continuing. Subsequently, a treatment contract was made with the patient in which concrete goals and quota were written down. The patient agreed to follow the quota according to the activity–rest contingency principle. If necessary, medication use was managed in a time-contingent fashion. Throughout the

[1] Copies of treatment manuals can be obtained from Ank M. J. Kole-Snijders, Hoensbroeck Rehabilitation Center, Zandbergsweg 111, 6432 CC Hoensbroek, the Netherlands.

treatment program, physical therapists provided 50 hr of individual treatment (with the strict exclusion of passive-treatment modalities) and 38 hr of group treatment. Occupational therapy consisted of 12 hr of individual contact and 26 hr of group training. Patients were taught to increase their sitting and standing tolerance and developed a daily activity schedule according to operant principles to be used at home. In weekly meetings of 15 min between the patient and the rehabilitation team, progress was discussed and ample reinforcement was provided. The psychologist saw the patients individually in weekly sessions of 30 min.

An important part of the operant behavioral treatment was the spouse group training, which consisted of 7 weekly sessions of 90 min. The training was given by two behavior therapists, who used a treatment protocol. Spouses were explained the operant model of pain and were taught to differentiate between pain and healthy behaviors, to identify their own responses to these behaviors, and to socially reinforce healthy behaviors rather than pain behaviors. Role-playing and homework assignments after each session were used to practice newly learned skills.

Cognitive coping skills training. The cognitive treatment was aimed at increasing pain control and self-efficacy expectations. The program consisted of 12 group sessions of 90 min according to a treatment manual given by a skilled behavior therapist and consisted of three phases: a reconceptualization phase, a skills acquisition phase, and a generalization phase. The goal of the reconceptualization phase was to modify the pain experience in terms that imply self-control and resourcefulness. Patients learned that hurt does not necessarily mean harm and that pain is influenced by multiple factors. In the skills acquisition phase, patients practiced two types of imagery: imaginative transformation of the pain sensation and pain-incompatible sensory imagery. These techniques were drawn from Diamond (1977) and Fernandez (1986). In addition, applied relaxation (Öst, 1988) was used to teach patients to relax and to use relaxation in situations that were reported to be personally stressful. Electromyography (EMG) biofeedback was used to help patients recognize changes in tension and relaxation. Each session ended with homework assignments that consisted of texts to read and tapes with the imagery or relaxation exercises to listen to.

Group discussion program (attention control). To provide an attention control to compare with the cognitive treatment, we developed a group discussion program during which patients were requested to read parts of a book about pain written for pain patients (Tromp, 1989; Winter, 1988) and to then share the information and their own thoughts with the other group members. In addition, participants listened to various audiotaped music fragments. Each session ended with a homework assignment that consisted of brief relevant reading assignments and listening to audiotaped musical fragments. The group discussion was conducted by the same behavior therapist who was in charge of the cognitive treatment and consisted of the same number of sessions. The use of EMG biofeedback was demonstrated once and without further practice. Hence, neither the participants nor the therapists of the interdisciplinary rehabilitation staff who were in charge of the educational program were aware of the difference between the two treatments.

Operant behavioral treatment as usual. In the operant behavioral treatment as usual, the operant principles were applied to individual patients. It contained the ingredients that therapists at the rehabilitation center already used before the start of this study: baseline phase and quota system. The program was less protocolized, and a number of treatment ingredients were not provided, such as spouse training, group program, and the use of a written treatment contract. The duration of treatment was not preset but was planned for each patient individually.

Concurrent interventions. During the rehabilitation program, no concurrent interventions took place. Health care use during the follow-up was monitored by means of a cost diary (Goossens et al., 1998).

Attrition

To determine if participants who dropped out or did not enter the study differed from those who stayed in the study, we used *t* tests to test the differences on pretreatment measurements, demographic measures, and MMPI scores.

Outcome Measures

The study included a number of self-report and observational measures (see Table 1).

Activity tolerance. Behavioral Approach Tests (BATs; Kole-Snijders, Vlaeyen, van Eek, Schuerman, & Groenman, 1990a) were used, during which patients were asked to (a) walk and (b) ride a bicycle and stop if pain prevented them from continuing, up to a preset maximum time of 7 and 14 min, respectively. The walking distance and walking and bicycling time were recorded.

Pain behavior. Just after termination of the BAT, the Checklist for Interpersonal Pain Behavior (CHIP; Vlaeyen et al., 1990a) and the Pain Behavior Scale (PBS; Richards, Nepomuceno, Riles, & Suer, 1982; Vlaeyen et al., 1990b) were completed by a research assistant, who was unaware of the allocation of patients to conditions. Both the CHIP and the PBS are reported to be reliable and valid measures of overt pain behaviors. The interrater reliabilities for CHIP factors Distorted Mobility (DM), Verbal Complaints, and Non-Verbal Complaints are .83, .77, and .67, respectively. The interrater reliability for the PBS is .74. In spite of blinding, observer bias in regard to condition and measurement time cannot be totally excluded. Relevant information might have been released during the conversations with the patients. Therefore, video recordings were made from 60 randomly selected measurements. On the basis of these recordings, two independent observers also completed the CHIP and the PBS and these scores were compared with those of the research assistants. Multivariate analyses of variance (MANOVAs) with the CHIP–DM and the PBS as dependent variables and observer (research assistant vs. video observer), measurement time (pre- vs. posttreatment), and treatment condition (OPCO or OPDI vs. WLC condition) as independent variables revealed no significant Observer × Measurement interaction nor a significant Observer × Condition interaction. Thus, it seems that the scoring of observation scales by the research assistants was not influenced by possible knowledge about the kind of measurement or the treatment condition.

Pain cognitions. Three questionnaires were used: the Pain Cognition List (PCL; Vlaeyen et al., 1990), the Dutch version of the Coping Strategies Questionnaire (CSQ; Rosenstiel & Keefe, 1983; Spinhoven, ter Kuile, Linssen, & Ganzendam, 1989), and the Dutch version of the Multidimensional Pain Locus of Control Questionnaire (MPLC; Engstrom, 1983; ter Kuile, Linssen, & Spinhoven, 1993). Besides the full CSQ, only the PCL factors Pain Impact, Catastrophizing, and Outcome Efficacy and the MPLC Internal Locus of Control scale were included.

