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Secondary Prevention of Work-Related Disability in Nonspecific Low Back Pain: Does Problem-Solving Therapy Help? A Randomized Clinical Trial

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Abstract:
Objectives: Given the individual and economic burden of chronic work disability in low back pain patients, there is a need for effective preventive interventions. The aim of the present study was to investigate whether problem-solving therapy had a supplemental value when added to behavioral graded activity, regarding days of sick leave and work status.
Design: Randomized controlled trial.
Patients and Setting: Employees who were recently on sick leave as a result of nonspecific low back pain were referred to the rehabilitation center by general practitioner, occupational physician, or rehabilitation physician. Forty-five employees had been randomly assigned to the experimental treatment condition that included behavioral graded activity and problem-solving therapy (GAPS), and 39 employees had been randomly assigned to behavioral graded activity and group education (GAGE).
Outcome Measures: Days of sick leave and work status. Data were retrieved from occupational health services.
Results: Data analyses showed that employees in the GAPS group had significantly fewer days of sick leave in the second half-year after the intervention. Moreover, work status was more favorable for employees in this condition, in that more employees had a 100% return-to-work and fewer patients ended up receiving disability pensions one year after the intervention. Sensitivity analyses confirmed these results.
Conclusions: The addition of problem-solving therapy to behavioral graded activity had supplemental value in employees with nonspecific low back pain.
Key Words: Low back pain—Problem solving—Randomized clinical trial—Secondary prevention—Work disability.

Indirect costs such as absenteeism and disability pensions make up about 90% of the economic burden of low back pain (LBP).[1–3] In the Netherlands, indirect costs due to back pain are estimated at $4.6 billion (U.S.), equivalent to 1.6% of the gross national product.[1] Moreover, total costs of back pain are not normally distributed. A relatively small group of patients with chronic LBP, approximately 10% to 25%, is responsible for about 75% of the economic burden of back pain.[4] Yet no satisfactory answer has been given to the rising trend of LBP disability and, as Waddell[5] concludes, ". . . trends of LBP disability show that current management and health care have failed to solve the problem." Obviously, the development of effective interventions to prevent chronic work disability is of the highest priority.

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Secondary prevention of LBP is defined in terms of initiatives taken from the point of the first reported pain incident until a full chronic problem has developed, that is, pain that continues after 6 months of health care or sick leave.[6] In a recent review by Linton and Van Tulder,[7] the effects of educational efforts, lumbar supports, exercises, ergonomics, and risk-factor modification in non–health care settings (e.g., in the general population or in the workplace) were evaluated. The effects reported from the 27 investigations were very sobering in that only "exercises" provided sufficient evidence to conclude that this form of prevention was effective. According to Linton and Van Tulder,[7] the reasons for this failure may be found in the methodology of the studies involved, as well as in the way interventions were designed.

In the last decades, a shift has taken place toward more cognitive–behavioral–oriented interventions, with accents on gradual exposure to physical activities and the application of operant-conditioning principles.[8–12] In addition, cognitive therapy has often been successfully applied, alone or in combination with other forms of therapy.[13,14] Moreover, there are several indications that a multidisciplinary approach is effective in the prevention of long-term disability and work loss.[15,16] Recently, a cognitive–behavioral return-to-work program was found to be more effective than "treatment-as-usual" in reducing days of sick leave and increasing general activity levels.[17] These effects, however, were found only in patients with short-term sick leave (2–6 months) and not in those with long-term sick leave (>12 months), underscoring the importance for an early return-to-work intervention.

Work-related problems, such as not being able to meet job demands or conflicts with co-workers, cause additional stress on top of the burden already caused by back pain. In this context, sick leave due to back pain can sometimes be considered a medical solution to a work-related problem.[18] Recently, a negative orientation toward problems was found to be associated with higher levels of functional disability in employees with LBP.[19] In line with this, Shaw et al.[20] found low scores on positive problem-orientation and high scores on impulsiveness and avoidant style associated with functional loss in LBP patients. The authors suggest that the prolonged impact of LBP on daily functioning may be reduced by assisting workers to conceptualize LBP and its consequences as problems that can be overcome, and to use active strategies in reducing risks for LBP disability.

Problem-solving therapy (PST), based on the model by D'Zurilla and Goldfried,[21] may successfully be used in the prevention of work disability. It teaches strategies that may help subjects to feel confident and in control of stressful situations—for example, to solve work-related problems when pain recurs. Problem-solving strategies have been successfully applied previously[10–12] in patients with pain, but integrated into multimodal treatment packages. To our knowledge, the unique contribution of a "protocolized" PST has never been evaluated.

