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# COMPARISON OF THREE INTENSIVE PROGRAMS FOR CHRONIC LOW BACK PAIN PATIENTS: A PROSPECTIVE, RANDOMIZED, OBSERVER-BLINDED STUDY WITH ONE-YEAR FOLLOW-UP

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ABSTRACT. **In a randomized, blinded study, we compared the outcome from a full-time functional restoration program with the outcome from shorter active rehabilitation programs for patients with chronic, disabling low back pain. The study initially included 132 patients, randomized into one of three treatment programs: (1) an intensive 3-week multidisciplinary program; (2) active physical training and back school; or (3) psychological pain management and active physical training. Nine of the randomized patients never started in any program, so the studied population consisted of 123 patients. Of these, 14 patients (11%) dropped out. The results presented here are at 1 year following treatment, where we achieved a 92% response rate, including the drop-outs. The functional restoration program was superior to the shorter programs as to work-ready rate, health care contacts, back pain level, disability level, staying physically active, and reduction in analgesics. There was no significant difference between Programs 2 and 3 in most of these parameters. As for sick leave and leg pain, there was no significant difference between Programs 1 and 2, although a difference was observed when comparing Program 3 with each of the other two. Conclusively, it seems that there is human, as well as economical, benefit from a functional restoration program compared to less intensive programs for these patients.**

*Key words:* chronic low back pain, functional restoration, multidisciplinary treatment, physical training, psychological pain management.

The attitude towards treatment for chronic low back pain (CLBP) has alternated over the past few decades between the passive and the active approach. In fact, the active treatment with specific back exercises was described as far back as 1925 by Hoffa (23). Throughout the 1960s and 1970s, treatment became dominated by passive elements such as bed-rest, hot packs, ultrasound, massage, spinal manipulation etc., although no studies have ever proved a convincing long-term benefit in CLBP (7, 17, 18, 24, 26, 41, 45). The passive elements are still frequently used and seem, at least in the United States, to be by far the most common treatments (4, 48). This may maintain people with back pain in a patient role, where responsibility for treatment outcome is taken away from the patient. It may also leave the message that even a minor back problem has to be taken care of by experts.

A trend towards the more active, using physical training in the treatment for back pain, was revived again in the 1980s, with several studies exhibiting benefits (20, 27, 31, 36, 38, 42, 49). However, a study with low-dose flexion exercises showed no advantage in patients with acute LBP (11). It seems as if physically fit people have fewer and shorter attacks of LBP (2), and moreover, that physical activity increases bone mineral content and muscle strength (21). It is well known that in patients with *chronic* back pain, the pathology and objective signs often correlate very poorly with subjective physical capacities and pain behaviours (3, 13, 34, 43, 47). It has also been shown that CLBP patients experience substantial limitations in recreational activities, social interaction, home management and general mobility (12). As a consequence, biopsychosocial models have been developed. From this perspective, a treatment program should include physical, psychological and social elements in order to reconstruct the person's total situation. Results from such a "functional restoration" program were first described by Mayer et al. (33), followed a few years later by Hazard and colleagues (22). Both US centres reported successful outcome in terms of return-to-work rate, better overall functioning, pain reduction and other parameters for patients with CLBP. Similar multidisciplinary programs also showed good results (6, 9, 29, 44). However, two studies from Finland and one

from Canada did not exhibit influence on return-to-work rate, but did so on different other parameters (1, 10, 37).

Billions of dollars are spent annually on the treatment of back pain in western countries (38). Every year the cost increases, as does the number of registered back patients (49). It seems, therefore, important to identify effective programs. Frymoyer (14) and Deyo (8) advertise clinical studies to be prospective, randomized with control programs, observer-blinded with sufficient follow-up, and with outcome measures based on the patient's subjective report about daily functioning, quality of life etc. rather than on laboratory tests.

Due to the fact that intensive multidisciplinary programs are expensive, the aim of this study was to compare an intensive multidisciplinary program, designed as the functional restoration programs from the US, with less time-consuming, and cheaper, active programs for patients with disabling CLBP. Outcome was assessed after 1 year, including various social, pain and disability variables.

