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REVIEW ARTICLE

EXERCISE REDUCES SICK LEAVE IN PATIENTS WITH NON-ACUTE NON-SPECIFIC LOW BACK PAIN: A META-ANALYSIS

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Objectives: **To investigate whether exercise alone or as a part of a multidisciplinary treatment reduces sick leave in patients with non-specific non-acute low back pain.**

Methods: **A meta-analysis of randomized controlled trials was performed. A qualitative analysis of the sick leave results was performed applying pre-defined levels of evidence. In studies comparing exercise with usual care, pooled effect sizes were computed.**

Results: **Fourteen trials were identified allowing 22 comparisons between treatments. The qualitative and the quantitative analysis showed strong evidence that exercise reduces sick days during the first follow-up year, the effect size (95% confidence interval) was −0.24 (−0.36, −0.11). In a subgroup of studies on the treatment of severely disabled patients (>90 sick days under usual care) the effect size was −0.30 (−0.42, −0.17). The effect size of the number of patients receiving a disability allowance was small and not significant.**

Conclusion: **The reviewed trials provide strong evidence that exercise significantly reduces sick days during the first follow-up year.**

Key words: low back pain rehabilitation, meta-analysis, randomized controlled trials, exercise, human, treatment outcome.

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INTRODUCTION

Work-related disability is a major problem in patients with non-specific non-acute low back pain (LBP). Ninety-five percent of all patients with acute LBP return to work within 4 weeks regardless of treatment (1). If patients do not return to work within 4 weeks, treatment to prevent chronic disability is recommended (2). It remains unclear whether sick leave can be reduced. Therefore the aim of this meta-analysis is to investigate whether sick leave can be reduced by exercise, defined as physical activities, which people can carry out to benefit their health.

Evidence suggests that less than 15% of individuals with back pain can be assigned to a specific back pain category such as nerve root compression, vertebral fracture, tumour, infection, inflammatory diseases, spondylolysthesis, spinal stenosis and definite instability (3). In the majority of patients LBP is non-specific.

The direct costs related to the treatment of LBP in the USA showed a rapid increase from $13 billion in 1984 to $33 billion in 1994 (4). The major costs were caused by sick leave and long-term disability. In Germany $24 billion were paid for LBP-related disability allowances in 1998, compared with $10 billion for the treatment of LBP (5).

While no evidence has been found to support the effectiveness of transcutaneous electrical stimulation (6) heat, massage, laser, traction, acupuncture and other modalities (7), injections (8) and bed rest (9), there is conflicting evidence regarding the long-term effects of exercise therapy (10, 11). A recent review of multidisciplinary interventions found strong evidence for the improvement of function, moderate evidence for the reduction of pain, and contradictory evidence regarding vocational outcomes (12). Most multidisciplinary interventions include some form of exercise, which seems to be one of the most promising options for treatment. According to several guidelines, resuming normal activities including return to work is the primary goal of treatment in patients with subacute and chronic LBP (2, 3). The outcome, sick leave in this case, is the starting point to search for evidence for clinical decision-making. In the majority of reviews, sick leave is not specifically evaluated. Usually pain, function and disability are reported but it is unclear whether improvements in these outcomes are accompanied by a reduction in sick days. The objective of this study was to investigate whether treatments using exercise alone or as a part of a multidisciplinary treatment reduce sick leave in patients with non-specific non-acute LBP.

METHODS

Identification of trials

The search strategy for the identification of trials, performed in December 2002, covered MEDLINE (1966 to Oct. 2002), EMBASE (1988 to Oct. 2002), PEDro (until Dec. 2002), the Cochrane Library

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Table I. *Criteria for methodological quality according to the PEDro-scale. Adaptations are in italics and the corresponding original descriptions are in brackets*

1.	Subjects were randomly allocated to groups
2.	Allocation was concealed
3.	The groups were similar at baseline regarding the most important prognostic indicators
4.	There was blinding of all subjects
5.	There was blinding of all therapists who administered the therapy
6.	There was blinding of *sick leave measurement* (all assessors who measured at least 1 key outcome). *Measurement by a patient questionnaire was not considered blinded. Obtaining sick leave data from a database was considered blind assessment.*
7.	Adequate follow-up: measures of *sick leave* (at least 1 key outcome) were obtained from more than 85% of the subjects initially allocated to groups
8.	Intention-to-treat analysis: all subjects for whom *sick leave results* (outcome measures) were available received the treatment or control condition as allocated or, where this was not the case, data for *sick leave results were* (at least 1 key outcome was) analysed by "intention to treat".
9.	The results of between-group statistical comparisons are reported for *sick leave* (at least 1 key outcome)
10.	The study provides both point measures and measures of variability for *sick leave* (at least 1 key outcome)

(2002, Issue 4) and PsycLIT (1984 to Dec. 2002). Based on the strategy described by the Cochrane Back Review Group, a combination of search terms was used for: (i) randomized controlled trials (RCTs); (ii) patients with non-acute LBP; and (iii) sick leave outcome (13). References were checked for further trials.

Selection of studies

Only RCTs published in English, German or Dutch were included. Studies were included if the primary diagnosis in all patients was non-specific non-acute LBP with a duration of at least 4 weeks. Excluded were studies including persons with thoracic or cervical pain, studies in specific low back pain caused by nerve root compression, vertebral fracture, tumour, infection, inflammatory diseases, spondylolysthesis, spinal stenosis and definite instability, and studies in pregnant women with LBP. Studies were included if the experimental treatments used exercise alone or as a part of a multidisciplinary treatment. Excluded were studies investigating the effect of treatments that did not contain any form of exercise such as respondent psychological interventions. Sick leave was the primary outcome in this meta-analysis. Therefore, studies were only included if at least 90% of the patients under treatment were available for the job market in that they were either employed or unemployed and seeking work.