Pain intensity. A Visual Analog Scale (VAS) as well as the Number of Words Chosen and Pain Rating Index were used from the McGill Pain Questionnaire (Melzack, 1985; van der Kloot & Vertommen, 1989).

Somatic anxiety. The Nijmegen Hyperventilation Questionnaire (van Doorn, Colla, & Folgering, 1983) was used as a measure for somatic anxiety and awareness.

Negative affect. The BDI (Beck et al., 1979) and the total score from the FSS-III-R (Arrindell & Zwaan, 1982; Wolpe & Lang, 1964) were included in this study.

Psychopathology. The mean *T* score on eight clinical scales (Scales 5 and 0 were excluded) of the MMPI (Hathaway & McKinley, 1967) was used. Graham (1977) suggested this to be a valid general measure of psychopathology.

Biomedical data. To be able to control for differences in biomedical status, we included the weighted score of the Medical Examination and Diagnostic Information Coding System (MEDICS; Rudy, Turk, Brena, Stieg, & Brody, 1990) to quantify biomedical findings.

Variable Reduction Procedure

We chose to analyze the data from the dependent variables that were least correlated. If correlated variables are combined, the inflation of the Type I error rate can be prevented and the combined variables are more reliable. To reduce the number of dependent variables, we conducted two principal-components analyses on the basis of the mean data of the pre-

Table 1
Original Variables and Results of First- and Second-Order Principal-Components Analyses (PCAs)

Original variable	Factor loading on first-order analysis	First-order PCA	Factor loadings on second-order analysis	Second-order PCA
PBS	.66	Pain Behavior	−.79	Motoric Behavior
CHIP				
Verbal Complaints	.75			
Non-Verbal Complaints	.70			
Distorted Mobility	.54	Activity Tolerance	.85	
BAT				
Walking Distance	−.96			
Walking Time	−.95			
Bicycle Time	−.79			
MPLC–IN	.82	Pain Control	.64	Coping Control
PCL–OE	.82			
CSQ				
Perceived Control	.58			
Attention Diversion	.81	Pain Coping	.74	
Reinterpreting Pain	.72			
Ignoring Pain	.71			
Praying and Hoping	.63			
Positive Self-Talk	.72			
Increasing Activities	.78			
Relaxation	.64			
PCL				
Pain Impact	.73	Catastrophizing	.87	Negative Affect
Catastrophizing	.86			
NHQ	.55			
CSQ–CA	.85			
VAS	.44/−.41[a]			
MPQ				
Number of Words Chosen	.92	Pain Intensity	.65	
Pain Rating Index	.86			
		Depression (BDI)	.89	
		Fear (FSS–III–R)	.57	

Note. PBS = Pain Behavior Scale (Richards et al., 1982; Vlaeyen et al., 1990b); CHIP = Checklist for Interpersonal Pain Behavior (Vlaeyen et al., 1990a); BAT = Behavioral Approach Test (Kole-Snijders et al., 1990a); MPLC = Multidimensional Pain Locus of Control Questionnaire (Engstrom, 1983; ter Kuile et al., 1993 [IN = Internal Locus of Control]); PCL = Pain Cognition List (Vlaeyen, Geurts, et al., 1990 [OE = Outcome Efficacy]); CSQ = Coping Strategies Questionnaire (Rosenstiel & Keefe, 1983; Spinhoven et al., 1989 [CA = Catastrophizing]); NHQ = Nijmegen Hyperventilation Questionnaire (van Doorn et al., 1983); VAS = Visual Analog Scale; MPQ = McGill Pain Questionnaire (Melzack, 1985; van der Kloot & Vertommen, 1989); BDI = Beck Depression Inventory (Beck et al., 1979); FSS–III–R = Fear Survey Schedule (Arrindell & Zwaan, 1982; Wolpe & Lang, 1964).
[a] Loaded .44 on pain intensity and −.41 on pain control.

treatment assessments (Kerns, Turk, Holzman, & Rudy, 1986).[2] This strategy has the advantage of aggregating measures that are correlated, producing a smaller set of more reliable composite scores (Turk, Rudy, & Sorkin, 1993). The first analysis included only measures of pain; the second also included measures of negative affect.

In the first analysis, measures for pain cognitions, pain behavior, activity tolerance, and pain intensity were included. The principal-components analysis with oblimin rotation resulted in six factors with eigenvalues greater than 1 (see Table 1), which explained 69% of the total variance: Activity Tolerance, Pain Coping, Catastrophizing, Pain Control, Pain Intensity, and Pain Behavior. The VAS was not included in one of the factors because the factor loading was too low (<.45 on all factors).

The second principal-components analysis was performed, in which the above-mentioned six factors, the BDI, and the FSS–III–R were included. After oblimin rotation, this resulted in three factors with eigenvalues greater than 1, which explained 65% of the total variance: (a) Motoric Behavior, consisting of Pain Behavior (with a negative factor loading) and Activity Tolerance (with a positive factor loading); (b) Coping Control, consisting of Pain Coping and Pain Control; and (c) Negative Affect, consisting of Catastrophizing, Pain Intensity, Depression, and Fear. Table 1 displays the original variables and the results from the first and second principal-components analysis. After transformation into standard z scores (score minus the mean pretreatment score divided by the standard deviation of the mean pretreatment score) we calculated composite (i.e., sum) scores for each factor. The three factors do not correlate significantly ($r = -.14$ to .04). These composite scores were used in the subsequent analyses.

Treatment Credibility

In studies comparing the effectiveness of two or more therapies, differences in treatment credibility can influence the outcome. In this study, the credibility of the cognitive coping skills training and of the group discus-

[2] A table of raw scores on all of the dependent variables can be obtained from Ank M. J. Kole-Snijders (see Footnote 1 for address).

sion program was measured similarly to the procedure described by Borkovec and Nau (1972). Both at the start of the program and at the last session, patients rated the extent to which they believed that the program would help them to cope better with their pain on a VAS ranging from *not at all* to *very much*. The belief score was calculated by measuring the number of centimeters from *not at all* to the vertical line placed by the patient. Subsequently, certainty of this belief was scored on a Likert 5-point rating scale ranging from 1 (*not certain at all*) to 5 (*very certain*). A total credibility score was calculated as the product of the belief and certainty scores. For the certainty score, the values 1, 1.25, 1.5, 1.75, and 2 were assigned to the ratings. This produced a normally distributed total credibility score (Kolmogorov–Smirnov goodness-of-fit $Z = .655$, $p = .784$).

