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Graded Activity for Low Back Pain in Occupational Health Care

A Randomized, Controlled Trial

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Background: **Low back pain is a common medical and social problem frequently associated with disability and absence from work. However, data on effective return to work after interventions for low back pain are scarce.**

Objective: **To determine the effectiveness of a behavior-oriented graded activity program compared with usual care.**

Design: **Randomized, controlled trial.**

Setting: **Occupational health services department of an airline company in the Netherlands.**

Patients: **134 workers who were absent from work because of low back pain were randomly assigned to either graded activity ($n = 67$) or usual care ($n = 67$).**

Intervention: **Graded activity, a physical exercise program based on operant-conditioning behavioral principles, to stimulate a rapid return to work.**

Measurements: **Outcomes were the number of days of absence from work because of low back pain, functional status (Roland Disability Questionnaire), and severity of pain (11-point numerical scale).**

Results: **The median number of days of absence from work over 6 months of follow-up was 58 days in the graded activity group and 87 days in the usual care group. From randomization onward, graded activity was effective after 50 days of absence from work (hazard ratio, 1.9 [95% CI, 1.2 to 3.2]; $P = 0.009$). The graded activity group was more effective in improving functional status and pain than the usual care group. The effects, however, were small and not statistically significant.**

Conclusions: **Graded activity was more effective than usual care in reducing the number of days of absence from work because of low back pain.**

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Nonspecific low back pain is an uncomfortable medical condition that causes frequent disability and absence from work. Most episodes of low back pain resolve fairly quickly and cause only short periods of absence from work. However, some workers with low back pain miss work for several days to weeks and are at risk for more permanent disability (1). To reduce the individual and socioeconomic burden related to this absenteeism, we need effective intervention strategies in occupational health care settings that promote safe and rapid return to work.

One promising and often-advocated intervention strategy for workers with prolonged nonspecific low back pain is active rehabilitation that is directed toward return to normal activity and work (2). Examples are graded activity interventions that include physical exercise, application of operant-conditioning behavioral principals, and promotion of improved functioning and safe return to work even if pain persists (3–6). In a randomized, controlled trial, Lindström and colleagues (3, 4) found that a graded activity intervention reduced absence from work more than did traditional care in Swedish workers employed in the automobile industry. We investigate, in a second randomized, controlled trial, whether absence from work because of low back pain is reduced more with graded activity intervention than with traditional care in an occupational health care setting in the Netherlands.

METHODS

Study Design and Sample

The study was a single-blind, randomized, controlled trial in an occupational health services center (KLM Health, Safety and Environment) at Schiphol Airport, Amsterdam, the Netherlands. The center provides occupational health services for all employees of a major Dutch airline (KLM Royal Dutch Airlines). The source sample ($n = 20\,000$) consisted of workers who were employed in the following organizational units of the airline: baggage and aircraft turnaround services, passenger services, engineering and maintenance, cargo, and cabin and cockpit.

Workers who were listed as absent from work because of low back pain were invited for a consultation with the occupational physician. Those who were thought to be eligible for inclusion were referred to the research assistant, who judged whether they met the inclusion criteria: full or partial absence from work because of nonspecific low back pain and low back pain symptoms with a minimum duration of 4 weeks in succession. The exclusion criteria were low back pain with radiation below the knee with signs of nerve-root compression (7); cardiovascular contraindications for physical activity, as checked according to the Physical Activities Readiness Questionnaire (8, 9); any conflict between worker and employer with legal involvement; or pregnancy. Workers who met the inclusion criteria were informed of the purpose and procedures of the study and were enrolled after giving informed consent. The

Context

Low back pain causes frequent disability and lost productive time.

Contribution

This randomized trial compared a behavioral-oriented graded activity program with usual care in 134 Dutch airline company workers who had missed work because of persistent low back pain. Graded activity consisted of biweekly 1-hour exercise sessions with physiotherapists who emphasized operant-conditioning principles. Over 6 months of follow-up, participants in the graded activity program missed 58 days of work, while participants receiving usual care missed 87 days.

Implications

A behavioral-oriented graded activity program returned participants with low back pain to work more often than did usual care.

–The Editors

Medical Ethical Committee of the VU University Medical Center, Amsterdam, the Netherlands, approved the study.