Two researchers (JK, SB) applied the admission criteria. Disagreement was resolved by discussion with a third researcher (RB). Authors were contacted if the information regarding the eligibility of a trials or sick leave outcome was unclear.

Assessment of methodological quality

Methodological quality may influence the results and validity of RCTs. Trials with inadequate allocation concealment have been associated with larger treatment effects compared with trials in which authors reported adequate allocation concealment (14). To assess the methodological quality of the included RCTs, studies were rated on a 10-point quality scale from the Physiotherapy Evidence Database with minor adaptations as required for this review (Table I) (15). Two researchers (JK, SB) independently performed the quality rating, resolving disagreement by consensus or by discussion with a third researcher (RB). Assessment of sick leave outcome was regarded blinded if data were obtained from a database for financial compensation of sick leave blinded to the patients' assignment. All authors were asked for further information regarding the methodological quality. Blinding of patients and therapists is not feasible in this field leading to a maximum score of 8 points. In concordance with other reviews (10–12) an arbitrary score of 5 or more points was considered to indicate high methodological quality.

Qualitative sick leave analysis

Two authors (JK, RB) extracted the results regarding sick leave outcome from the original publications. If necessary, the numbers required for the calculations were approximated from graphs and statistics in the publication.

Treatment contrasts in decreasing order are obtained by comparisons with placebo followed by usual care, and finally by other treatments also expected to be effective. Comparisons with placebo therapy are not possible in this field. As different types of comparisons should not be mixed in a meta-analysis, we first evaluated comparisons between experimental interventions and usual care. Usual care by the physician generally included rest, giving advice including written information, medication, sick listing, and physical therapy (16, 17).

The qualitative analysis was performed using the levels of evidence as defined by the US Clinical Practice Guidelines for Acute Low Back Problems in Adults and repeatedly used by the Cochrane Back Review Group (12). The rating system consists of 4 levels of scientific evidence based on the quality and the outcome of the studies (Table II). Results were considered contradictory if statistically significant results in favour of and against an experimental treatment were found.

Quantitative analysis of sick leave

Statistical pooling of sick-leave-related outcome measures was performed in comparisons between experimental treatments and usual care. All analysis was conducted using Meta-View Rev-Man software version 4.1 (Cochrane Collaboration 1999). A random effects model was used because studies are likely to be heterogeneous with regard to treatments, and predictive factors for sick leave such as the duration of LBP, employment status, nationality and socio-economic background. The relative risk was computed in dichotomous data. If methods of continuous sick leave measurement were different among studies, data were analysed with the standardized mean difference (SMD) method. Effect sizes were computed with Hedges adjusted *g*, which is very similar to Cohen's *d* but includes a correction for small sample sizes (18).

RESULTS

Study selection

The systematic search in databases and references in reviews and RCTs resulted in 341 publications concerning 166 RCTs.

Table II. *Levels of evidence*

Evidence	
Strong	Multiple relevant, high quality RCTs.
Moderate	One relevant, high quality RCT and 1 or more relevant, low quality RCTs.
Limited	One relevant, high quality RCT or multiple relevant, low quality RCTs.
No	Only 1 relevant, low quality RCT, no relevant RCTs or contradictory outcomes.

RCTs: randomized controlled trials.

Table III. *Methodological quality*

	Total score	Randomized	Concealed	Baseline comparability	Blinded assessment	Subjects blinded	Therapist blinded	Follow-up in 85% of patients	Intention-to-treat analysis	Comparison between groups	Point estimates and variability
Alaranta et al. (76)	6	1	–	1	1	–	–	1	–	1	1
Bendix et al. (52, 53, 58, 77)	5	1	–	1	–	–	–	1	–	1	1
Bendix et al. (52, 58, 59)	4	1	–	–	–	–	–	1	–	1	1
Bendix et al. (78)	4	1	–	1	–	–	–	–	–	1	1
Hagen et al. (60)	7	1	1	1	1*	–	–	–	1	1	1
Härkäpää et al. (51, 54)	5	1	–	1	1	–	–	1	–	1	–
Hurri (61)	6	1	–	1	–	–	–	1	1	1	1
Lindström et al. (56, 57, 79)	8	1	1*	1	1	–	–	1	1*	1	1
Ljunggren et al. (20)	7	1	1	1	–	–	–	1	1*	1	1
Lonn et al./Soukup et al. (21, 55)	7	1	1*	1	–	–	–	1	1*	1	1
Petersen et al. (80)	6	1	1	1	–	–	–	–	1	1	1
Skouen et al. (50)	6	1	1	–	1	–	–	1	–	1	1
Torstensen et al. (49)	6	1	1	1	1	–	–	–	1	1	–
White (19)	4	1	–	1	–	–	–	1	–	1	–

*Score based on communication with the author.

Fourteen RCTs met the inclusion criteria. Five studies were conducted in Norway (N), 4 in Denmark (DK), 3 in Finland (SF) and 1 each in Canada (Can) and Sweden (S). All studies had been published since 1989 with 1 exception, a publication in 1966 reporting the results from 3 studies of which only the third (pp. 52–55) fulfilled the inclusion criteria (19). Two publications described the intervention as "secondary prevention" (20, 21). These studies were included because all patients had sick leave prior to treatment. Primary prevention trials in patients without a recent history of LBP were excluded.