Compliance

To measure patients' compliance, we checked their written homework assignments from the cognitive coping skills training and the group discussion. This is especially important for OPCO because regular practice is required to sufficiently achieve these pain coping skills. For OPCO, the number of times that the patients filled out their pulse rate before and after a relaxation exercise was counted as well as the number of times they described the results of an imagery exercise. For OPDI, the number of times patients wrote comments about the music they had listened to and about the texts they had read was counted.

Contamination Check

The group discussion with music was given by the same experienced behavior therapist who gave the cognitive coping skills training to increase the blinding of patients and other therapists to the treatment condition. This implies, however, that contamination bias might have influenced the effect of the programs. To be able to check this, we made audiotapes of several sessions of both programs according to a preset schedule. Ten fragments of 5 min each, taken from different sessions in both programs, were randomly selected and presented to nine behavior therapists who worked at different mental health treatment centers. After listening to each fragment, therapists were asked to determine whether the fragment belonged to the pain coping skills training or to the group discussion program.

Baseline Comparisons

To describe the study population and check the results of randomization, we compared the pretreatment measurements for the demographic variables and the three dependent variables (motoric behavior, coping control, and negative affect) for the patients in the three conditions using chi-square analyses and analyses of variance.

Statistical Procedure

To test the differences between the conditions, we used multiple linear regression analyses with a hierarchical backward elimination method. The analysis was done for the posttreatment and follow-up data of the three main dependent variables. At posttreatment, the differences were tested between OPCO, OPDI, and the WLC condition. At posttreatment and follow-up, the differences were tested between OPCO, OPDI, and OPUS (using Posttreatment 2 data) and between OPCO and OPDI. The independent variables were the pretreatment measurement of the dependent variable (for OPUS, this was posttreatment from the WLC condition); treatment condition; gender; age; level of education; pain duration; compensation status; biomedical status (measured by the MEDICS); psychopathology (mean T score for the clinical scales, except Scales 5 and 0, from the MMPI, as suggested by Graham, 1977); treatment credibility (only for the comparison between OPCO and OPDI); and the interaction variables Age × Treatment, Gender × Treatment, and Pretreatment Measurement × Treatment. The treatment condition always remained in the regression model, but the other independent variables were added to increase the power of the analysis and were subsequently eliminated to keep only the significant ones. At each step of the analysis, tests were done to check for high collinearity (variance inflation factor >10) and/or outliers (using Cook's distance and studentized residual). If Cook's distance was greater than 1, the case was removed from the analysis. If the Studentized residual was less than −3 or greater than 3, the case was removed, providing that Cook's distance of this case was considerably higher than that of the other cases. By looking at plots of the relationship between each independent variable and the dependent variable, we excluded a possible curvilinear relationship. We also checked whether the prediction errors were normally distributed (Studentized residual). For each dependent variable, the initial regression model included all independent variables and interactions mentioned above. Nonsignificant interactions ($p > .05$) were deleted from the model. If a significant interaction was found, a median split on the independent variable was used for a separate regression analysis. Next, nonsignificant ($p > .10$, two-tailed) predictors were deleted one by one, except the treatment factor, which always remained in the model.

Improvement Rate

To detect regression to the mean, we conducted paired T tests of posttreatment versus (Pretreatment 1 + Pretreatment 2)/2 within the WLC group. If this test showed a significant improvement, this indicated either regression to the mean or some other change unrelated to treatment (e.g., spontaneous recovery). To correct for regression to the mean and other threats to the internal validity, we computed the 90% prediction interval for individual change scores, that is, mean of change ± (1.65 × SD of change), only using the WLC group. Under the null hypothesis of no-treatment effect, this interval should include 90% of the individual change scores in each treatment group (OPCO and OPDI). Within each treatment, we classified patients as lying within, below (worsened), or above (improved) this interval and conducted a chi-square test of this null hypothesis using the observed and expected frequencies of the classification.

Intention-to-Treat Analysis

At Follow-Up 2, 27% of the patients had dropped out of the study. The reasons for dropout were illness, not reaching goals, and dissatisfaction. Dropout disrupts the randomization and may thus bias the treatment-effect evaluations. Therefore, an additional intention-to-treat analysis was done in which the missing values of dropouts were replaced by the mean score of the least favorable quartile of the patients at the respective measurement. Only patients who participated in at least the first measurement were included because the data from this measurement were needed as a covariate for the analysis and could not be derived from other sources. We then repeated the regression analyses using the same procedure as described above.

Results

Attrition

The 27 patients who decided not to enter the study before the pretreatment measurement had a shorter pain duration than the other patients, $t(173) = 2.24$, $p = .028$, and were less depressed (using the MMPI D), $t(173) = 2.34$, $p = .023$. There were no other significant differences on demographic measures or on other scales of the MMPI. It is possible that these patients suffered less from their complaints.

At the pretreatment measurement, the OPCO group consisted of 59 patients, the OPDI group of 58 patients, and the WLC group of 31 patients. Of the 148 patients who started the measurements, results were available for 133 patients at posttreatment and 107 at

Follow-Up 2. For the WLC condition, 30 patients (96%) completed the posttreatment measurement; 26 patients (83%) entered OPUS. Attrition at Follow-Up 2 was not equally divided over treatment conditions: 24% for OPCO, 24% for OPDI, and 43% for OPUS. The patients who dropped out of the study did not differ from the remaining patients on gender, age, education, pain duration, disability compensation, or use of supportive equipment for ambulation ($p \geq .150$) or on the pretreatment scores of the dependent variables ($p \geq .487$). The main reasons for dropping out of the study did not differ between conditions.