Treatment Allocation

The participants were assigned to graded activity or usual care on the basis of block randomization, after prestratification for the organizational unit in the workplace from which they were recruited (the 5 organizational units listed earlier) and for the severity of pain symptoms (scored on a scale of 0 to 10; severity scores were <6 or ≥ 6 points). This resulted in a total of 10 strata. Randomized, permuted blocks of 4 allocations were generated for each stratum through a computer-generated random-sequence table. Opaque, sequentially numbered, sealed envelopes were prepared for each stratum by a researcher who was not involved in enrolling the participants or assigning them to their groups. The envelopes contained a sheet of paper that indicated 1 of the 2 interventions. Participants learned their group assignments after a research assistant completed the baseline measurements and delivered the sealed envelopes.

Blinding

The research assistants who collected the data were blinded to the treatment allocation. All participants were repeatedly asked not to reveal any information about their treatment allocation. The participants and treatment providers were not blinded to treatment allocation.

Interventions

In the Dutch occupational health care system, occupational physicians guide disabled workers who are absent from work through their disability period. These occupational physicians are employed by occupational health services that are paid for by the companies. The occupational physicians adhere to back pain management strategies that consist of advising workers on ergonomics, prevention, and return-to-work schedules and advising and communicating with other stakeholders (such as health care providers and representatives of the workplace). Disabled workers who participated in the present study were assigned to either graded activity or usual care within the context of the Dutch occupational health care setting.

Graded Activity

The intervention group received the usual guidance from the occupational physician about work-related problems and barriers to return to work as well as the graded activity intervention supervised by a physiotherapist. Three physiotherapists who worked in a private practice at Schiphol Airport provided the treatment according to the graded activity protocol. Two of those physiotherapists were also trained as manual therapists, and 1 was also a human movement scientist. Before the study, the physiotherapists had been specifically trained to treat patients with low back pain according to behavioral principles. A research physiotherapist who was experienced in treating patients with chronic pain in rehabilitation centers instructed the physiotherapists in three 2-hour sessions and practiced patient–therapist interactions with them through role-play. Before the study, the physiotherapists treated several patients according to the graded activity protocol to gain more experience. The physiotherapists made audiotapes of the intervention sessions before and during the study period. The contents of these audiotapes were assessed and discussed with the research physiotherapist in 3 additional meetings. Furthermore, the physiotherapists summarized the treatment after each session, and researchers used these summaries to review the sessions. The same physiotherapist treated participants each time, except for temporary stand-in sessions that were supervised by colleagues because of holidays or other reasons. Specific therapists were not systematically selected to treat specific participants; selection was based on pragmatic reasons, such as the time available in the work schedules of the physiotherapists or the days of treatment preferred by the participants.

Table 1 presents the concept and content of the graded activity intervention. The intervention consisted of 1-hour exercise sessions that participants attended twice per week until they returned completely to regular work or until the maximum therapy duration of 3 months was reached. At the start of the intervention, the physiotherapist inquired about the participant's medical history and completed a brief physical examination consisting of flexion, extension, and lateroflexion of the lumbar spine and a brief screening for nerve-root pain (10). The purpose of the physical examination was to confirm the diagnosis of benign, nonspecific low back pain and to reduce participants' fears about any presumed underlying disease. The

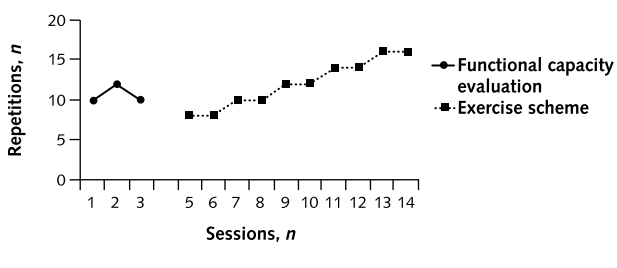
Table 1. **Description of Graded Activity Intervention**