## MATERIALS AND METHODS

### *Project design*

The project was designed as a prospective, randomized, observer-blinded, parallel-program study. Prior to the randomization, all patients went through a medical examination by the same physician (AFB, who also performed the 1 year follow-up). In connection with this examination, the patients filled in a questionnaire concerning:

- actual work situation
- days of sick leave due to back pain during the previous 3 years
- pain level: back and leg pain separately, using a box-scale from 0 (no pain) to 10 (worst possible pain)
- assessment of activities of daily living (ADL), using a total of 15 questions after Manniches principles (32). Each question was rated at 0 points (no problems), 1 point (''might be a problem'') or 2 points (''is a problem''). The total score of the questions stated disability level for the patient: the higher the score, the more the disability.
- smoking
- alcohol use
- medication during the previous 2 weeks. This was assessed as suggested by Manniche (32): 0, no intake; 2, ≤ 4 days/week; 4, NSAID > 4 days/week; 8, morphine (-like) < or = 4 days/week; and 10, morphine (-like) > 4 days/week.
- previous disc surgery.

After the medical examination, the patients were randomized to one of the three treatment programs described below. The *randomization* procedure followed the minimization principle, described by Taves (45), aiming to equalize the following parameters across groups:

- age
- sex
- pain levels
- disability scores
- days of sick leave during the previous 3 years
- number of cigarettes/day.

### *Treatments*

The intervention consisted of three different treatment programs, to which the patients were randomized by minimization. The overall philosophy concerning physical and psychological training and patient education was the same in the three programs. However, the dosage and content in Program 1 were much heavier than in Programs 2 and 3, as seen from Table I.

The first day in all three programs was *test day*. The tests differed in the three programs as described below.

The *physical training* had a very active approach with no passive modalities included, except cold packs for self administration.

The *pain management* followed a behavioral approach, making the patients understand the importance of pain coping and self responsibilities.

The three programs were run in parallel in the Back Center by the same staff. The treatment programs are described in details below.

### *Program 1*

This intensive, multidisciplinary program was designed after the functional restoration model, earlier described by Mayer et al. (33) Gatchel & Mayer (15) and Hazard et al. (22). The program

Table I. *Dose and content of the three programs (see text for details)*

| | | Program 1 | Program 2 | Program 3 |
|---|---|---|---|---|
| Dose | | | | |
| | Weeks | 6 | 6 | 6 |
| | Total hours | 135 | 24 | 24 |
| Content | | | | |
| | Aerobics class | x | x | (x) |
| | Resistance training | x | x | x |
| | Stretching | x | (x) | (x) |
| | Occupational therapy | x | | |
| | Pain management | x | | x |
| | Back school | x | x | |
| | Other theoretical class | x | | |
| | Recreational activity | x | | |

ran for 3 successive weeks, 39 h per week, followed by 3 weeks with one 6-h day per week. *Initial tests* included muscle strength and endurance, cardiovascular fitness, lifting capacity, walking and running 400 m, standing and sitting tolerances and tests for activity of daily living (ADL). Psychological testing included the Million Behavioral Health Inventory (MBHI), the Million Pain Analog scale, the Symptom Check List 90 (SCL90), the Vanderbuilt Coping Questionnaire, and a structured interview by a clinical psychologist. Results from the psychological tests are not included in this article but will be published elsewhere. From the second day of the program the patients followed the same schedule every day with content as outlined in Table II. Seven patients participated as a group at the same time, and except for individual psychological counselling, all training was carried out in the group. One hour of *aerobics* included a combined training of cardiovascular fitness, muscular endurance, coordination and stretching. Progressive *resistance-training* and endurance for all major muscle groups were carried out in machines with air-based resistance. *Stretching* for 30 min included all major muscle groups. In *occupational therapy* 1.5-h training focused on simulated work situations and work hardening, including lifting, pulling and pushing, sitting and standing workplaces (adjustments and adaptation), and garden and kitchen work. The daily *psychological pain management* had the major goal of making the patients understand the importance of greater responsibility for coping with pain, setting up realistic personal goals, changing the negative experience of pain into a more positive way of living, and finally increasing self-acknowledgement. This was combined with daily relaxation of 30 min and individual counselling once a week for 1 h. One hour of daily *theoretical class* included traditional back school subjects according to Swedish principles (51), taught in a "fear-avoidance" pattern. It also included medication, diagnosis, surgery, sexual issues, nutrition, a minor job analysis course including how to write an application and curriculum vitae, job options, evaluation of advertisements, etc. In *recreational activities*, different sports, games, (power)walking, running, swimming etc. were carried out.