The present study describes a secondary preventive intervention developed against the background of a biopsychosocial model of pain. The aim of this study was to determine whether PST had supplemental value as an adjunct to behavioral graded activity in reducing number of sick days and facilitating return to work in employees with a new episode of sick leave due to LBP.

MATERIALS AND METHODS

Study design

A two-armed randomized clinical trial was performed in a rehabilitation setting, to specifically test the supplemental value of PST when added to behavioral graded activity (Fig. 1.). A rehabilitation physician (P.H.) and a mental health scientist (J.v.d.H.), both of whom were blind to the allocated condition, carried out the selection procedure. Patients had to sign an informed consent. After being selected, subjects were assigned to one of two treatment conditions in groups of 5. The randomization scheme was computer-generated and was known only to the logistics planner of the rehabilitation center.

Two treatment conditions were compared: graded activity plus problem-solving therapy (GAPS) and graded activity plus group education (GAGE). Group education was included in both groups. The same therapists in both treatment conditions guided the graded activity program. Therapists were not blinded to the condition because multidisciplinary consultation was part of the treatment

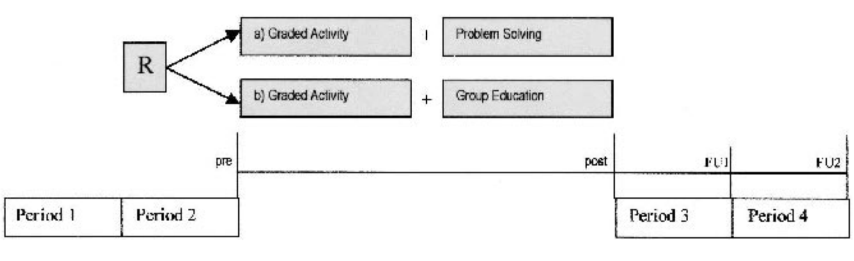

FIG. 1. The study design. R, randomization; Pre, pretreatment assessment; post, post-treatment assessment; FU1, 6-month follow-up; FU2, 12-month follow-up; period 1, 12 to 6 months before intervention; period 2, a half year before intervention; period 3: first half-year after intervention; period 4, second half-year after intervention.

program. To avoid contamination, the GAPS and the GAGE groups had their programs planned separately such that they did not encounter one another.

Subjects

Study subjects were employees who were recently absent due to LBP, referred to the study by general practitioners, occupational physicians, or rehabilitation physicians. Eligibility criteria for study subjects were as follows: age between 18 and 65 years, LBP for more than 6 weeks, on sick leave with LBP but no longer than 20 weeks, and no more than 120 days of sick leave during the last year. Those persons who had specific back disorders (vertebral fracture, infectious disease, rheumatoid arthritis, ankylosing spondylitis, or herniated disc)[23]; had predominant psychopathology; were pregnant; were not proficient in Dutch; or were seeing a medical specialist other than a rehabilitation physician for their LBP at the time of referral were excluded. Furthermore, subjects had to agree to stop any other ongoing treatments they were receiving for their back disorders at the start of the intervention.

Patients with medical comorbidity were excluded when the disorder interfered with the treatment program or rendered them unable to participate in every part of the program, as decided by the rehabilitation physician. Patients who were involved in any litigation regarding work conflicts were excluded as well.

Treatments

The treatment program consisted of 19 half-day sessions over the course of 8 weeks, given in small groups of, at most, 5 patients. In the course of the program the team of therapists had three meetings with individual patients. During these meetings, aids and impediments toward goal achievement and return to work were discussed. Two months after the final treatment session, a booster session was planned in which treatment components were summarized and individual developments were discussed in the group.

Graded activity

Graded activity is an operant behavioral treatment that aims to increase activity levels by means of quota systems. The training included registration of baseline levels during the first two weeks, a treatment contract, positive reinforcement for activity increments, and a workplace visit.[24] The training consisted of 15 one-hour sessions and 3 additional sessions dedicated to back education and lifting instructions. The occupational therapist treated patients individually for 30 minutes per week, during which graded activity was applied to personally relevant activities like work, housekeeping, and leisure-time activities. Furthermore, the occupational therapist contacted the occupational physician and the patient's supervisor at the workplace to discuss a plan of return-to-work. When considered necessary by the occupational therapist, a workplace visit was planned.