Feature	Description
Disciplines	Physiotherapist, occupational physician (case manager).
Concept	Pain and its related behaviors (pain behavior), such as physical inactivity, complaining, or absence from work, are controlled by learning (operant conditioning). Favorable consequences that follow pain behavior will reinforce the future occurrence of pain behavior. Exercise and physical activity are considered to be incompatible with pain behavior. The stimulation of exercise behavior may therefore lead to a decrease in competing pain behavior.
Sessions	Two 1-hour sessions per week, supervised by the physiotherapist, until full return to regular work. The intervention has a maximal duration of 3 months.
Education messages	Pain does hurt, but this does not mean it harms. Exercise and physical activity are recommended and safe, despite pain symptoms. Improvement of functioning is the primary goal, not pain relief.
Exercises	General exercises (aerobic, abdominal, back, and leg exercises) and individually tailored exercises to simulate and practice problematic tasks at work or problematic activities of daily living.
Baseline values of maximal performances	During the first 3 sessions, workers are asked to perform each exercise separately until the limits of pain tolerance (pain contingent) are reached. The average results of these 3 maximal performances are used as baseline values for the quota-based exercise program.
Date of return to work	After the third session, the worker proposes a date for return to work (in consultation with the physiotherapist), which corresponds with the end of the intervention period.
Exercise program	The worker determines (in consultation with the physiotherapist) a gradually increasing quota for each exercise. The exercise quotas start at a level below the average baseline value of functional capacity (to ensure success) and are gradually increased during the course of the intervention.
Time-contingent management	The exercise quotas are preset and not subject to change during the course of the intervention, regardless of level of pain.
Return to work	The worker may return to work partially or with modified duties before returning to full regular work. Partial return to work is considered to be of therapeutic value. Appointments with regard to this return-to-work plan are also applied on a time-contingent basis, which means that they are not subject to change because of any variations in pain symptoms.

participants were reassured that despite the annoying pain, nothing was seriously wrong with their backs. Subsequently, the physiotherapist and participant decided on a set of general exercises and individually tailored exercises. Both types of exercises had to be performed during each session. The general exercises were aerobic exercises, such as cycling or rowing, and strengthening exercises for large muscle groups, and most were carried out in a gym while using exercise equipment. The strengthening exercises were a floor abdominal sit-up exercise, a dynamic back extension exercise, a leg-press exercise, a latissimus pull-down exercise, and standing up from a low chair. Participants in the graded activity group had to perform not only these general exercises but also individually tailored exercises, which imitated physical tasks at work or difficult and painful activities of daily living. For example, a participant who reported back problems while lifting and moving suitcases from a luggage wagon into an airplane might be given an exercise to practice lifting and moving a suitcase with a certain number of repetitions. During the first 3 sessions, the maximal performance (for example, the maximum number of repetitions) was assessed for each exercise separately, and the average score for each exercise over the 3 sessions was used as a baseline value for specifying a gradually progressive exercise scheme. Subsequently, the participant was asked to propose a date for full return to regular work, which would consequently be the end point of the physical exercise program. Before returning to full regular work, participants could return to work with modified hours and duties. Advised by the physiotherapist, the participant then decided on a gradually increasing quota for each exercise to achieve a preset exercise goal immediately before the proposed date of full return to work. The increase in the quota was visualized for each exercise in a graph drawn by the participant (**Figure 1**), which was intended to give visual feedback on the participant's improvement during the course of the intervention. The exercises were started during the fourth session at a level below the average maximal functional capacity assessed during the first 3 sessions to guarantee that the participant could complete the exercise quota and succeed. The exercise quota was gradually increased during the course of the intervention, according to the time-contingency principle. The preset increasing exercise quota was fixed, and the participant had to perform the exercises each session according to this quota, regardless of the amount of pain.

The physiotherapist verbally praised the participant

Figure 1. **Example of a graded activity exercise scheme for an exercise consisting of lifting and moving a suitcase with a certain number of repetitions.**



During the first 3 sessions, maximal performance of exercises is evaluated. Session 14 marks the participants' return to full regular work.

each time 1 of the preset exercise goals was achieved. In general, the physiotherapists were instructed to pay particular attention to the participants' improvements rather than their pain. It should further be stressed that the primary goal of the physical exercises was not to improve aerobic endurance, muscle strength, or any other aspect of physical fitness but to make the disabled worker aware that it was safe to move and to be physically active despite his or her pain.