Every Monday, two or three new patients started in the program, and every Friday two or three patients graduated. This "rolling-schedule" seemed effective in terms of having the patients support each other on different levels in the program. The first week seemed very hard to many participants, but the "older" patients in the second and third weeks helped them to endure, by feeling responsibility, authority and, thus, self-confidence.

*Follow-up.* One day per week for the subsequent 3 weeks, the patients came in for a follow-up program of 6 h, including psychological, physical and ergonomic training, following the principles described above.

Table II. *The daily schedule for the functional restoration program*

| Time | Subject |
|---|---|
| 08.00–09.00 | Aerobics |
| 09.00–10.00 | Resistance training |
| 10.00–11.30 | Work simulation/Work hardening |
| 11.30–12.00 | Lunch |
| 12.00–12.30 | Relaxation |
| 12.30–01.30 | Psychological group |
| 01.30–02.00 | Stretching |
| 02.00–03.00 | Theoretical class |
| 03.00–04.00 | Recreational activities |

*Program 2*

This outpatient program was carried out for 2 h twice a week for 6 weeks. *Initial tests* included muscle strength and endurance and cardiovascular fitness. The *aerobics class* consisted of 45 min of cardiovascular fitness, muscular endurance, coordination and stretching. This was followed by 45 min of progressive *resistance-training* and endurance for all major muscle groups, carried out in air-moderated machines. One hour of theoretical back school lessons was carried out every second day. Groups of seven to eight patients, all starting and graduating at the same time, participated at any time, and no individual treatment was carried out.

*Program 3*

An outpatient program, as time-consuming as Program 2. *Initial tests* included muscle strength and endurance, cardiovascular fitness and two psychological tests. Each session included 15 min of *warm-up exercises,* which could not be classified as "aerobics". This was followed by 30 min of progressive *resistance-training* and endurance for all major muscle groups, carried out in air-moderated machines. The physical exercises were followed by 75 min of psychological pain management, a combination of pain coping, setting up realistic personal goals and relaxation. Groups of seven to eight patients, all starting and graduating at the same time, participated at any time, and no individual treatment was carried out.

For this study the following *outcome variables* were tested:

*Work readiness.* This was defined as being part of the labour force, which means working, seeking work or training. If a treatment program can get patients back to a normal working life, it will save social pensions and retirement payment, and in that way can be an economical advantage for the society—on top of the human advantages for the individual.

*Contacts with health care system.* Another goal was to evaluate how much the patients continued their "doctor-shopping" in search of a cure. That was reflected in numbers of contacts with family doctors, specialists, physical therapists, chiropractors, hospitals or other health-care professionals.

*Days of sick leave.* This parameter also reflects the economical aspects for society.

*Pain scores.* Back and/or leg pain might be influenced in a positive or a negative way while being physically active. To get chronic pain patients completely out of pain is usually unrealistic.

*Subjective disability.* This parameter reflects the patients' own impression of their function in activities of daily living (ADL).

*Staying physically active.* Do the patients continue to participate in physical activities after treatment in programs with active physical training?

*Medication.* Does participation in these programs influence medication use in this patient population?

*Patients*

The study initially included 132 patients with disabling CLBP, referred to the Copenhagen Back Centre. *Inclusion* criteria were: age between 18 and 59 years, ability to read and write Danish, a minimum of 6 months of disabling low back trouble. They were all threatened in their job situation owing to back problems: the majority was sick-listed or did not have a job. *Exclusion* criteria were: actual/clinical relevant disc herniation, back problems

requiring surgery, pregnancy, cancer, clinical relevant fractures, unstable spondylolisthesis, and social pension. Table III gives the clinical diagnoses of the patients. Only the major diagnosis for each patient is listed in the table, although most patients had more than one diagnosis. "Discogenic pain" was never verified by discography, but believed in cases with pain aggravation in forward flexion, sitting, disc narrowing or other X-ray disc degeneration, and with no indications of other specific pathology.