One study was excluded because the publication was available in Finnish only (22, 23). Twelve studies, investigating patients with pain in the lower back together with patients with pain in other body parts (24–35), were excluded. Three excluded studies investigated patients with spondylolysthesis (36–38) and 2 studies investigated women with LBP during pregnancy (39, 40). Seven studies were excluded because less than 90% of the patients were gainfully employed and separate sick leave data for these patients were not available (41–47). Two excluded studies investigated the effect of a psychological intervention in addition to the standard treatment of physical reconditioning through exercise (43, 45). One study was excluded because the method of randomization did not fulfil the applied methodological criteria as patients were alternatively allocated to the experimental and control group (48).

Methodological quality

The methodological quality of the 14 studies included ranged from 4 to 8 points (Table III). Additional information from the authors improved the score in 4 studies. The methodological score was high in 12 studies (79%) obtaining 5 or more points.

Qualitative sick leave analysis

The included studies allowed 13 treatment comparisons between experimental treatments and a usual care control group (Table IV). Table V shows comparisons between 2 or 3 experimental treatments. Three studies contain comparisons with usual care, displayed in Table IV, as well as comparisons between 2 experimental treatments displayed in Table V (49–51). Bendix et al. combined the 5-year follow up results of 2 RCTs, data for the single treatment comparisons were not available (52).

Five RCTs compared 3 treatments. Bendix et al. compared a work hardening programme with aerobic exercise and a psychological intervention (53). Härkäpää et al. compared inpatient rehabilitation (In) and outpatient rehabilitation (Out) with usual care (51, 54). Skouen et al. compared a light and an extensive multidisciplinary programme with usual care (50). Torstensen et al. compared medical exercise therapy (MET) and conventional physiotherapy (CP) with usual care including the advice for self-exercise by daily walks (SE) (49). Soukup and Lonn used a common control group receiving usual care to evaluate an Active-Back-School (ABS) (21) and exercise therapy according to the concept developed by Mensendieck (M) (55).

Two studies reported mean values of sick days for the subset of patients taking sick leave during the follow-up year (21, 55).

Table IV. *Results of experimental treatments compared with usual care.*

Author, year, country	Subjects	Experimental treatment	Sick leave outcome for the experimental group (E) and usual care control group (C) (Mean and SD).
Bendix et al. 1996 (DK) (52, 58, 59)	106 patients with >6 months of disabling back pain	Work hardening, 3 weeks, 39 hours/ week, aerobics, weight training, work hardening, relaxation, psychological group therapy, stretching	Sick days (adapted from median, range and IQR): Significant difference during the first 4 months, E: 48 (SD = 50), C: 82 (SD = 50) (59). Work capability as judged by a physician: significantly greater improvement at 4 months, E: from 27% to 64%, C: from 16% to 28% (59). No difference after 2 years E: 52%, C: 51% (58). Disability allowances: no difference after 4 months, E: 13% (6/45), C: 16% (8/49) (59), 2 years E: 39%, C: 40% (58) and 5 years E: 48%, C: 51% (52).
Hagen et al. 2000 (N) (60)	457 patients with LBP and sick leave 8–12 weeks	Examination at spine clinic; information, advice to stay active and go on daily walks, individual instructions on stretching and training at home by the physical therapist	Sick days: significant reduction during the 1st year (E: 95.5 (SD = 102), C: 133.7 (SD = 110). Full duty return to work: significant improvement after 3 months, E: 51.9%, C: 35.9%, 6 months E: 61.2%, C: 45.0% and 1 year E: 68.4%, C: 56.4%. (60). Disability allowances: No difference after 1 year E: 14/237, C: 14/220.
Härkäpää te al. 1990 (SF) (51, 54)	476 blue collar workers, LBP since 2 years, sick leave due to LBP during the last 2 years	Inpatient rehabilitation; 3 weeks, groups of 6–8 patients, Swedish back school, relaxation, heat or electrotherapy prior to exercise, 2 structured group discussions, home programme, rehearsal after 1.5 years (2 weeks)	Sick days: no difference after 1.5 years, E: 5.5 (SD = 25.0), C: 7.5 (SD = 25.0). Results disregard the first 7 days of each episode of sickness absence leading to a considerable underestimation of the days lost from work (51). Disability allowances: no difference after 4.5 years E: 10%, C: 12% (51).
Härkäpää et al. 1990 (SF) (51, 54)	476 blue collar workers, LBP since 2 years, sick leave due to LBP during the last 2 years	Outpatient treatment at the work place or local health centre; 15 sessions in 2 months, groups of 6–8 patients, Swedish back school, relaxation, heat or electrotherapy prior to exercise, 2 structured group discussions, home programme, rehearsal after 1.5 years	Sick days due to LBP: no difference after 1.5 years, E: 5.8 (SD = 25.0), C: 7.5 (SD = 25.0). Results disregard the first 7 days of each episode of sickness absence leading to a considerable underestimation of the days lost from work (51). Disability allowances: no difference after 4.5 years E: 8%, C: 12% (51).
Hurri 1989 (SF) (61)	80 Female employees with LBP >12 months	Back school given by a physical therapist; 6 sessions of 1 hour in groups of 11 patients. Education and exercise. Two review sessions after 6 months	Sick days due to LBP: no difference during the 1st year, E: 8.1 (SD = 26.9), C: 11.1 (SD = 26.6) and during the 2nd year E: 9.0 (SD = 23.6), C: 9.5 (SD = 25.0), personal communication.
Lindström et al. 1992 (S) (56, 57, 79)	103 blue collar workers sick listed 6 weeks, no LBP sick listing in the prior 12 weeks, able to speak Swedish	Graded activity; measurement of functional capacity, work place visit, back school, individual sub-maximal gradually increased exercise programme	Time until return to work: significantly shorter, E: 10 weeks (SD = 12.7), C: 15.1 weeks (SD = 15.6) (56). Return to work: significantly greater proportion of patients returned to work after 6 weeks, E: 59% (30/51), C: 40% (21/52) and 12 weeks, E: 80% (41/51), C: 58% (30/52) (56). Sick days during the 2nd follow-up year (mean, SD): E: 60 (SD = 92), C: 98 (SD = 103.5) (56). Disability allowance: no difference after 2 years, E: 1/51, C: 4/52 (56).
Lonn et al. 1999 (N) (21, 81)	120 persons with LBP requiring treatment or sick days.	Active Back School (ABS); 20 sessions of 1 hour during 13 weeks, 20 minutes theory and 40 minutes exercise	Sick days: significant reduction during the 1st year, E: 1.9 (SD = 4.1), C: 11.9 (SD = 15) (21) and during 3 years follow-up, E: 4.7 (SD = 8.0), C: 32.9 (SD = 41.0) (81). Number of patients taking sick leave: no difference during the first follow-up year (E: 7/38 = 18%, C: 11/35 = 31%) (21) and during 3 follow-up years (E: 12/37 = 32%, C: 18/35 = 52%) (81). Duration of sick leave in those patients who took sick leave: significantly shorter duration during the 1st year, E: 10.4 (SD = 9.3), C: 37.8 (SD = 28.0) (21) and during 3 follow-up years, E: 14.4 (SD = 12.7), C: 63.9 (SD = 76.3) (81) Disability allowances: No difference after 1 year (E: 0/38, C: 0/35) (21).