The participants could have also consulted their general practitioners, as well as the occupational physician, for their low back pain during the study period. Therefore, their general practitioners were informed about the study and the principles of the graded activity program. They were requested to treat the participants according to the low back pain guidelines issued by the Dutch College of General Practitioners (7). These guidelines advocate an active approach and possible referral for exercise therapy in patients with chronic low back pain. However, the general practitioners were asked not to refer the participants for any additional treatments for low back pain during the course of the graded activity intervention.

Usual Care

The usual care group received the usual guidance and advice from the occupational physician. Other types of treatment were not required, except that the participants were not allowed to attend treatment sessions at the same physiotherapy practice where the participants in the graded activity group were treated. The general practitioners of all participants in the usual care group were also requested to treat the participants according to the low back pain guidelines of the Dutch College of General Practitioners (7).

Outcome Measures and Data Collection

Outcome measures were the total number of days absent from work because of low back pain, functional status, and pain. Functional status and pain were measured at baseline and 3 and 6 months after randomization. Data on days absent from work because of low back pain were continuously collected in the electronic medical records of the company. The primary outcome was the total number of days of absence from work (both initial days and days of recurrent episodes of absence from work) because of low back pain over the entire follow-up period. During follow-up, some participants might have returned to partial work with modified hours or duties (for therapeutic reasons) but remained on the work absenteeism list. Full return to regular work was defined as any full return to regular work with a minimum duration of 4 weeks. This means that recurrent episodes of absence from work because of low back pain within 4 weeks of full return to regular work were considered as belonging to the same first continuous period of absence from work, which is in accordance with the Dutch social security laws.

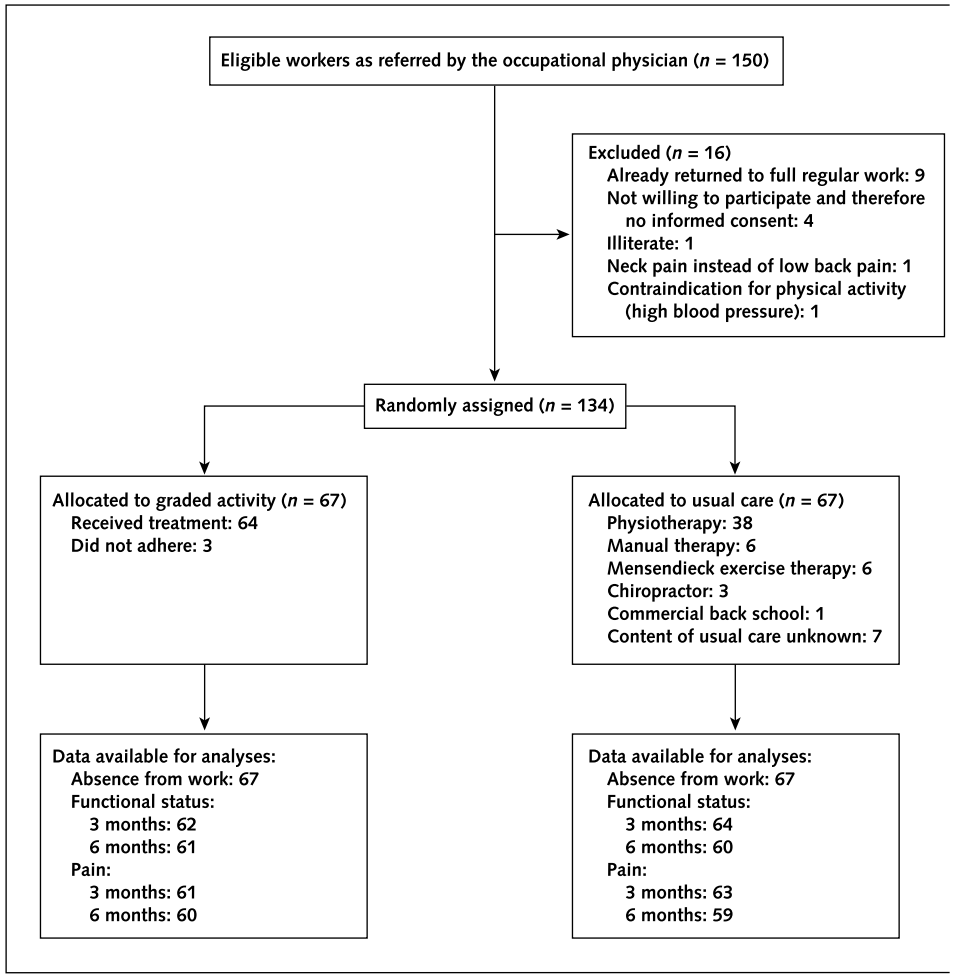
The functional status of participants was assessed by using the Roland Disability Questionnaire (11). This questionnaire consists of 24 items relevant for the functional status of a patient with low back pain. The scoring was based on the number of positive responses. An individual score could range from 0 (no disability) to 24 (severe disability). The Dutch translation of the Roland Disability Questionnaire was a reliable, valid, and responsive outcome measure (12). The average pain intensity in the previous week was evaluated by the participant on an 11-point numerical scale ranging from 0 (no pain) to 10 (very severe pain) (13).