Fig. 1 shows *patient flow* from randomization until 1 year follow-up. Nine patients *never started* treatment: two acquired new jobs which they could not refuse, one never showed up, and six had different psychosocial reasons for not participating. Thus 123 patients started in one of the three programs. Fourteen patients (11%) *dropped out*: five had increased back pain to a level they could not accept, two were so disappointed with the program they were randomized to that they did not want to continue, one lived far away and found that the commuting time was not acceptable, one acquired a legionella-pneumonia, one had a hand-scalding injury and did not want to continue, and four dropped out due to psychosocial problems. We could not contact six graduates and four drop-outs at the 1 year follow-up, which gives a response rate of 84% of the graduates, and 92% if the drop-outs are included.

Initial patient characteristics are listed in Table IV. There was no significant difference between patients in the three groups. The drop-outs tended to be a little younger and to have more sickness impact in many of the measured parameters than patients completing the programs.

Evaluation 1 year following treatment was performed at exactly 13 months following the Monday after 3 weeks of treatment for all three programs. Thus, the date was close to 1 year following the last day of treatment for all programs. However, the time period consisted of 390 days, influencing the variables "sick leave" and "health-care contacts".

Before examination all patients filled in a questionnaire on work situation, sick leave, pain level, disability level, and medication. In addition, there was a question about level of physical activity in terms of participation in any kind of sport activity, including home exercises.

*Blinding*

The same physician (AFB) examined all the patients initially and after 1 year, and was unaware of what kind of treatment each patient had received. The blinding was broken by the patients in about 10% of the cases at the 1 year follow-up.

*Statistical methods*

Non-parametric statistical methods were used. "Before-" and "1-year values" for days of sick leave as well as "1-year values" for contacts with the health care system were compared in separate one-way analyses of variance (Kruskal–Wallis tests). For back and leg pain and disability levels Kruskal–Wallis tests were made on differences (after–before). If a $p$-value of the various 3-group ANOVAs was highly significant *and* practically relevant, two of the three parameters were compared separately by means of a Mann–Whitney test. For comparing within-group values for back and leg pain and disability, the Wilcoxon test was used. The $\chi^2$ test was used for "work readiness". For "medication", the Wilcoxon test was used to assess possible change across time for each of the three treatment groups. The level of significance was defined as 5%.

## RESULTS

*Work readiness*

Fig. 2 illustrates the percentage of participants being "work ready" prior to treatment and at 1 year follow-up. The functional restoration program created a significantly higher "work-ready" rate compared to the other two programs ($p = 0.01$). The rate was increased by 65% (25 persons) for Program 1, 19% (6 persons) for Program 2 and 17% (6 persons) for Program 3 ($p < 0.001$). Most people went back to the same kind of work as before injury, and were working full-time. In Program 1, one of the patients able to work on entering the program, was not able to work after 1 year. In Programs 2 and 3 these numbers were two and three respectively. The differences from the top of the columns and 100% are the percentage of patients still sick-listed or receiving some kind of pension.

*Contacts with health care system*

Table V shows values for the number of contacts with family doctors, specialists, physiotherapists, chiropractors,

Table III. *Clinical diagnosis for patients in the different programs. Only the major diagnosis for each patient is included here, although most patients had more than one diagnosis. See text for further details concerning "discogenic pain"*

| Clinical diagnosis | Program 1 $n = 38$ | | Program 2 $n = 31$ | | Program 3 $n = 34$ | | Drop-outs $n = 14$ | |
|---|---|---|---|---|---|---|---|---|
| | % | $n$ | % | $n$ | % | $n$ | % | $n$ |
| Non-specific lumbago ± sciatica | 47 | (18) | 48 | (15) | 44 | (15) | 50 | (7) |
| Discogenic pain | 11 | (4) | 6 | (2) | 12 | (4) | 14 | (2) |
| Facet-joint pain/spondylarthrosis | 5 | (2) | 6 | (2) | 11 | (4) | 14 | (2) |
| Chronic disc herniation without previous surgery | 8 | (3) | 0 | (0) | 3 | (1) | 0 | (0) |
| Previous disc surgery | 16 | (6) | 33 | (10) | 18 | (6) | 7 | (1) |
| Thoraco-lumbar Scheuermann's disease | 8 | (3) | 0 | (0) | 0 | (0) | 0 | (0) |
| Muscle tension/psychological | 5 | (2) | 6 | (2) | 11 | (4) | 14 | (2) |

hospitals or other health-care professionals, in the 13 months period. Program 1 had significantly less contacts, compared to the other two programs ($p = 0.002$). As mentioned previously, the 13 months period started the Monday after 3 weeks of treatment, and the remaining treatment sessions in the respective programs were not included in calculating numbers of health care contacts.