Table IV. *Continued*

Author, year, country	Subjects	Experimental treatment	Sick leave outcome for the experimental group (E) and usual care control group (C) (Mean and SD).
Soukup et al. 1999 (N) (55, 82)	120 persons with LBP requiring treatment or sick days.	Mensendieck exercise group (M) with 6–10 participants, 20 sessions of 60 min. for 13 weeks. Warm up and stretching exercises, ergonomic information	Sick days: no difference during the 1st year, E: 8.8 (SD = 15), C: 11.9 (SD = 15) (55) and during 3 years follow-up E: 22.0 (SD = 35.0), C: 32.9 (SD = 41.0) (82) Number of patients taking sick leave: No difference during the 1st year (E: 10/34 = 29%, C: 11/35 = 31%) (55) and during 3 follow-up years (E: 13/31 = 42%), C: 18/35 = 52%) (82). Duration of sick leave in those patients who took sick leave: No difference during the 1st year (E: 29.9 (55.2), C: 37.8 (28.0)) (55) and during 3 follow-up years (E: 14.4 (12.7), C: 63.9 (76.3)) (82).
Skouen et al. 2002 (N) (50)	195 persons with LBP sick-listed >8 weeks	Light multidisciplinary programme: information about exercise, fear avoidance. Instruction of a personal exercise programme based on physical tests. Follow-up visits at 3 and 6 months. Further physiotherapy, appointment with psychologist and work place visits if necessary.	Sick days: no difference during the first year, E: 151 (SD = 132), C: 188 (SD = 138) (50) and after 28 months E: 192.5 (SD = 180), C: 263.5 (SD = 180). Results represent sick days exceeding 16 days per episode (personal communication) Full months at work: No difference during the 1st year E: 7.0 (SD = 4.4), C: 5.7 (SD = 4.6) (50).
Skouen et al. 2002 (N) (50)	195 persons with LBP sick-listed >8 weeks	Extensive multidisciplinary programme: 6 hours/day, 5 days/ week, 4 weeks. Cognitive behavioural modification in group sessions, education, exercise, occasional work place interventions.	Sick days: no difference during the first year, E: 161 (SD = 135), C: 188 (SD = 138) (50) and after 28 months E: 240.5 (SD = 180), C: 263.5 (SD = 180). Results represent sick days exceeding 16 days per episode (personal communication). Full months at work: No difference during the 1st year E: 6.6 (SD = 4.5), C: 5.7 (SD = 4.6) (50).
Torstensen et al. 1998 (N) (49)	137 gainfully employed patients sick listed 4–8 weeks because of LBP, birth in Norway	Medical exercise therapy (MET) 36 treatments of 1 hour duration for 12 weeks, groups of 5 patients, 6 to 9 exercises with approximately 1000 repetitions	Sick days: No difference after 1 year, E: 132 (SD = 100), C: 155 (SD = 130) (49) Persons at work: No difference after 1 year, E: 41/71 = 58%, C: 40/70 = 57% (49) Disability allowance: No difference E: 9/71 = 13%, C: 5/70 7% (49).
Torstensen et al. 1998 (N) (49)	137 gainfully employed patients sick listed 4–8 weeks because of LBP, birth in Norway	Conventional physiotherapy (CP); 36 treatments of 1 hour duration for 12 weeks, heat or cold, massage, traction, electrotherapy, exercises individually tailored to the patients symptoms	Sick days: no difference after 1 year, E: 119 (SD = 100), C: 155 (SD = 130) (49) Persons at work: No difference after 1 year E: 42/67 = 63%, C: 40/70 = 57% (49) Disability allowance: No difference E: 9/67 = 13%, C: 5/70 7% (49).
White 1966 (Can) (19)	194 men sick listed for LBP since 6 weeks–1 year	Inpatient rehabilitation: up to 6 weeks, progressive treatment in 4 stages: bed rest – light – medium – heavy	Satisfactory return to work: significantly better at 3 months, E: 42/99 = 42%, C: 15/95 = 16%. A satisfactory return to work is defined as working at previous job with <20% time loss or modified work full time or by own statement able to perform that level of work (19).