Physical activity at baseline was measured with the Baecke Questionnaire. This is a self-administered questionnaire (16 items) consisting of 3 constructs: physical activity at work; sport during leisure time; and physical activity during leisure time, excluding sport (14, 15). Although most participants were fully absent from work at baseline, we compared only the baseline scores for sport during leisure time with physical activity during leisure time, excluding sport. Data about any treatment received during the study period other than graded activity were collected in both groups through diaries and questionnaires.

Statistical Analyses

To calculate sample size, we assumed that a statistically significant difference of 5 days of absence from work because of low back pain between the groups was the smallest clinically important difference. This difference would correspond with the point at which the costs of the graded activity intervention equaled the profits of the reduction in days of absence from work. The calculations showed that with a power of 0.90 and a significance level of 0.05, a target sample of 70 participants in each group was needed. Measures of central tendency and dispersion were calculated for baseline characteristics and baseline values of the outcome measures to determine the prognostic similarity of the groups. The difference in the total number of days absent from work between the groups was analyzed by using survival analysis. A Cox multivariable regression model for repeated events was used to calculate hazard ratios and 95% CIs. Because the Cox proportional hazard assumption was not met by the work absence data, hazard ratios were calculated for specific follow-up periods by adding an interaction between a specific follow-up period and treatment allocation to the model. Functional status and pain severity during the previous week were analyzed by using longitudinal analysis of covariance (that is, the follow-up measurement as outcome and the baseline value of the particular outcome variable as covariate). The baseline values of the particular outcome variable were added to the model to correct for possible regression to the mean. The coefficients of the longitudinal analysis of covariance were estimated with random coefficient analysis. Random coefficient analysis "corrects" for the dependence of the observations by allowing random regression coefficients for each individual (16). In both the Cox regression analyses and the longitudinal random coefficient analyses, adjustments

Figure 2. **Flow diagram showing the progress of the participants through the phases of the trial.**



were made for age, sex, duration of the last period of absence from work before randomization, and either partial or full absence from work at baseline. All covariates were forced in the multivariable models. All statistical analyses were performed according to the intention-to-treat principle. In addition, alternative per-protocol analyses were performed, excluding all participants who were not treated according to protocol. A P value less than 0.05 was considered statistically significant. Cox regression for repeated events was analyzed with Stata, version 7 (Stata Corp., College Station, Texas) (17), and the random coefficient analyses were performed with MLwiN, version 1.1 (Centre for Multilevel Modelling, Institute of Education, London, United Kingdom) (18, 19).

Role of the Funding Source

The funding source had no role in the collection, analysis, or interpretation of the data or in the decision to submit the manuscript for publication.

RESULTS

From April 1999 to January 2001, the occupational physicians referred 150 workers. Sixteen workers did not meet the inclusion criteria (**Figure 2**). A total of 134 participants were randomly assigned to either the graded activity group ($n = 67$) or the usual care group ($n = 67$). Data on the number of days of absence from work were available for all randomly assigned participants since work-loss data were available regardless of the worker's participation in treatment or follow-up. Thirteen participants withdrew from the study during follow-up and did not complete the functional status and pain measurements. Except for the cases already mentioned and several incidental missing values for some variables, the data set for the entire follow-up period was complete. Of the 13 participants who withdrew from the study, only 3 did not adhere to the graded activity intervention protocol. One nonadherent participant withdrew from the study immediately after randomization, declining to participate in the graded activity intervention. The 2 other participants were dissatisfied with the content of the graded activity sessions and withdrew after a few sessions.