*Days of sick leave*

As the total follow-up period was 390 days, this was the maximum sick leave. Comparing the three programs, there was a significant difference between programs ($p = 0.002$), as listed in Table V. This corresponds to differences between all three two-group comparisons, the smallest difference between the groups 1 and 2 exhibiting a $p$ value of 0.03. The difference in sick leave prior to treatment, also disfavouring program 3, can most probably be ignored due to the high $p$ value of 0.4 (Table IV).

*Pain- and disability levels*

The patients were asked to distinguish between pain in the back and irradiating pain from the back to one/both legs. In Tables V and VI, back and leg pain, as well as disability levels, are outlined. A reduction in back pain from before treatment until 1 year follow-up was seen in group 1 ($p = 0.002$), but not in groups 2 ($p = 0.78$) or 3 ($p = 0.37$) (Table VI). Comparison across the three groups shows a significant difference between groups, lowest in Program 1 ($p = 0.005$). There was no significant difference between Programs 2 and 3 ($p = 0.7$).

As for leg pain, the results showed an increase in group 3 ($p = 0.02$) from before treatment until 1-year follow-up. No difference could be shown for groups 1 and 2 ($p = 0.07$ and 0.09, respectively) (Table VI). There was an overall difference between the three programs ($p = 0.008$), and the differences between Programs 1–2 and 1–3 giving the statistical significances, $p = 0.04$ and