Problem-solving therapy

Problem-solving therapy is a cognitive–behavioral therapy in which problem-solving skills are taught.[21] The PST-model describes 5 steps in which problems are typically solved: (1) problem orientation, (2) problem definition and formulation, (3) generation of alternatives, (4) decision making, and (5) implementation and evaluation. In the present trial, a protocol, as originally designed by Nezu et al.,[25,26] was translated and provided as a group intervention. Patients underwent skills training in 10 90-minute sessions under the guidance of two experienced behavior therapists. The foci of the therapy were skills training and application of skills in daily life, rather than one specific problem area. Patients were free to select their own problem areas, which did not need to be pain related. Between sessions, homework assignments were given to practice skills in everyday life. Homework assignments were discussed within the group at all sessions.

Group education

Group education was provided in both groups to ensure that both conditions were comparable with regard to nonspecific factors. Since educational approaches turned out to have limited effects on worrying, functional status, health care use, or other primary outcome measures,[27,28] this intervention was chosen as the control factor. Group education consisted of 10 90-minute lessons in which issues related to the back and to back pain were discussed. A physiotherapist, an occupational therapist, and a psychologist, using a protocolized manual, served as lecturers. No skills were taught, and each theme was discussed during no more than one protocolized session.

Outcome measures

Work status

Each patient's work status was obtained from the OHS data report. Work status was defined one week before the intervention, a half year after the intervention, and one year after the intervention. The classification was as follows: (1) 100% return-to-work; (2) part-time return-to-work; (3) no return-to-work; (4) 100% disability pension as a result of back pain; and (5) 100% disability pension not as a result of back pain. In those cases where sick leave was reported not to be associated with back pain, the cases were deleted from the analyses. Cases in which data on period 2 and post-treatment data on periods 3 and 4 were available were included in the study.

Days of sick leave

Data on sick leave were obtained from the occupational health service (OHS) associated with the workplace of the employee. Employees were asked to give written consent, which would allow the research team to retrieve data from the OHS. In total, 23 OHS centers were involved in the data collection process. There is no national administration of sick leave data in the Netherlands; data were therefore recorded quite differently. One research assistant who was blind to the condition calculated the number of days of sick leave, taking into account (1) a ratio of 5 working days to 7 (5:7); (2) the percentage of full-time equivalents (fte); and (3) disability pensions (defined in terms of days of sick leave). Data were calculated with respect to 4 time periods: 2 half-year periods preceding the intervention (periods 1 and 2); and 2 half-year periods after the intervention (periods 3 and 4). A variable regarding general sick leave was also calculated, in which all days of sick leave were cumulated, regardless of the primary reason.

A sensitivity analysis was executed in which only those patients who actually returned to work (full time, part time, or on a therapeutic basis) after the intervention were included. Outcomes with regard to this group would be indicative of work retention in this group of patients.

Because return-to-work, whether full time, part time or on a therapeutic basis (i.e., reduced workload), was considered to have a preventive effect on the patient's recovery, the calculation of days of sick leave accounted for part-time work-resumption and work on a therapeutic basis. Because OHS irregularly reported whether work was fully or partly lost and whether work was done on a therapeutic basis, a second calculation was made to conduct a post hoc sensitivity analysis. According to the second calculation, sick leave was considered to be 100% work loss, regardless of part-time work-resumption or work on a therapeutic basis.

Data quality

Data quality was considered at three levels: good, moderate, and poor. Data were rated as good when the report provided information on work on a therapeutic basis and on the percentage of work resumption. Quality was judged moderate when data were provided on the percentage of work resumption, but not with respect to work on a therapeutic basis. Finally, the quality of the sick leave data was considered as poor when no information was available about either part-time resumption of work or work on a therapeutic basis. To optimize data quality, one researcher (J.Z.) contacted each OHS to obtain more detailed information that had not been included in their reports.

Problem-solving skills

Problem-solving skills were measured by the Social Problem Solving Inventory (SPSI-R)[29] to conduct a manipulation check. The social problem-solving inventory consists of 5 subscales: positive problem orientation, negative problem orientation, rational problem-solving skills, avoidant style, and impulsive–carelessness style.