Baseline Comparisons

Patients in the three conditions did not differ significantly on the pretreatment measurement for demographic variables (see Table 2). In spite of the careful randomization procedure, there was a difference for the dependent variables: Patients in the OPCO group scored lower on motoric behavior, which means that they had a lower activity tolerance and showed more pain behavior than patients in the OPDI group or the WLC condition. The pretreatment measurements were therefore included in the regression analyses as a covariate.

Treatment Credibility

Although the cognitive treatment was judged higher on treatment credibility than the group discussion (10.0 vs. 8.9), this difference was not statistically significant before treatment, $t(114) = 1.44$, $p = .152$. After treatment, the cognitive program was again rated as more credible (9.9 vs. 9.0), but this difference was not significant either, $t(101) = 0.90$, $p = .370$. This suggests that the effectiveness of both programs was not substantially influenced by differences in treatment credibility.

Compliance

For OPCO, patients completed on average 63% of the relaxation exercises and about 75% of the imagery exercises. The percentage of patients who completed all the homework assignments was 14% for the relaxation exercises and 36% for the imagery exercises. For OPDI, patients completed an average of 66% of the homework assignments for music and about half of the assignments for the texts. Only 14% of the patients wrote down a comment on each piece of music and 10% on each text. Apparently, the patients did not have as much practice during the program as planned. This may have affected the effectiveness of OPCO because regular practice is essential to learn the coping skills. In line with this, we found a positive correlation between the increase in pain coping and pain control from pre- to posttreatment and the number of exercises (imagery and relaxation) the patients did during their homework ($r = .32$, $p = .058$). The correlation between the increase from pretreatment to Follow-Up 2 and the number of exercises was also positive and significant ($r = .35$, $p = .043$).

Contamination Check

The interrater agreement between the nine independent behavior therapists was acceptable ($\kappa = .60$), suggesting that the raters agreed highly on their judgment about the origin of the treatment fragments. Of a total of 10 fragments to be classified by nine raters

Table 2
Baseline Characteristics of Patients in OPCO (n = 59), OPDI (n = 58), and WLC (n = 31)

Variable	% OPCO	% OPDI	% WLC	p[a]
Gender				.913
Male	37	34	39	
Female	63	66	61	
Education				.213
High	16	29	21	
Low	84	71	79	
Disability compensation				.613
Yes	60	60	68	
No	40	40	32	
Use of supportive equipment for walking				.073
Yes	34	17	35	
No	66	83	65	

	OPCO		OPDI		WLC		
Variable	*M*	*SD*	*M*	*SD*	*M*	*SD*	p[b]
Age (years)	39.7	8.8	39.2	9.2	41.1	9.6	.649
Pain duration (years)	8.2	8.6	10.7	8.9	11.3	8.6	.185
Duration of disability compensation (months)[c]	42.8	63.7	32.5	37.7	66.2	51.9	.089
Motoric behavior	−1.22	4.80	1.45	4.10	0.88	4.40	.002
Coping control	0.28	6.50	−0.89	4.90	1.11	6.40	.339
Negative affect	0.10	6.20	−0.48	5.30	−0.41	5.20	.570

Note. OPCO = operant behavioral treatment and cognitive coping skills training; OPDI = operant behavioral treatment and group discussion; WLC = waiting-list control condition.
[a] Based on a chi-square test. [b] Based on an analysis of variance. [c] Patients who did not have disability compensation were excluded from this analysis.

(10 per rater), 16 fragments were assigned to the wrong condition (18%). One fragment from the cognitive program was called *group discussion* by six raters and another fragment by two raters. Of the group-discussion fragments, 2 were considered to be cognitive treatment by four raters each. On the basis of these data, contamination bias cannot be ruled out completely nor can it be considered a real threat to the internal validity of our study.

Statistical Significance

Figures 2, 3, and 4 show a graphical representation of the mean scores on the three dependent variables for the four conditions at the different measurements. For OPUS, the posttreatment assessment for the WLC condition was used as the pretreatment measurement. On the variable negative affect, an increase was seen in the WLC condition, a slight decrease in OPUS, and a relatively large decrease in both OPCO and OPDI. Motoric behavior did not change during the WLC condition but seemed to increase during the three treatment conditions. At follow-up, the results seemed to favor OPCO and OPDI as compared with OPUS. The variable coping control decreased during the WLC condition; both OPCO and OPUS led to a large increase in coping control during treatment but a relapse at follow-up. OPDI seemed to lead to a smaller increase at posttreatment, a decrease at Follow-Up 1, and an increase at Follow-Up 2.

The regression analyses did not reveal any significant interactions between age and treatment, gender and treatment, and pretreatment measurement and treatment. Table 3 shows the results of regression analyses on posttreatment measurements for the comparison between OPCO, OPDI, and the WLC condition and between OPCO and OPDI. Both OPCO and OPDI showed improvement on all three variables compared with the WLC condition: less negative affect (catastrophizing, pain intensity, fear, and depression), higher activity tolerance and lower pain behavior, and higher pain coping and control. Patients who received the cognitive coping skills training that included relaxation showed higher pain coping and control than patients who received group discussion. Because there was no significant interaction effect between treatment condition and Follow-Ups 1 and 2 (according to the MANOVA; for negative affect, $F(2, 79) = 0.75$, $p = .474$; for motoric behavior, $F(2, 93) = 0.58$, $p = .560$; and for coping control $F(2, 94) = 0.30$, $p = .745$), we used the mean Follow-Ups 1 and 2 score for the follow-up analyses. As shown in Table 4, there were no significant differences between OPCO and OPDI at follow-up. As shown in Table 5, there were no significant differences between OPCO, OPDI, and OPUS on any of the variables at posttreatment or at follow-up.