These numbers were adapted to mean values of sick days for the total group, which leads to numbers that seem to be different from those in the original publication. Lindström reported both time until return to work during the first year and the number of sick days during the second follow-up year (56, 57). Soukup reported sick days results both with and without an outlier that accounted for most of the sick days in the experimental group (55). In this review we used the results with the outlier, assuming that outliers balance out across studies.

Table IV shows the sick-leave-related outcomes in 9 studies reporting 13 comparisons between experimental treatments and usual care. In general, positive results were reported for sick days and for the proportion of patients at work. Effects were smaller at longer follow-up intervals. Sick days were the most frequently used outcome reported in 8 studies with 12 comparisons. Results were significant and positive in 5 comparisons. Non-significant improvements were reported in 7 treatment comparisons. In 4 of these 7 treatment comparisons, the control group reported less than 15 sick days during the follow-up year. No benefits with regard to disability allowances were reported in 8 comparisons (6 studies). The results display a wide variety in the average level of work-related disability. Sick days and

Table V. *Results of comparisons between experimental treatments.*

Author, year, country	Subjects	Treatment	Sick leave outcome
Alaranta et al. 1994 (SF) (76)	293 patients with chronic LBP >6 months, selected by insurer	A Programme of 3 weeks duration, 37 hours/week of guided or self-controlled physical exercise, 5 hours/week cognitive-behavioural disability management groups, no passive treatments B Rehabilitation 3 weeks; 15–20 hours/week physical activity, large amount of passive treatments	Sick days: no difference after 1 year (A: 33.9, B: 36.9) (76). Disability allowances: no difference after 1 year (A: 4/153 = 3%, B: 7/141 = 5%) (76). Sick leave (number of subjects): no difference during the 1st year (A: 26%, B: 23%) (76).
Bendix et al. 1995 (DK) (53, 58, 77)	132 patients with disabling LBP >6 months, threatened job situation or out of work	A Functional restoration; a full-time intensive 3-week multidisciplinary programme, including active physical and ergonomic training and psychological pain management, followed by 1 day weekly for the subsequent 3 weeks. B Active physical training, twice a week for 6 weeks, for a total of 24 hours C Psychological pain management combined with active physical training, 2 hours twice a week for 6 weeks	Sick days (median, IQR): Significant advantage after 4 months for A and B vs C. A: 25 (0–103), B: 13 (0–122), C: 122 (60–122). (77). Significant advantage after 13 months for A vs B and C and for B vs C. A: 52 (0–127), B: 100 (0–390), C: 295 (0–390) (53). Work capability as judged by a physician: Significant pre treatment difference between groups (A: 9/46 = 23%, B: 18/43 = 42%, C: 18/43 = 42%). Significantly greater work ability in A versus B and C after 4 months (A: 75%, B: 48%, C: 40%) (77) and 2 years (A: 80%, B: 55%, C: 44%) (58). Disability allowance: Significant advantage after 2 years for A versus C (A: 17%, B: 33%, C: 50%) (58).
Bendix et al. 2000 (DK) (78)	138 patients in a precarious work situation due to LBP	A Three weeks of comprehensive functional restoration, 39 hours/week, involving intensive physical and ergonomic training and behavioural support B Outpatient intensive physical training; aerobics and strengthening exercises for 1.5 hours 3 times/week for 8 weeks	Results disregard 32 of 138 randomized patients who did not finish treatment. Work ability (number of patients): great pre-treatment difference between groups. No statistical comparison between groups. Pre-post A: from 28 to 36/48, B: from 21 to 35/51 (78) Sick days: no difference, A: median in 34/48 patients 5.5 (IQR 0 -113), B: median in 40/50 patients 2.5 (IQR 0 -301) (78).
Härkäpää et al. 1990 (SF) (51, 54)	476 blue collar workers, 2 years of chronic or intermittent LBP, sick leave due to LBP during the last 2 years	A Inpatient rehabilitation; 3 weeks, groups of 6–8 patients, Swedish back school, relaxation, heat or electrotherapy prior to exercise, 2 structured group discussions, home programme, rehearsal after 1.5 years B Outpatient treatment at the work place or local health centre; 15 sessions in 2 months, groups of 6–8 patients, Swedish back school, relaxation, heat or electrotherapy prior to exercise, 2 structured group discussions, home programme, rehearsal after 1.5 years C Usual care, comparisons with the usual care group see Table IV	Sick days due to LBP: no difference after 1.5 years A: 5.5 (SD = 25.0), B: 5.8 (SD = 25.0). Results disregard the first 7 days of each episode of sickness absence leading to a considerable underestimation of the total days lost from work (51). Disability allowances: no difference after 4.5 years A: 10%, B: 8% (51).
Ljunggren et al. 1997 (N) (20)	126 persons with a history of LBP, occupationally active	A Home exercises with a training apparatus called the TerapiMaster 3 times/week, 15–30 minutes, 12 months. Initial instruction by physical therapist, 8 control visits B Conventional training with home exercises. Initial instruction by physical therapist, 8 control visits	Sick days: no difference after the 1st year, A: 15.4 (SD = 5.3), B: 17.2 (SD = 6.0) and 2nd year, A: 9.3 (SD = 3.1), B: 9.9 (SD = 3.2) (20).