Treatment credibility

To check whether GAPS and GAGE treatment conditions were equally credible to participants, treatment credibility was measured at the start of the intervention by a procedure similar to that described by Borkovec and Nau[30] and applied in Vlaeyen et al.[31] Psychometric properties of this credibility questionnaire are good.[32]

Baseline characteristics

Additional data were collected before treatment regarding demographics (Distress and Risk Assessment Method [DRAM][33]), functional disability (Roland Disability Questionnaire [RDQ][34]), RDQ-level at baseline,[35] pain intensity (McGill Pain Questionnaire-Dutch Version [MPQ][36]), and job satisfaction in terms of work (VAG_work) and work conditions (VAG_cond).[37]

Statistical analyses

Demographic variables, treatment credibility, data quality, and data at baseline were compared between the two treatment conditions (GAPS and GAGE), as well as each of the subscales of the SPSI-R,[29] to check whether randomization and manipulation succeeded. Differences in work status were assessed by means of χ^2 tests regarding work status one week before the intervention, and 6 and 12 months after the intervention. Multiple linear regression analyses were conducted to test whether days of sick leave in periods 3 and 4, independently, differed by treatment condition. Next to treatment condition, the number of days of sick leave in the half year before treatment (period 2) was added to the model as a covariate. Finally, variables that were unequally divided between conditions, despite randomization, were included in the analyses as covariates. Analyses were executed with respect to days of sick leave (1) as a result of back pain and (2) in general. Moreover, work retention was analyzed by deleting those cases in which the patient never returned to work after the intervention.

To control for the possible confounding influence of incomplete data, a sensitivity analysis was carried out in which sick leave was classified as 100% work loss, regardless of part-time or therapeutic work-resumption. Outcomes based on this conservative classification were compared with those initially found.

RESULTS

Baseline characteristics

One-hundred thirty-eight patients completed the selection procedure and 115 patients met the inclusion criteria.[22] Another 7 patients refused consent to retrieve data regarding sick leave and work status from the OHS. Furthermore, the OHSs retrospectively provided data on 84 of the remaining 108 patients included in the study, regarding period 2 (pretreatment) and one or both of periods 3 and 4 (post-treatment). The group of 31 patients who dropped out of this part of the study (n: GAPS = 13; GAGE = 18) was comparable to the current sample regarding baseline characteristics ($p > 0.05$). Eventually, 45 patients had been randomly assigned to the GAPS condition and 39 to the GAGE condition. In Table 1, baseline characteristics of the sample included in this part of the study are reported by condition. Overall, the average age was 40 years (range: 23–54 years), and 76% of all patients were male. Mean pain duration from the onset of the current pain episode was 1.5 years (range: 0.5–25 years), and from the first pain episode ever, 7.6 years (range: 6 weeks to 38 years). Four patients reported their current pain episode to be shorter than 6 weeks; however, all four of them had recurrent pain for more than 6 weeks and were therefore included in the study. The current pain episode was subacute (6–12 weeks) in 28% of the cases and chronic (>12 weeks) in 67% of the cases. On average, patients were sicklisted for more than 8 weeks (60 calendar days; SD = 57 days; median = 44 days) when they entered the study. Mean pain intensity was 17.7 (standard deviation [SD] = 9.9), which is higher than that of a group of Dutch physiotherapy patients who reported a mean pain intensity of 11.6 (SD = 7.0) just before the start of treatment.[36] The mean score on functional disability, as measured by the RDQ,[34] was 13.2 (SD = 5.3), and 31% of the patients had a score higher than 15, suggesting that they were moderately to highly disabled.[34,38] Overall, 50.6% of the patients were classified as normal, 34.6% at risk, 6.2% distressed–depressive, and another 8.6% distressed–somatic, as measured by the DRAM.[33]

Randomization and manipulation checks

With the exception of two variables, there were no significant differences between treatment conditions regarding baseline characteristics (Table 1; $P > 0.05$). The distribution of RDQ scores at baseline (low/moderate/high) showed differences between the conditions ($P = 0.05$) in that more patients in the GAPS condition had high RDQ scores (17–24) compared with the GAGE condition, where more patients had moderate RDQ scores (9–16). Because high disability was regarded as a potential predictor of later work-related disability, this variable was added to the regression analyses as a covariate. The second variable that differed between treatment conditions was treatment credibility, with patients in the GAGE condition reporting higher expectations of group education than patients in the GAPS condition of problem-solving therapy (8.0 vs. 6.9 respectively). Treatment credibility was found to be an important predictor of cognitive–behavior therapy in patients with pain[13] and was therefore added to the analyses as a covariate. The manipulation of problem-solving

TABLE 1. *Baseline characteristics of patients in graded activity + problem-solving therapy and graded activity + group education groups*