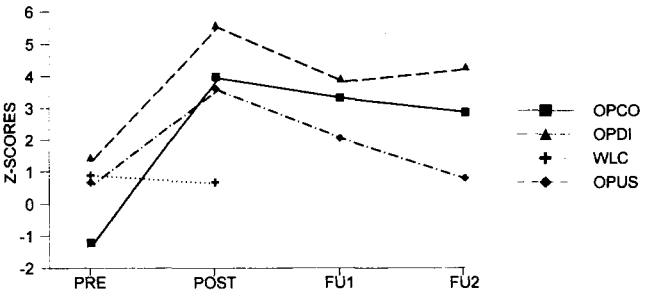

Figure 3. Graphical representation of the variable motoric behavior at pretreatment (PRE), posttreatment (POST), and 6- (FU1) and 12-month (FU2) follow-ups. Higher scores are more favorable. OPCO = operant behavioral treatment and cognitive coping skills training; OPDI = operant behavioral treatment and group discussion; WLC = waiting-list control condition; OPUS = operant behavioral treatment as usual.

Predictors of Outcome

Tables 3, 4, and 5 also show the significant predictors of outcome. Because of the high number of variables and chances of Type I error, the predictors were interpreted only if they appeared on more than one analysis. Patients who received disability compensation had more catastrophizing thoughts and negative emotions immediately after treatment and at follow-up. Patients with higher levels of psychopathology improved less on motoric behavior at posttreatment and at follow-up. Immediately after treatment, patients who believed more in the cognitive program or group discussion at the start improved more on motoric behavior and coping control. A higher treatment credibility also predicted a higher activity tolerance and

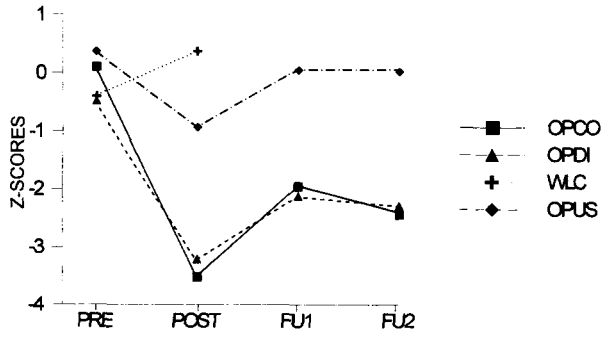

Figure 2. Graphical representation of the variable negative affect at pretreatment (PRE), posttreatment (POST), and 6- (FU1) and 12-month (FU2) follow-ups. Lower scores are more favorable. OPCO = operant behavioral treatment and cognitive coping skills training; OPDI = operant behavioral treatment and group discussion; WLC = waiting-list control condition; OPUS = operant behavioral treatment as usual.

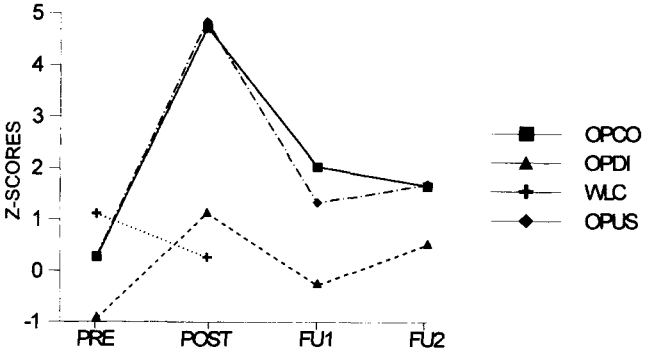

Figure 4. Graphical representation of the variable coping control at pretreatment (PRE), posttreatment (POST), and 6- (FU1) and 12-month (FU2) follow-ups. Higher scores are more favorable. OPCO = operant behavioral treatment and cognitive coping skills training; OPDI = operant behavioral treatment and group discussion; WLC = waiting-list control condition; OPUS = operant behavioral treatment as usual.

Table 3
Results of Multiple Linear Regression Analyses at Posttreatment for the Three Dependent Variables

Dependent variable	Range[a]	n	Adj. R^2	OPCO vs. WLC		OPDI vs. WLC		Other predictor	B
				B	95% CI	B	95% CI		
Negative affect	−15.4 to 13.6	93	.68	−2.52*	−4.47 to −0.58	−2.40*	−4.30 to −0.51	Pre meas.	0.84***
								Compensation	1.98**
Motoric behavior	−11.0 to 10.8	110	.46	4.07***	2.33 to 5.81	3.64***	1.94 to 5.34	Pre meas.	0.60***
Coping control	−18.0 to 19.4	124	.50	5.12***	2.67 to 7.57	2.87*	0.40 to 5.34	Pre meas.	0.80***
								Age	−0.09†
				OPCO vs. OPDI					
Negative affect	−15.2 to 13.7	79	.42	−0.24	−2.01 to 1.54			Pre meas.	0.78***
								Compensation	2.01*
								Gender	−1.89*
								Age	0.09†
Motoric behavior	−11.0 to 10.7	78	.58	−0.22	−1.72 to 1.28			Pre meas.	0.53***
								Credibility	0.23*
								MEDICS	−0.74†
Coping control	−17.9 to 20.1	91	.49	2.64*	0.48 to 4.80			Pre meas.	0.64***
								Credibility	0.46**

Note. OPCO = operant behavioral treatment and cognitive coping skills training (n = 50); WLC = waiting-list control condition (n = 25); OPDI = operant behavioral treatment and group discussion (n = 52); Adj. = adjusted; CI = confidence interval; Pre = pretreatment; meas. = measurement; MEDICS = Medical Examination and Diagnostic Information Coding System.
[a] The range of values of the dependent variables for these analyses.
† $p < .10$ (marginally significant). * $p < .05$. ** $p < .01$. *** $p < .001$.

less pain behavior at follow-up. Older patients scored higher on negative affect at posttreatment and at follow-up and lower on coping control at posttreatment. Patients with more findings on medical examinations before treatment had a lower activity tolerance and more pain behavior at posttreatment and follow-up but also lower negative affect at follow-up.

Improvement Rate

Figures 5, 6, and 7 show the percentage of improved patients across the four conditions for the dependent variables negative affect, motoric behavior, and coping control. Significantly more patients improved after OPCO and OPDI than after the WLC condition for all three variables, $\chi^2(2, N = 149) \geq 17.4$, $p < .001$. For OPUS, no patients improved on any variable immediately after treatment and only 1 or 2 patients (3% and 6%, respectively) improved at follow-up (this did not differ significantly from the WLC condition: $\chi^2[2, N = 149] = 1.55$ and 0.13, respectively). The results of OPUS were, however, negatively influenced by the high number of dropouts and patients with missing data on one or more of the variables (64% at Follow-Up 2). OPCO and OPDI did not differ significantly in the percentage of patients who improved, except for motoric behavior at Follow-Up 1, which was lower in OPCO as compared with OPDI, $\chi^2(2, N = 148) = 3.51$, $p = .061$.