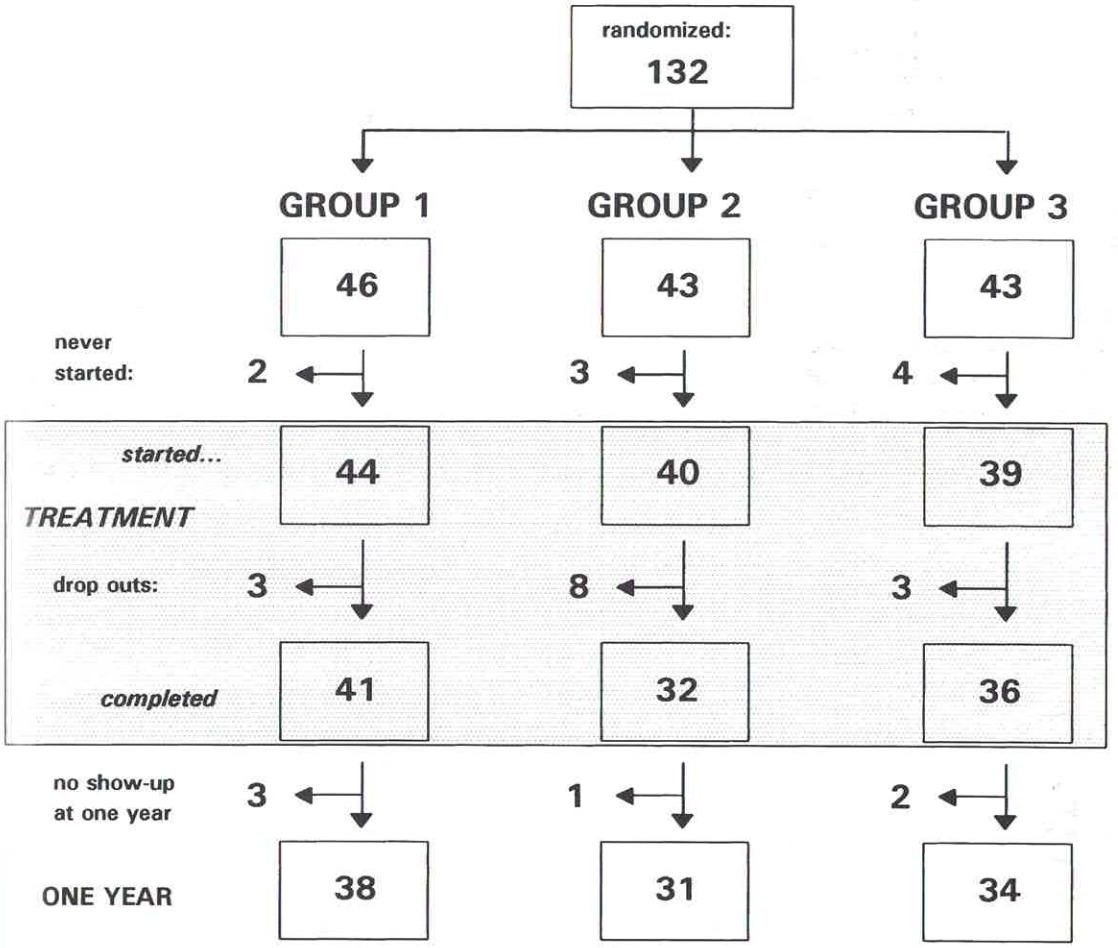


*Fig. 1.* Patient flow from randomization until 1-year follow-up.

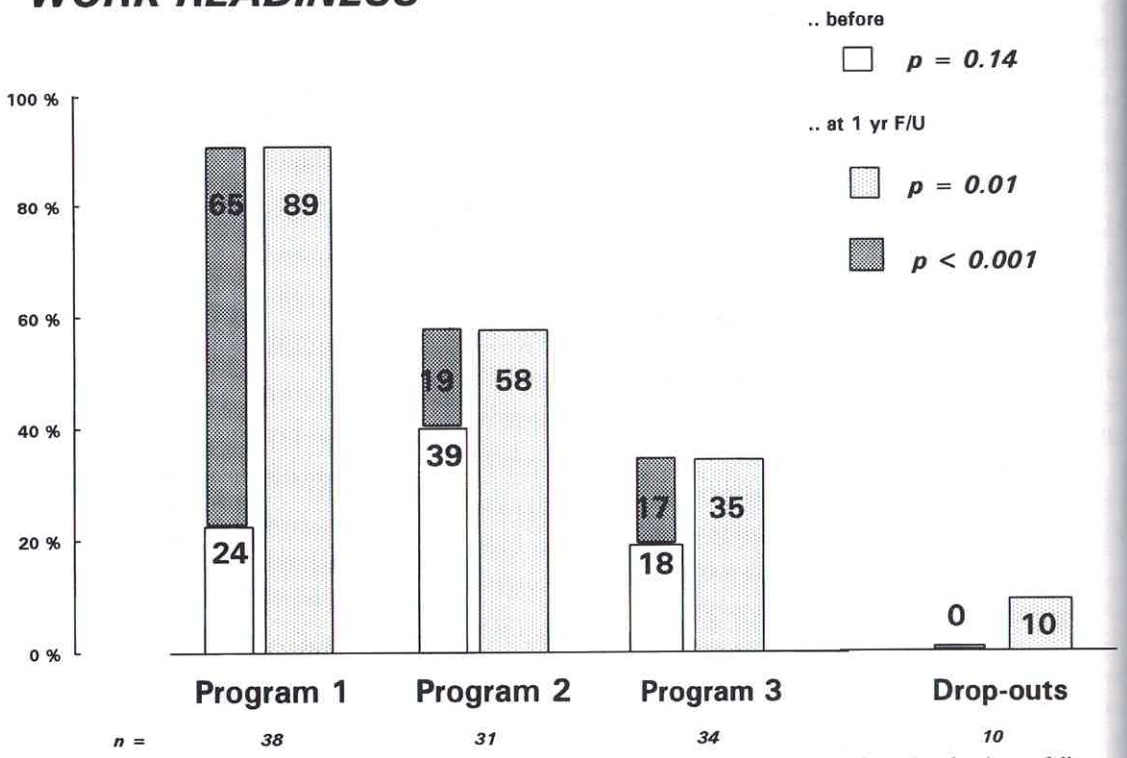


*Fig. 2.* The percentage of the population being ready for the labour force, before treatment (white columns) and at 1-year follow-up (light grey columns). There was a non-signifi cant trend towards difference in the "before" numbers ($p = 0.14$). Comparing results from the 1-year follow-up, there was a significant difference ($p < 0.001$) between the increases from before until 1 year (dark grey colums) across the three groups.

$p = 0.001$. The difference between Programs 2 and 3 did not show statistical significance ($p = 0.4$).