Variable	GAPS (n = 45)	GAGE (n = 39)	P
Sex (% male)	73.3	79.5	0.51*
Education (%)			
High	48.9	35.9	0.23*
Low or medium	51.1	64.1	
Current medication use (%)			
Yes	44.4	33.3	0.30*
DRAM classification (%)			
N	47.6	53.8	0.60*
R	33.3	35.9	
DD	9.5	2.6	
DS	9.5	7.7	
RDQ level at baseline (%)			
0–8	20.0	12.8	0.05*
9–16	40.0	66.7	
17–24	40.0	20.5	
Data quality (%)			
Poor	11.1	5.1	0.47*
Moderate	57.8	53.8	
High	31.1	41.0	
Workplace visit (%)			
Yes	38.9	48.6	0.40*
No	61.1	51.4	
Age, M (SD)	40.3 (9.3)	40.8 (8.4)	0.80†
Pain duration since first pain episode (yr), M (SD)	8.7 (9.4)	6.4 (6.5)	0.21†
Duration current pain episode (yr), M (SD)	1.7 (4.5)	1.4 (2.6)	0.69†
Sick leave duration (wk), M (SD)	7.4 (6.1)	10.0 (9.9)	0.14†
Treatment credibility, (0–10), M (SD)	6.9 (2.0)	8.0 (1.1)	0.00†
Functional disability (RDQ), M (SD)	13.8 (5.4)	12.5 (5.2)	0.28†
Pain intensity (MPQ), M (SD)	17.8 (10.6)	17.6 (9.0)	0.93†
Job satisfaction			
VAG Work	19.2 (3.2)	18.4 (2.7)	0.24†
VAG Cond	36.4 (4.6)	37.8 (4.1)	0.16†

*Based on χ^2 test; †based on independent samples t test.

GAPS, graded activity + problem-solving therapy; GAGE, graded activity + group education; DRAM, Distress and Risk Assessment Method; N, normal; R, at risk; DD, distressed–depressive; DS, distressed–somatic; RDQ, Roland Disability Questionnaire; MPQ, McGill Pain Questionnaire (Dutch version); VAG, in English, Perception and Evaluation of Work Questionnaire; M, mean; SD, standard deviation.

skills succeeded in that subscales of the SPSI-R showed treatment-related changes in the GAPS condition only.

Work status

Work status before treatment and at 6- and 12-month follow-up are reported for each treatment condition. In the week before the start of the intervention, most patients were reported to be on the sick list (Table 2). Because inclusion was based on sick leave at the time of the selection procedure, it was possible for patients to return to work before the intervention started. Twelve patients had a full return-to-work between the selection procedure and the start of the intervention. The Pearson χ^2 test did not reveal a significant difference between treatment conditions before treatment. Six months after the intervention, most patients (73%) had a full return-to-work in both conditions. In 3 cases (1 GAPS, 2 GAGE) sick leave was not caused by back pain, and therefore cases were omitted from the analyses. Seven percent versus 19% of patients did not return to work at 6-month follow-up in GAPS and GAGE conditions, respectively. Differences between conditions were not significant ($P > 0.1$). Finally, work status one year after the intervention was evaluated. Data of one patient in the GAPS condition were not available at 12-month follow-up because he changed his job. Furthermore, in 7 cases (3 GAPS, 4 GAGE) sick leave had causes other than back pain and cases were therefore deleted from the analyses. Figure 2 illustrates the differences between conditions. The percentage of patients with 100% return-to-work is 85% versus 63% in GAPS and GAGE conditions, respectively. At one-year follow-up more patients in the GAGE condition received disability pensions, as compared with patients in the GAPS condition (23% vs. 10%, respectively). These findings may indicate that patients in the GAPS condition were more successful in their job resumption as compared with patients in the GAGE condition. Differences between conditions, however, were not statistically significant ($\chi^2 = 6.88$; $P = 0.114$).

Days of sick leave

Number of days of sick leave as a result of back pain are reported in Table 3. Although not statistically significant ($P > 0.05$), the number of days of sick leave in the half year before the intervention (period 2) are lower in the GAPS than in the GAGE condition (difference = 10.5 days). Figure 3 shows the developments regarding days of sick leave within each condition in the year before the intervention (periods 1 and 2) and in the year after the intervention (periods 3 and 4). In the first half-year after the intervention, days of sick leave decreased in both conditions. During the second half-year after the intervention, however, conditions developed in a remarkably different manner: in the GAPS condition days of sick leave continued to decrease, whereas in the GAGE condition days of sick leave slightly increased again.