Table V. *Continued*

Author, year, country	Subjects	Treatment	Sick leave outcome
Lonn et al. 1999, Soukup et al. 1999 (N) (21, 55)	120 persons with LBP requiring treatment or sick days	A Active Back School (ABS), 20 sessions of 1 hour each during 13 weeks, 20 minutes theory and 40 minutes exercise B Mensendieck exercise group (M) with 6–10 participants, 20 sessions of 60 minutes for 13 weeks. Warm up and stretching exercises, ergonomic information C Usual care, comparisons with the usual care group see Table IV	Sick days (mean, SD): no difference after the 1st year, A: 1.9 (SD = 6.1), B: 8.8 (33) (21, 55). Significant benefit for A compared with B after 3 years, A: 4.7 (SD = 8.0), B: 22 (SD = 35) (82). Sick leave (number of patients): no difference during the 1st year, A: 7/38 = 18%, B: 10/34 = 29% (21, 55) and during 3 years follow-up, A: 12/37 = 32%, B: 13/31 = 42% (82). Sick leave (duration of episodes in those patients who took sick leave, mean days, SD): no difference during the 1st year, A: 10.4 (SD = 9.3), B: 29.9 (SD = 55.2) (21, 55) and during 3 years follow-up, A: 14.4 (SD = 12.7), B: 52.4 (SD = 97.9) (82).
Petersen et al. 2002 (DK) (80)	260 persons with LBP >8 weeks	A Physical therapy using the McKenzie method: self-mobilization with repeated movements, mobilization by physiotherapist B Strengthening training of trunk flexors and extensors in groups of 6 patients	Sick leave (number of patients): no difference after 2 months, A: 9/94 = 10%, B: 12/86 = 14% and 8 months, A: 7/94 = 7%, B: 7/86 = 8% (80).
Skouen et al. 2002 (N) (50)	195 persons with LBP sick-listed >8 weeks	A Light multidisciplinary programme: information about exercise, fear avoidance. Instruction of a personal exercise programme based on physical tests. Follow-up visits at 3 and 6 months. Further physiotherapy, appointment with psychologist and work place visits if necessary. B Extensive multidisciplinary programme: 6 hours/day, 5 days/week, 4 weeks. Cognitive behavioural modification in group sessions, education, exercise, occasional work place interventions. C Usual care, comparisons with the usual care group see Table IV	Sick days (mean, SD, personal communication): no difference A: 192.5 (SD = 180), B: 240.5 (SD = 180). Results represent sick days exceeding 16 days per episode, during 28 months follow-up. Full months at work (mean, SD): no difference during the 1st year A: 7.0 (4.4), B: 6.6 (4.5) (50).
Torstensen et al. 1998 (N) (49)	137 gainfully employed patients sick-listed 4–8 weeks because of LBP, birth in Norway	A Medical exercise therapy (MET) 36 treatments of 1 hour duration for 12 weeks, groups of 5 patients, 6 to 9 exercises doing approximately 1000 repetitions B Conventional physiotherapy (CP); 36 treatments of 1 hour duration for 12 weeks, heat or cold, massage, traction, electrotherapy, exercises individually tailored to the patient's symptoms C Usual care, comparisons with the usual care group see Table IV	Return to work: no difference 15 months after inclusion A: 41/71 = 58%, B 42/67 = 63% (49). Disability benefit: no difference 15 months after inclusion A: 9/71 = 13%, B 9/67 = 13% (49).

LBP: Low back pain.

disability allowances are minimal in some studies possibly leading to a floor effect in outcome measurement. Positive results are more frequently reported in studies with severely disabled patients. Based on the levels of evidence as defined in the methods, there is strong evidence that exercise alone, or as a part of a multidisciplinary treatment, reduces sick days one year after treatment in patients with non-acute non-specific LBP. Due to insufficient research, there is no evidence for the effectiveness or ineffectiveness after more than 1 year or for the effect of treatment on the number of persons receiving a disability allowance at any follow-up time up to 5 years.

Table V shows 9 studies comparing the effectiveness of 2 or 3 different experimental treatments. Only 1 study reported significant sick leave related benefits (58). All other studies showed no difference in any sick leave outcome. The number of patients in the comparisons of Table V was similar to those in Table IV, but the smaller treatment contrast probably reduced the power in these comparisons. The variety of treatments makes it impos-

sible to combine the results of the studies in Table V. Based on the levels of evidence as defined in the methods, there is no evidence for the superiority of any type of exercise alone or as a part of a multidisciplinary treatment to reduce sick leave in patients with non-acute non-specific LBP.

To investigate the question regarding which patients might benefit more, several studies performed a subgroup analysis. Because different subgroups were analysed in the studies, and results were inconsistent, no conclusions can be drawn. We performed an analysis in a subgroup of studies investigating patients with more severe disability, which is described in the next section.