Table 2 shows the baseline characteristics and baseline values of the outcome measures for both groups. There were only small differences between the treatment groups.

Table 2. **Prognostic Variables and Baseline Values of Outcome Measures***

Baseline Variable	Graded Activity (*n* = 67)	Usual Care (*n* = 67)
Characteristics		
Mean age ± SD, *y*	39 ± 9	37 ± 8
Men/women, *n/n*	64/3	62/5
Company departments, *n*		
Baggage and aircraft turnaround services	35	32
Engineering and maintenance	16	19
Cargo	5	5
Cabin and cockpit	5	5
Passenger services	6	6
Absence from work at the start of the study, *n*		
Partial	34	31
Full	33	36
Median duration of complaints before randomization (IQR), *wk*	8.5 (6–14)	8 (6–12)
Baecke Questionnaire sport index score (1–5)†	2.4 ± 0.6	2.3 ± 0.7
Baecke Questionnaire leisure time index score (1–5)†	3.0 ± 0.6	2.7 ± 0.7
Values of outcome measures		
Median duration of absence from work with the current episode of low back pain before randomization (IQR), *d*	43 (31–68)	41 (25–65)
Mean functional status score ± SD‡	13.3 ± 4.6	13.0 ± 4.9
Mean pain severity ± SD during the previous week	6.7 ± 1.8	6.4 ± 1.7

* IQR = interquartile range, 25th percentile to 75th percentile.
† A higher score indicates a higher level of physical activity.
‡ As measured by using the Roland Disability Questionnaire (11).

Content of Treatments

The participants who were assigned to the graded activity group attended a mean (±SD) of 13 ± 5.4 treatment sessions. The graded activity intervention had an average duration of almost 7 weeks. One physiotherapist changed jobs a few months after the start of the study. She had provided the graded activity treatment for 7 participants. The median number of days that these participants were absent from work because of low back pain after randomization was 53 days. To replace this physiotherapist, we trained another physiotherapist during the study period. He treated 15 participants, and the median number of days that they were absent from work because of low back pain after randomization was 54 days. The third physiotherapist delivered treatment during the entire study period for 44 participants, who were absent from work because of low back pain after randomization for a median of 65 days. Eight participants who received the graded activity intervention reported that they used nonsteroidal anti-inflammatory drugs, and 3 participants reported that they used painkillers during the intervention period.

Sixty of the 67 participants (90%) in the usual care group completed and returned their diaries about the usual care they received. **Figure 2** shows the different types of care received by participants in the usual care group. They had received a mean (±SD) of 13 ± 8.4 sessions of treatment from various caregivers. Sixteen participants reported that they had used nonsteroidal anti-inflammatory drugs, and 6 participants reported that they had used painkillers either with their treatment or separately. The remaining 7 participants in the usual care group who did not return their diaries did not receive any treatment similar to the graded activity intervention. In the Dutch system, such interventions in an occupational health care setting cannot be delivered without knowledge or involvement of the occupational physician.

Absence from Work Because of Low Back Pain

The median total number of days of absence from work because of low back pain after randomization was 58 days in the graded activity group and 87 days in the usual care group. In the first 50 days after randomization, the rate of return to work was more or less similar in both groups, although from approximately 50 days after randomization and onward, the curves of the graded activity group and the usual care group diverged. We assumed that hazard ratios were constant within each time period. Through Cox regression analyses for repeated events, hazard ratios were calculated for the participants with fewer than 50 days of absence from work after randomization and for the participants with 50 or more days of absence from work after randomization. The hazard ratio for the period up to 50 days after randomization was 1.0 (95% CI, 0.6 to 1.8; $P > 0.2$), and the hazard ratio for the period from 50 days after randomization was 1.9 (CI, 1.2 to 3.2; $P = 0.009$), which was in favor of the graded activity intervention. Per-protocol analysis was also performed, excluding the 3 nonadherent participants in the graded activity group. In this case, the hazard ratio for the period up to 50 days after randomization was 1.1 (CI, 0.6 to 1.9; $P > 0.2$), and the hazard ratio for the period from 50 days after randomization was 2.0 (CI, 1.2 to 3.2; $P = 0.004$), in favor of the graded activity group.