The results of multiple regression analyses are reported in Table 4. In the first half-year after the intervention, treatment condition did not have a significant contribution to the regression models of days of sick leave. The RDQ level at baseline was the only variable that had a significant contribution to the model at 6-month follow-up ($P < 0.05$). The regression analyses regarding days of sick leave during the second half-year after the intervention, on the other hand, show that treatment condition was the only variable that had a significant contribution to the model, in that patients in the GAPS condition reported significantly fewer days of sick leave than patients in the GAGE condition ($P < 0.05$). Remarkably, none of the covariates had predictive value at this time. The results were comparable whether days of sick leave in general or as a result of back pain were taken into account.

In total, 8 patients (3 GAPS, 5 GAGE) never returned to work after the intervention. Regarding analyses of work retention, including only those patients who succeeded in returning to work after the intervention, outcomes were identical to the initial analyses, indicating that patients who succeeded at returning to work in the GAPS condition did better regarding work retention.

TABLE 2. *Work status*

	GAPS			GAGE		
	Pre (n = 45)	FU1 (n = 44)	FU2 (n = 41)	Pre (n = 39)	FU1 (n = 37)	FU2 (n = 35)
100% Return-to-work	8.9 (4)	75.0 (33)	85.4 (35)	20.5 (8)	70.3 (26)	62.9 (22)
Part-time return-to-work	28.9 (13)	13.6 (6)	2.4 (1)	33.3 (13)	8.1 (3)	2.9 (1)
No return-to-work	62.2 (28)	6.8 (3)	2.4 (1)	46.2 (18)	18.9 (7)	11.4 (4)
100% Disability compensation as a result of back pain	0	2.3 (1)	4.9 (2)	0	2.7 (1)	20.0 (7)
100% Disability compensation not as a result of back pain	0	2.3 (1)	4.9 (2)	0	0	2.9 (1)

Values are given as percentage and absolute number.
GAPS, graded activity + problem-solving therapy; GAGE, graded activity + group education; Pre, 1 week before treatment; FU1 and FU2, 6 and 12 months, respectively, after treatment.

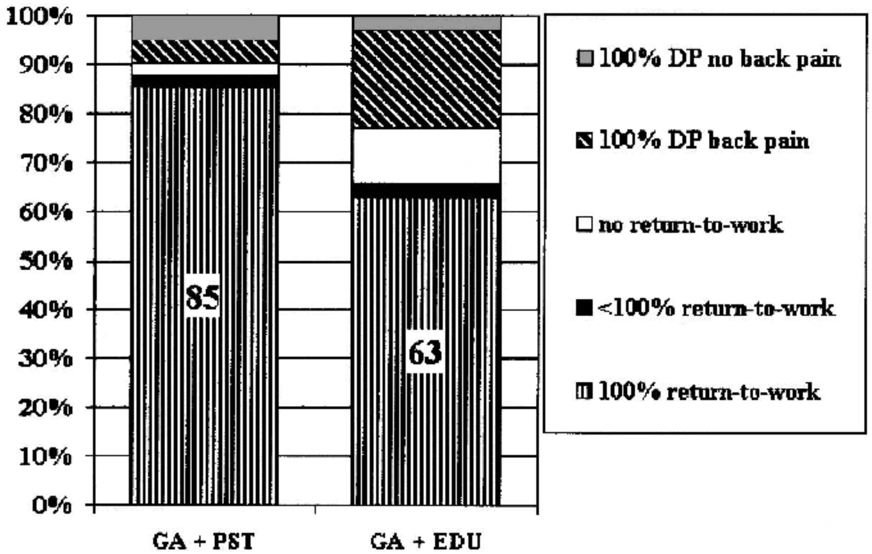

FIG. 2. Work status at 12-month follow-up, by condition. GA, graded activity; PST, problem-solving therapy; EDU, group education; DP, disability pension.

Post hoc sensitivity analyses were conducted to control whether data quality (incomplete data) influenced outcomes of the effect evaluation. Regression analyses were therefore repeated, but this time sick leave was defined as 100% work loss, regardless of whether work was partly resumed or took place on a therapeutic basis. Analyses did not show any marked differences and endorsed the previous finding that treatment condition was the only variable successfully predicting days of sick leave as a result of back pain during the second half-year after the intervention. When sick leave in general was regarded, RDQ level at baseline had a significant contribution to the prediction of days of sick leave during the second half-year after treatment (standardized $\beta = 0.218$; $P < 0.05$) next to treatment condition (standardized $\beta = 0.287$; $P < 0.05$).