Table 4
Results of Multiple Linear Regression Analyses at Follow-Up for the Three Dependent Variables

Dependent variable	Range[a]	n	Adj. R^2	OPCO vs. OPDI		Other predictor	B
				B	95% CI		
Negative affect	−14.0 to 16.7	58	.65	0.50	−1.71 to 2.72	Pre meas.	0.71***
						Psychopathology	0.25**
						Compensation	2.39*
						Age	0.13*
						MEDICS	−1.04†
Motoric behavior	−7.7 to 11.1	66	.55	0.39	−1.33 to 2.11	Pre meas.	0.67***
						Credibility	0.35**
						MEDICS	−1.19*
Coping control	−21.1 to 19.1	79	.66	−1.09	−2.98 to 0.80	Pre meas.	0.97***

Note. OPCO = operant behavioral treatment and cognitive coping skills training (n = 44); OPDI = operant behavioral treatment and group discussion (n = 44); Adj. = adjusted; CI = confidence interval; Pre = pretreatment; meas. = measurement; MEDICS = Medical Examination and Diagnostic Information Coding System.
[a] The range of values of the dependent variables for these analyses.
† $p < .10$ (marginally significant). * $p < .05$. ** $p < .01$. *** $p < .001$.

Table 5
Results of Multiple Linear Regression Analyses at Posttreatment and Follow-Up for the Three Dependent Variables

Dependent variable	Range[a]	*n*	Adj. R^2	OPCO vs. OPUS		OPDI vs. OPUS		Other predictor	*B*
				B	95% CI	*B*	95% CI		
					Posttreatment				
Negative affect	−15.4 to 13.6	81	.61	−1.43	−5.37 to 2.50	−1.55	−5.45 to 2.35	Pre meas.	0.83***
								Compensation	1.84*
								Gender	−1.53†
Motoric behavior	−4.4 to 10.5	100	.36	0.72	−1.54 to 2.98	0.62	−1.61 to 2.85	Pre meas.	0.50***
								Psychopathology	−0.11*
Coping control	−18.0 to 17.9	111	.44	1.94	−1.39 to 5.26	−0.37	−3.75 to 3.01	Pre meas.	0.75***
					Follow-up				
Negative affect	−14.0 to 17.7	68	.57	−1.78	−5.38 to 1.83	−1.70	−5.22 to 1.81	Pre meas.	0.69***
								Psychopathology	0.17†
								Compensation	1.92†
Motoric behavior	−13.2 to 10.9	78	.45	1.35	−1.98 to 4.68	0.14	−3.25 to 3.53	Pre meas.	0.66***
								MEDICS	−0.84†
Coping control	−20.1 to 17.9	92	.69	0.59	−1.84 to 3.01	1.66	−0.84 to 4.16	Pre meas.	0.97***

Note. OPCO = operant behavioral treatment and cognitive coping skills training (n = 44); OPUS = operant behavioral treatment as usual (n = 15); OPDI = operant behavioral treatment and group discussion (n = 44); Adj. = adjusted; CI = confidence interval; Pre = pretreatment; meas. = measurement; MEDICS = Medical Examination and Diagnostic Information Coding System.
[a] The range of values of the dependent variables for these analyses.
† $p < .10$ (marginally significant). * $p < .05$. *** $p < .001$.

Intention-to-Treat Analysis

As mentioned before, we performed an intention-to-treat analysis at which dropouts were given the value of the lowest quartile for a particular measure at a particular measurement point. We present the results only when they differed from the per-protocol analyses. At posttreatment, OPCO and OPDI did not differ significantly from the WLC condition on negative affect (p = .234 and .381, respectively) and OPDI did not differ from the WLC condition on coping control (p = .415). The OPCO and OPDI groups showed less negative affect after treatment as compared with the OPUS group (p = .001 for both). The difference between OPCO and OPDI on coping control did not reach significance (p = .054). At Follow-Up 1, the OPDI group improved more on negative affect than did the OPUS group (p = .060) and the same can be said for the OPCO group compared with the OPUS group on motoric behavior (p = .060). There were no significant differences between the groups at Follow-Up 2 ($p > .114$).

Power Analysis

Because sample size has an effect on the statistical analyses of the data, and because our samples were relatively small, we performed an ad hoc power analysis (see Table 6 for a summary of the results). On the basis of a minimal detectable difference of 15% of the full range of our dependent variables (after removal of outliers, as defined earlier), and using the power calculation method described by Kirkwood (1989), the power of our tests can

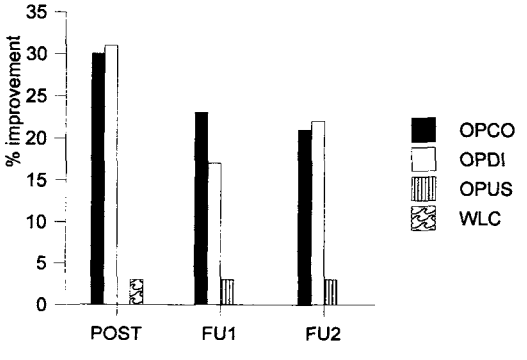

Figure 5. Percentage of improved patients for OPCO, OPDI, WLC, and OPUS for negative affect at posttreatment (POST) and 6- (FU1) and 12-month (FU2) follow-ups. OPCO = operant behavioral treatment and cognitive coping skills training; OPDI = operant behavioral treatment and group discussion; WLC = waiting-list control condition; OPUS = operant behavioral treatment as usual.