Subjective statement of activity of daily living (ADL; disability) showed group 1 to do significantly better after 1 year compared to before treatment ($p < 0.001$) whereas the other two groups showed no difference ($p = 0.09$ for group 2 and $p = 0.73$ for group 3). The difference between the three programs was highly statistically

Table IV. *Initial values for all patients prior to program start: median values (except for gender) and p values (except for age and gender). The p values refer to the comparison of the median values. For "days of sick leave", "back pain", "leg pain" and "disability", "Inter-Quartile Range" (IQR, referring to the middle half of the data) and "total range" are listed as well (compare with Table V). For drop-outs only median values are listed*

| | Program 1 $n = 38$ | | | Program 2 $n = 31$ | | | Program 3 $n = 34$ | | | | Drop-outs $n = 14$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Median | IQR | Range | Median | IQR | Range | Median | IQR | Range | $p$ | |
| Age | 40 | — | — | 43 | — | — | 42 | - | - | - | 37 |
| Women/Men | 27/11 | — | — | 23/8 | — | — | 25/9 | - | - | - | 9/5 |
| Work ready (%) | 24 | — | — | 39 | — | — | 18 | - | - | 0.14 | 0 |
| Smokers (%) | 68 | — | — | 70 | — | — | 59 | - | - | 0.63 | 79 |
| Medication (%) | 68 | — | — | 74 | — | — | 65 | - | - | 0.47 | 86 |
| Days of sick leave in the past 3 years | 273 | 184–526 | 5–1013 | 300 | 158–506 | 30–1170 | 415 | 151–788 | 0–1131 | 0.40 | 564 |
| Back pain (0–10) | 5.3 | 4.1–6.3 | 1–10 | 5.4 | 3.8–6.9 | 3–10 | 5.7 | 4.8–6.9 | 1–8 | 0.56 | 5.5 |
| Leg pain (0–10) | 2.9 | 0.8–5.3 | 0–8 | 3.7 | 0.6–6.1 | 0–10 | 3.5 | 0.3–5.3 | 0–8 | 0.74 | 3.3 |
| Disability (0–30) | 15.0 | 12–17 | 6–28 | 14.4 | 12–17 | 10–26 | 14.8 | 12–19 | 7–26 | 0.89 | 16.8 |

Table V. *Results at 1-year follow-up: "median", "IQR" and "p" values, referring to the comparison of the median values. For the last three variables, where pre-treatment values were also available, the p values refer to before–after differences, compared across the three groups*

| | Program 1 $n = 38$ | | | Program 2 $n = 31$ | | | Program 3 $n = 34$ | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Median | IQR | Range | Median | IQR | Range | Median | IQR | Range | $p$ |
| Contacts with health care system | 4.5 | 0.3–12.3 | 0–47 | 11.8 | 4.0–25.0 | 0–75 | 12.0 | 0.8–23.3 | 0–51 | = 0.002 |
| Days of sick leave | 52 | 0–127 | 0–390 | 100 | 0–390 | 0–390 | 295 | 0–390 | 0–390 | = 0.002 |
| Back pain (0–10) | 3.3 | 2.1–5.6 | 0–9 | 5.3 | 3.3–7.6 | 0–10 | 6.5 | 4.8–7.7 | 0–9 | = 0.005 |
| Leg pain (0–10) | 2.1 | 0.2–4.13 | 0–9 | 2.8 | 1.4–7.0 | 0–10 | 4.8 | 2.3–7.3 | 0–9 | = 0.008 |
| Disability (0–30) | 8.9 | 5–13 | 0–21 | 13.7 | 9–17 | 3–23 | 16.4 | 14–19 | 1–24 | < 0.001 |

significant in favour of Program 1 ($p < 0.001$). The difference between Programs 2 and 3 did not show statistical significance ($p = 0.07$).

*Physical activity*

Participants from Program 1 in 68% of cases reported participation in some kind of sport activity 1 year following treatment. This was the case for 30% from Program 2 and 45% from Program 3. The difference between programs was statistically significant ($p = 0.006$). No difference was found between the Programs 2 and 3 ($p = 0.3$).

*Medication*

None of the treatment groups showed significant reduction in medication intake over the 1-year period. Group 1 reduced median score from "2" to "1" ($p = 0.35$). Neither group 2 nor 3 changed median scores, which for both groups were "2" ($p = 0.8$ and 0.9, respectively).