DISCUSSION

The aim of the present study was to investigate the supplemental value of PST when added to behavioral graded activity, with regard to days of sick leave and work status in employees with LBP. The results show that PST had supplemental effects, which became apparent 12 months after termination of the program. First, work status did not differ significantly between conditions. Patients who received PST in addition to graded activity, however, had significantly fewer days of sick leave (50%) during the second half-year after the intervention than patients who did not receive additional PST. The same conclusion can be drawn with regard to work retention, in that addition of PST resulted in better work retention in the year after the intervention. Several checks to control for possible sources of confounding revealed that the manipulation was successful, as well as

TABLE 3. *Days of sick leave*

	Condition				
Period	GAPS	n	GAGE	n	*P*
1: 1–0.5 year, pretreatment	8.3 (16.9)	45	10.4 (22.8)	39	0.99
2: 0.5–0 year, pretreatment	30.8 (24.7)	45	41.3 (27.8)	39	0.09
3: 0–0.5 year, post-treatment	24.5 (31.3)	44	34.2 (44.3)	39	—
4: 0.5–1 year, post-treatment	18.5 (36.4)	44	37.9 (50.1)	39	—

Values are given as mean (SD). Means are based on all available data in the period concerned; *P* values are based on Mann-Whitney *U* test.
GAPS, graded activity + problem-solving therapy; GAGE, graded activity + group education.

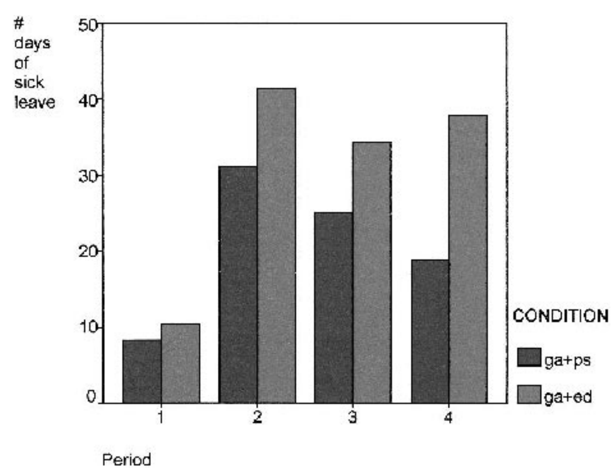

FIG. 3. Number of days of sick leave as a result of back pain, by condition. Ga: graded activity; pst, problem-solving therapy; edu, group education; period 1, 12 to 6 months before treatment; period 2, a half year before treatment; period 3, a half year after treatment; period 4, one-half to one year after treatment; I, intervention.

TABLE 4. *Results of multiple linear regression analyses in the first and second half-year after the intervention, for days of sick leave as a result of back pain and in general*

Dependent variable	n	Adjusted R^2	Independent variables	Standardized β
Period 3:				
As a result of back pain	83	0.069*	Treatment condition	0.117
			Days of sick leave, period 2	0.195†
			RDQ level at baseline	0.229*
			Treatment credibility	0.006
In general	81	0.066†	Treatment condition	0.117
			Days of sick leave, period 2	0.151
			RDQ level at baseline	0.260*
			Treatment credibility	−0.011
Period 4:				
As a result of back pain	83	0.038	Treatment condition	0.247*
			Days of sick leave, period 2	0.080
			RDQ level at baseline	0.156
			Treatment credibility	−0.082
In general	81	0.077*	Treatment condition	0.284*
			Days of sick leave, period 2	0.113
			RDQ level at baseline	0.179
			Treatment credibility	−0.106

Period 2, half-year before intervention; period 3, first half-year after intervention; period 4, second half-year after intervention; RDQ, Roland Disability Questionnaire.

*$P < 0.05$; †$P < 0.1$.

the randomization, with the exception of the level of functional disability and treatment credibility. Furthermore, sensitivity analyses did not show any marked differences when days of sick leave were computed according to an alternate definition in which sick leave was defined as 100% work loss, regardless of partial or therapeutic work-resumption.

The sample described in the present study was a smaller part of the original sample of 115 patients, as described by Van den Hout.[22] Although unlikely, slight selective dropout of data cannot be ruled out. On the other hand, baseline characteristics were comparable between the current sample and the group of patients whose data on sick leave were not available. Neither can we rule out that the dropout rate was more favorable for one condition than the other. The comparable distribution of baseline characteristics between conditions in the group that dropped out, however, may indicate that the original randomization was not violated.

Although the manipulation succeeded, neither the responsiveness nor the validity of change scores of the Dutch version of the SPSI-R was reported in previous studies. This warns against premature conclusions regarding the mechanisms mediating the effects found in the present study.