Quantitative sick leave analysis

Nine studies analysed 13 comparisons between exercise and usual care. The number of sick days was the most frequently used sick leave outcome, reported in 12 treatment comparisons (21, 49–51, 55, 56, 59–61). Three studies reported sick days due to LBP (21, 51, 55, 61). Four studies reported sick days due to all diseases (49, 50, 59, 60) whereas 1 study did not clearly specify the reason for sick leave during the second follow-up year (56). Most studies reported work days lost due to sick leave (49–51, 56, 59, 60). One study reported calendar days lost due to sick leave (59) and 2 studies did not give details on this aspect (21, 55, 61). One study recorded work capability as judged by a physician (59). Other studies reported the mean time until return to work (56) or the rate of return to work (60). Because sick days were recorded with different methods, a standardized effects model was used for pooling. The sick days during the follow-up year ranged from 1.9 (21) to 155 days (49).

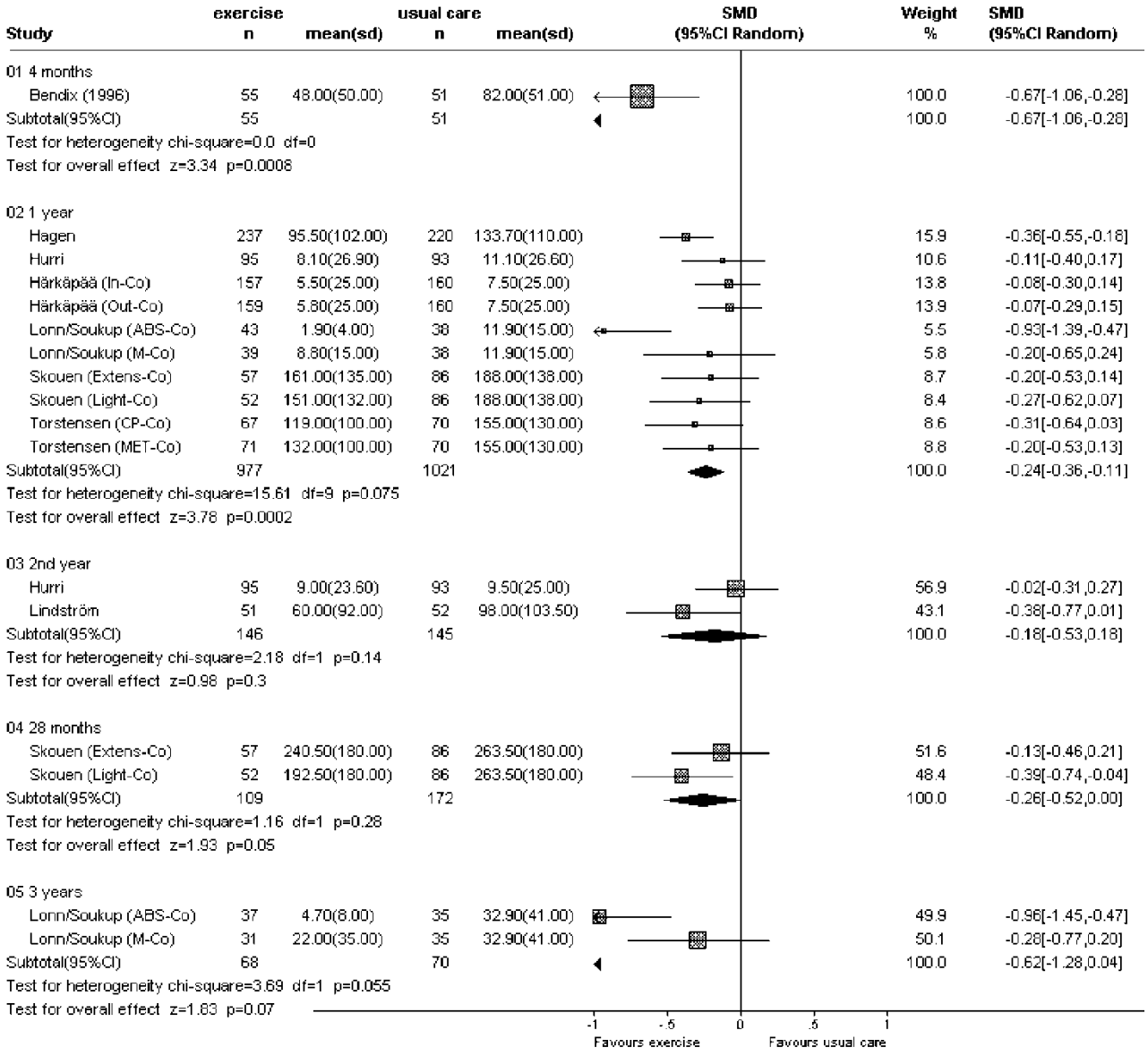

Fig. 1. Sick days, comparisons between experimental treatments and usual care.