*Drop-outs*

Of the 14 drop-outs, we got into contact with 10 (71%) after 1 year (Table VII). The drop-outs differed from the patients in Program 1, but in most parameters measured they were comparable to patients from Programs 2 and 3. Thirty per cent participated in sporting activities. No change in medication use was seen.

Table VI. *Results at 1-year follow-up: p values for changes in pain and disability levels from before treatment to 1-year follow-up, analysed separetely for each group*

| | Program 1 $n = 38$ | Program 2 $n = 31$ | Program 3 $n = 34$ |
|---|---|---|---|
| Back pain | 0.002 | 0.78 | 0.37 |
| Leg pain | 0.07 | 0.09 | 0.02 |
| Disability | <0.001 | 0.09 | 0.73 |

Table VII. *Results for drop-outs at 1-year follow-up*

| | Drop-outs ($n = 10$) | | |
|---|---|---|---|
| | Median | IQR | Range |
| Contacts with health care system (NB) | 12.5 | 4.0–35.3 | 1–90 |
| Days of sick leave | 390 | 389.7–390.2 | 13–390 |
| Back pain (0–10) | 7.0 | 4.5–8.1 | 2–9 |
| Leg pain (0–10) | 5.0 | 2.5–6.8 | 0–8 |
| Disability (0–30) | 19.0 | 12.5–22.3 | 6–24 |

## DISCUSSION

The results from this study indicate that a multidisciplinary, intensive treatment program may be effective in a Scandinavian country, where, in many ways, the social system is much more secure than in the United States, where these programs have shown to be beneficial (22, 33). Nachemson refers to a hearing in the US Senate (38) that if an income received during sickness is greater than 55% of net income, the number of claims increases drastically. In Denmark, the sickness payment is 80% of net income, but in spite of this, it appears from this study that economical aspects can be beaten. It seems possible to motivate many long-term sick-listed chronic back patients to return to the labour force. Moreover, it also seems to be necessary to apply a very intensive and multidisciplinary approach to that group of patients. This is believed because the less intensive programs in this study did not seem to be effective for *this* group of patients.

It is uncertain if the shorter programs would have shown other results if the training period had been longer. Another study has shown good results with intensive, dynamic exercises over a 3 month period (30), although the CLBP patients in that study had less sickness impact than in our study.

There was no difference in most parameters between the two shorter programs; thus, the results from this study do not support results from Nicholas et al. (39), who found that a combined psychological/physical program was better than a combined support program/physical program in terms of functional impairment, coping strategies and medication use.

The intensive multidisciplinary program is expensive compared to the less intensive programs. The cost for a patient in the functional restoration program was approximately $5000 (30,000 DKr), compared to approximately $500 (3000 DKr) for a patient in one of the less intensive programs. On the other hand, the cost of having a patient long-term sick-listed—perhaps eventually on social pension/early retirement payment—is many times the cost of the functional restoration program. The results of this study show that 46–48% more patients became "work ready" in Program 1 compared to Programs 2 and 3. Provided pensions are saved for the majority of these people, the difference easily covers the differences in program cost.

Other studies from Scandinavia (1, 10, 40) did not show an increased return-to-work rate from modified functional restoration programs. It seems important to follow the original philosophy and include all elements to obtain optimal results, as also stated by Gatchel et al. (16).

Fear of pain and re-injury are major obstacles in the treatment of these patients. They are afraid that pain will get worse by increasing activity, e.g. return to work (28, 50). There does not seem to be any connection between increase in physical activity and increased pain level (28, 42). Results from our study seem to support this, as the patients in the treatment program with the highest percentage of physical activity at leisure time during the follow-up year, obtained the lowest pain level and the best subjective function in ADL. It is believed that the patients in the functional restoration program experienced that initial increased muscle pain due to the program passed quickly with continued training. This was supported by theoretical understanding of anatomy and physiology, which seemed to reduce fear and improve coping, which has also been stated previously (5, 19, 51).

Conclusively, the functional restoration program seems, from this study, to be superior from the patient's point of view, as well as economically, to less intensive programs for patients with disabling CLBP. The results might be better if a pre-program is applied (25, 35), as that will facilitate the elimination of inhibitory factors, like fear of injury and pain by increased physical activities. Further studies should be performed to elucidate that.

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