Functional Status and Pain

Both treatment groups improved in functional status and pain over time (**Table 3**). The differences between the groups in improvement of functional status and pain at 3 and 6 months favored graded activity but were not statistically significant.

DISCUSSION

We found that graded activity for low back pain in an occupational health setting had a beneficial effect on absence from work but had no statistically significant effect on functional status and pain when compared with usual care. The reduction in days of absence from work because of this intervention is promising and confirms results of an earlier Swedish trial by Lindström and colleagues (3, 4). We found that graded activity did not affect return to work until more than 50 days after randomization. The apparent delayed effect may relate to the time involved in the inter-

Table 3. **Improvements in Functional Status and Pain from Baseline at 3 and 6 Months and Differences in Effects between the Groups**

Outcome	Participants	Mean Improvement ± SD		Effect of the Graded Activity Intervention (95% CI)*	*P* Value
		Graded Activity	Usual Care		
Functional status†					
3 months	124	6.3 ± 6.7	4.9 ± 6.2		
6 months	120	7.8 ± 6.6	6.4 ± 6.6	−1.5 (−3.3 to 0.4)	0.11
Pain					
3 months	122	2.8 ± 2.4	2.5 ± 2.8		
6 months	118	2.9 ± 3.1	2.7 ± 2.8	−0.4 (−1.1 to 0.4)	>0.2

* Adjusted for the baseline value of the outcome measure, age, sex, duration of absence from work before randomization, and either partial or full absence from work at baseline. The effect is the regression coefficient derived from longitudinal random coefficient analysis (corrected for the baseline value of the outcome measure), which can be interpreted as the difference in adjusted improvement over time between the groups. Both differences favor the graded activity group.
† As measured by using the Roland Disability Questionnaire (11).

vention (on average, 13 treatment sessions twice per week) because participants might be less inclined to return to work during active treatment periods.

Functional status results showed a tendency toward improvement with graded activity (point estimate of effect, 1.5 points on the Roland Disability Questionnaire scale), but it was not statistically significant. Whether a difference of this magnitude could be clinically important is debatable (20). Stratford and colleagues (21) compared scores on the Roland Disability Questionnaire with a global rating of change to classify patients as having changed a clinically important amount or not. They suggested that a change of 1 to 2 points is clinically important for patients with little disability, which was defined as an initial score of 0 to 8 points. In the present study, mean (±SD) baseline scores were 13.1 ± 4.8 points. Detecting clinically important changes for patients scoring within this baseline range may require changes of 5 points or more (21). Furthermore, changes detected by the Roland Disability Questionnaire do not necessarily apply to work-related functioning because no item on the questionnaire is related to work.

We found that the intervention did not affect pain severity. This finding corresponds with the general principle of the graded activity intervention, which primarily focuses on improvement in functioning and return to work and not on pain relief. We do not consider pain relief a prerequisite for returning to work, and participants were told that they could safely return to work despite pain. To shift participants' attention away from negative symptoms, such as increasing pain, numbness, tiredness, or paresthesia, we did not routinely question or monitor them for these adverse events. The caregivers did not ignore these symptoms but focused on the abilities, not the disabilities, of the participants.

In general, disabled workers' return to work does not depend only on their medical condition or their perception of their medical condition. It also depends on other contextual factors, such as compensation, legal issues, and the culture of the workplace. In the Netherlands, workers usually receive their full salary during the first year of absence from work, regardless of the cause of their disability. The graded activity intervention in this study was aimed at changing the way disabled workers perceive and cope with their back pain. Its goal was to convince workers that their pain was benign by telling them that it was safe to return to work and by giving them experiences (that is, physical exercise and resumption of work activities) that supported that message. In our view, this change in workers' perception of their medical condition and subsequent return to work is relatively independent from contextual circumstances, such as compensation issues and the organization of the health care system. If so, our findings, which are similar to those of a previous trial involving Swedish workers, may be generalizable across several settings. Nevertheless, future randomized, controlled trials in this field across different occupational and organizational settings are needed to clarify both the mechanisms and the generalizability of our results.

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