Remarkably, in the half year after the intervention the level of perceived functional disability at baseline is predictive of days of sick leave, regardless of days of sick leave in the half year preceding the intervention. From this, it seems to be important to screen employees regarding the level of self-reported disability.[39,40] At 12 months' follow-up, treatment condition was a significant predictor of the number of days of sick leave. Teaching problem-solving skills in addition to gradually increasing activity levels through operant principles successfully contributes to the prevention of sick leave and promotes work retention in the long term.

The results suggest that problem-solving skills may indeed play a role in disability as a result of LBP, as was suggested in two recent cross-sectional studies.[19,20] For example, Shaw et al.[20] suggest that a secondary prevention program could use problem-solving skills to help patients to overcome psycho-social, vocational, and ergonomic risk factors. The present prospective study is the first to demonstrate the preventive effects of a problem-solving intervention regarding sick leave in the long term. The results indicate that behavioral graded activity may have an important contribution to the effects in the first half-year after the intervention. Only employees who also received the problem-solving intervention, however, continued to show positive developments during the second half-year after the intervention. These long-term effects result in better work retention and fewer days of sick leave. As suggested by Shaw et al.,[20] effects in the long term may indeed be related to a more positive orientation, not only to the pain problem, but even more so to problems in general, either in the workplace or at home.

The sample selected in this study consisted in the greater part of employees with chronic or recurrent LBP who had been able to continue to work despite pain for quite some time. It would be more appropriate, therefore, to consider duration of sick leave rather than duration of pain when indicating the target population for the intervention described in this study. It would be interesting to select employees with recurrent short episodes of back pain to prevent them from work loss when back pain becomes less manageable in future situations. These suggestions are supported by a report[41] of significant preventive effects of a cognitive–behavioral group intervention with regard to sick leave in a nonpatient population who experienced 4 or more episodes of intense spinal pain during the last year, but had not been out of work more than 30 days.

The introduction of problem-solving techniques, especially in a population of employees at risk for developing chronic disability, may be a promising innovation with respect to early intervention at the workplace in primary care settings. Indeed, Mynors Wallis[42] found problem-solving therapy to be effective regarding disability days and days off work in patients with emotional disorders in primary care.

Before introducing these problem-solving techniques to patients, however, some conditions need to be fulfilled. In the present study, cooperation between the occupational health physician, the general practitioner, and the multidisciplinary rehabilitation team was initiated regarding individual cases. To achieve a consistent plan agreed on by all parties, one party (e.g., the occupational therapist) must initiate contacts and communicate about therapy to parties outside the rehabilitation center. A plan for return-to-work must be agreed on between the occupational health physician, the employer, the employee, and the rehabilitation team. In addition, it is plausible that problem-solving techniques yield the best effects when broadly implemented, not only within the rehabilitation setting, but also at the workplace and at home. When employees see results in their new way of dealing with work-related problems, it may facilitate the use of problem solving in future situations.

A limitation of the present study may be that the study design did not include a treatment-as-usual condition, and therefore does not allow conclusions to be drawn about efficacy of the entire program. Nevertheless, graded activity was previously shown to be more effective than treatment-as-usual.[9–11] From this, it may be cautiously suggested that the PST ingredient added supplemental value to the effect of graded activity. Another limitation of this study may be that cost-effectiveness was not analyzed. We did not find statistically significant effects with regard to work status; however, the high indirect costs that are related to work disability (days of sick leave and disability pensions) may put the effects found with regard to work status in a different perspective. Different percentages of disability pensions, especially, with the lowest percentage in the experimental condition, may have important implications regarding cost-effectiveness.

Finally, the supplemental value of problem solving occurred only at long term. This may indicate that the generalization of problem-solving skills to daily life needs time and that eventual effects would not have been detected if measurements had been restricted to the short-term. In line with this, Linton and Van Tulder[7] found that almost all studies included in their review had relatively short follow-up periods, and suggested that the full preventive effect may not yet be visible. From the present findings it is recommended that long-term follow-up measurements be included, especially when behavioral change and maintenance are important aims of the intervention.

In conclusion, PST turned out to be an effective treatment in LBP. It showed favorable effects in the course of sick leave in the year after the intervention. The intervention may alter the course of work disability and even protect employees against new episodes of sick leave. A logical continuation of the present study would be to examine cost-effectiveness and to explore possibilities for implementation of problem-solving techniques in occupational health care.

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