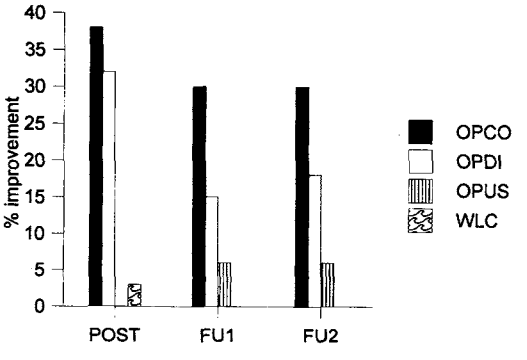

Figure 6. Percentage of improved patients for OPCO, OPDI, WLC, and OPUS for motoric behavior at posttreatment (POST) and 6- (FU1) and 12-month (FU2) follow-ups. OPCO = operant behavioral treatment and cognitive coping skills training; OPDI = operant behavioral treatment and group discussion; WLC = waiting-list control condition; OPUS = operant behavioral treatment as usual.

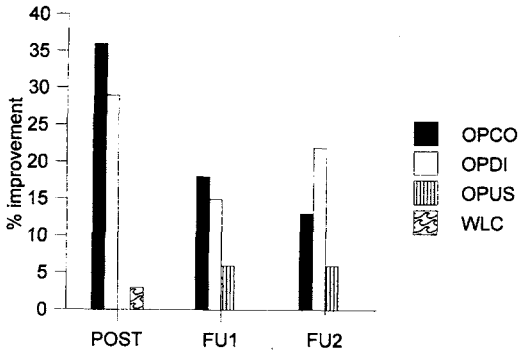

Figure 7. Percentage of improved patients for OPCO, OPDI, WLC, and OPUS for coping control at posttreatment (POST) and 6- (FU1) and 12-month (FU2) follow-ups. OPCO = operant behavioral treatment and cognitive coping skills training; OPDI = operant behavioral treatment and group discussion; WLC = waiting-list control condition; OPUS = operant behavioral treatment as usual.

be considered reasonable (range = .73 to .98, with the exception of the motoric behavior variable in the comparison of OPCO/OPDI vs. OPUS [.54]).

Discussion

For a group of 148 moderately to severely disabled CLBP patients, an operant treatment with cognitive coping skills training that included relaxation (OPCO) was compared with an operant treatment with group discussion and passively listening to music (OPDI); a WLC group; and less protocolized operant treatment that lacked spouse training, group program, and treatment contract (OPUS). Both clinically and methodologically, this study is noteworthy because (a) the treatment was offered to a group of moderately to severely disabled CLBP patients; (b) the operant treatment component included a structured spouse training program; (c) the experimental cognitive–behavioral treatments were compared with a nonprotocolized operant treatment condition that is usually provided at Dutch rehabilitation centers and which lacks a number of behavioral ingredients, such as treatment contract, individual counseling, pain coping skills training, and spouse training; (d) to control for nonspecific treatment effects of the group cognitive treatment, an attention-control condition consisting of group discussion was included; (e) there were a number of additional measures to control for various threats of internal validity, including measures for treatment credibility, patient compliance, and contamination bias; (f) besides self-report measures of distress, pain cognitions, pain coping, pain control, and pain intensity, it also included pain-specific observational measures of activity tolerance and pain behaviors; (g) composite variables were derived factor analytically to decrease the inflation of Type I errors and to increase the reliability of the outcome measures; and (h) multivariate regression analyses were applied for testing differences between conditions, allowing for the detection of predictors other than the experimental manipulation.

Following an intention-to-treat analysis, in which missing values from dropouts were substituted using the mean score of the lowest quartile for motoric behavior and coping control, the highest quartile for negative affect revealed that, compared with OPUS, both OPCO and OPDI resulted in less negative affect, a higher activity tolerance with less pain behavior, and more pain coping and pain control. The only difference between OPCO and OPDI was higher pain coping and pain control for OPCO at posttreatment. The percentage of patients who improved, however, was significantly lower for OPUS (even lower than that for the WLC condition); on all three variables, immediately after treatment and at follow-up, OPUS produced many more dropouts during or after treatment. It is possible that there was selective dropout of bad responders to therapy, leading to a narrowing of differences between outcome in OPCO, OPDI, and OPUS. The per-protocol analyses revealed that on the negative affect variable, the differences between the OPUS and OPCO groups disappeared, but both the OPCO and OPDI groups improved significantly on this variable as compared with the WLC group.

Although coping and control increased in OPCO as compared with OPDI, this did not lead to higher quality of life as measured with the rating scale from the Maastricht Utility Measurement Questionnaire (Goossens et al., 1998). Goossens et al. also found that the program costs, use of health care resources in the year after completion of the program, and indirect costs did not differ significantly between OPCO, OPDI, and OPUS. However, all of the patients receiving the OPUS program were hospitalized longer than the patients in OPCO and OPDI. Thus, at least the same effects as the usual individual therapy can be achieved at the same costs by a shorter, more intense, protocolized group program.

What are the reasons for the lack of supplemental value of the cognitive copings skills training? A possible explanation is the limited compliance. Most patients did not do their homework assignments as planned. The effects of a cognitive treatment can be expected only if patients exercise regularly, not just during the sessions but also at home (Turk & Holzman, 1986). For the OPCO group, the increase in pain coping and pain control from pretreat-

Table 6
Result of the Ad Hoc Power Analysis

Variable	Minimal difference to be detected[a]	OPCO/OPDI vs. WLC	OPCO vs. OPDI	OPCO/OPDI vs. OPUS
Negative affect	3	.953	.971	.761
Motoric behavior	2	.719	.899	.544
Coping control	4	.896	.977	.726

Note. OPCO = operant behavioral treatment and cognitive coping skills training; OPDI = operant behavioral treatment and group discussion; WLC = waiting-list control condition; OPUS = operant behavioral treatment as usual.

[a] 15% of the range, after removal of outliers.

ment to posttreatment and pretreatment to the 1-year follow-up correlated positively with the number of exercises (imagery and relaxation) the patients did during their homework. Given the relatively low educational level of the patients in our sample, the pain coping skills training might have been too difficult. Although contamination bias between cognitive coping skills training and the group discussion was checked and considered negligible, contamination bias between OPCO, OPDI, and OPUS might also have influenced the results. The same therapists who were involved in OPCO and OPDI also carried out OPUS. A number of ingredients from the operant program was also used in OPUS: establishing a baseline, setting quota, positive reinforcement of progress, and sometimes a patient conference. Ingredients that were definitely not used were the spouse training, the group program, and the treatment contract.

Second, the cognitive coping skills training may not have been specific enough. If a patient has learned to use coping skills, what has he or she learned to cope with and is this coping adequate for daily life? For example, the difference in coping and control from pretreatment to the 1-year follow-up did not correlate significantly with the difference in motoric behavior ($r = .07$, $p = .262$). Perhaps the cognitive program should be spread over a longer period of time, or perhaps booster sessions should be included to help patients to generalize the results to their daily life. Alternatively, the inclusion of more general problem-solving skills might be considered in the future. In problem-solving therapy (PST; Nezu, Nezu, & Perri, 1989), the focus of treatment is not so much directed to specific stress-related complaints (such as depression, anxiety, insomnia, and pain) but to the systematic way in which problems in general, whatever they are, can best be approached. Preliminary data of an ongoing trial on the effectiveness of PST in low-back pain are very promising (Van den Hout et al., 1998). The assumption that the coping skills training lacks specificity is supported by the observation that in OPCO, the increase in the use of coping strategies failed to produce decreases in pain catastrophizing (an element of negative affect). Our cognitive program did not address these pain-specific beliefs and fears directly. Recent studies have shown that catastrophizing is an important predictor of pain disability (Burton, Tillotson, Main, & Hollis, 1995; Crombez, Vlaeyen, Heuts, & Lysens, 1999) and that this association is mediated by pain-related fear and avoidance (Vlaeyen, Kole-Snijders, Boeren, & van Eek, 1995). For the subgroup of pain patients reporting these specific fears, a more systematic application of graded exposure to fearful situations is therapeutically much more powerful to correct catastrophic misinterpretations (Vlaeyen et al., 1997; Vlaeyen, De Jong, Geilen, Heuts, & van Breukelen, 1999).

Third, nonspecific effects from the group program might also have been important. A good choice of an attention-control condition is difficult to make in this type of behavioral research. The researcher is faced with two conflicting demands: The control condition must be designed such that it is considered as credible as the active treatment, but, at the same time, active ingredients must be omitted. At least we succeeded in developing a highly credible control condition. The drawback is that the group discussion with music might have been more effective than expected. It was led by the same experienced behavior therapist, who used the same kind of materials (texts, tapes, and homework assignments). The influence of contamination bias on the results cannot be ruled out, but it is probably limited. Patients might have learned from discussions with other patients and may have used suggestions described in the texts. In our study, the group-discussion part of the attention-control condition may have worked as a kind of exposure for patients with phobic complaints, given that they were asked to read a text and prepare a lecture for the group. Most patients feared this task but were reinforced afterward by the applause from the other members of the group. These observations raise questions about how (in)active our attention control was. O'Leary and Borkovec (1978), Parloff (1986), and Strayhorn (1987) warned that, in contrast to pharmacology, placebo controls can hardly be used in psychotherapy research. According to Parloff, and more recently Schwartz, Chesney, Irvine, and Keefe (1997), there is no agreement on which therapies can be considered placebos or not. In future replications, their advice may be followed not to compare an experimental therapy with an attention control or placebo but to compare two or more alternative interventions.

The regression analyses also included other predictors for outcome. Patients who received disability compensation scored higher on negative affect immediately after treatment. This association might have been caused by changes in the social security legislation in the Netherlands that occurred during the study. For most patients, their liability for disability compensation was reassessed. This might have caused insecurity, which in turn increased catastrophizing thoughts and negative emotions. It is also possible that pain intensity and signs of distress increased the chance of receiving disability compensation. Higher levels of psychopathology were a predictor of motoric behavior and negative affect in the short term and at follow-up. As this does not imply severe psychopathology (these patients were not included in the program), the results might improve if more attention is given to individual problems. In the present program, each patient received only 30 min of individual counseling per week. These contacts were aimed at helping patients find their way to psychotherapy outside the rehabilitation center, if needed. Of particular interest was that treatment credibility, which was included to control for differential credibility of the cognitive treatment and group discussion, appeared to be an important predictor of successful outcome, not only of self-reported pain coping and control but also of observed activity tolerance and pain behavior at follow-up. This might be explained by the transtheoretical model of behavior change (DiClemente & Prochaska, 1982) that was recently applied to pain treatment (Jensen, 1996; Kerns, Rosenberg, Jamison, Caudill, & Haythornthwaite, 1997). The model is based on the assumption that patients vary in their motivation for treatment and describes five stages: precontemplation, contemplation, preparation/decision making, action, and maintenance. A treatment will be effective only if the patient is willing to participate actively. In our study, patients who decided not to enter the program had a shorter pain duration and were less depressed. These could be signs that they were precontemplaters. In the treatment of excessive drinkers, the action stage of change, as measured by the Readiness to Change Questionnaire, was a significant predictor of changes in alcohol consumption, even when other possible predictors were taken into account (Heather, Rollnick, & Bell, 1993). Treatment credibility may be reflective of the patient's readiness to change.

Overall, a protocolized operant program that included a treatment contract, spouse training, and individual counseling has proved to be effective for CLBP patients. The supplemental value of a cognitive program with relaxation as used in this study appears to be limited. The results suggest that the comprehensive

and interdisciplinary nature of the treatment, rather than the specific components that are added to it, may be the important factor. What is probably needed now are more studies that answer the question "What kind of treatment modalities are most effective for patients with a certain set of characteristics?" (Turk, 1996). An example is a recent study with fibromyalgia patients showing that fearful patients generally did somewhat better when they received group discussion in combination with education, whereas the low-fearful participants tended to show more improvement when receiving a cognitive treatment with applied relaxation added to group education (Vlaeyen et al., 1997). Finally, the available knowledge gained both in the predictors of disability and in developing behavioral rehabilitation programs should be applied to the field of secondary prevention (Linton, 1987). Waiting until pain problems have fully developed into chronic and almost irreversible situations is ethically and economically unjustifiable.

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