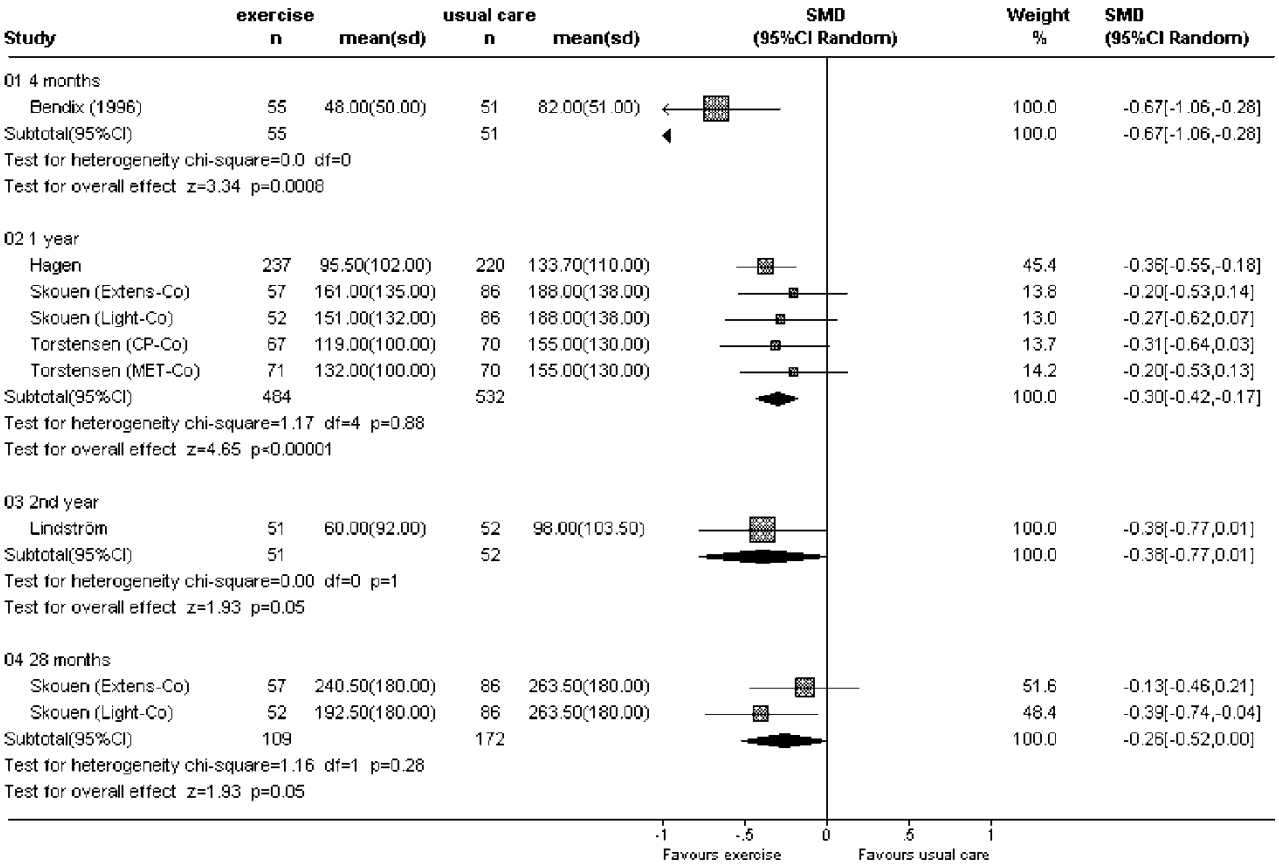

Fig. 2. Sick days in studies with severely disabled patients (>90 sick days in the control group). Extens = extensive rehabilitation, co = control group, Light = light rehabilitation, CP = conventional physiotherapy, MET = medical exercise therapy.

The number of sick days, the proportion of patients who returned to work and the proportion of patients receiving a disability allowance were analysed separately for the different follow-up durations.

Figure 1 shows the number of sick days in 12 comparisons between exercise and usual care. The effect sizes were negative in all studies (between −0.18 and −0.67) favouring the experimental treatment. Ten treatment comparisons with 1998 patients reported sick days after 1 year. The 1-year results were homogeneous (chi square = 15.61, $p = 0.075$) and the effect size was −0.24 (−0.36, −0.11, $p = 0.0002$) in favour of the treatments using exercise. At the other follow-up times only 1 or 2 treatment comparisons with 106–291 patients were available with effect sizes of −0.67 (4 months, $p = 0.0008$), −0.18 (second year, $p = 0.31$), −0.26 (28 months, $p = 0.05$) and −0.62 (3 years, $p = 0.07$).

Figure 2 shows the sick days results in a subgroup of 5 studies describing 7 treatment comparisons in patients with an average of more than 90 sick days in the control group during the first follow-up year. All studies favoured the experimental treatment. The 1-year results were homogeneous (chi square = 1.17, $p = 0.88$) and the effect size was −0.30 (−0.17, −0.42, $p < 0.00001$, $n = 1016$). At the other follow-up times the effect size was −0.67 (4 months), −0.38 (during the second year) and −0.26 (28 months).

Three studies reported the proportion of patients who had returned to work, a desirable outcome generally favouring the experimental treatment. To obtain results with a meaning comparable to sick days and disability allowances, which are undesirable outcomes, we computed the proportion of patients not at work, displayed in Fig. 3. The relative risk at the different follow-up times ranged from 0.64–0.75 and was significant after 3 and 6 months and after 1 year.

The number of patients receiving a disability allowance was reported in 6 studies with non-significant results in all studies (Fig. 4). The pooled relative risk was not significant at any follow-up time and ranged from 0.76 to 1.29. The prevalence of receiving a disability allowance was low in most studies, which reduces the power to detect a relevant difference.

DISCUSSION

The results of the qualitative and quantitative analysis are consistent. Treatments using exercise alone or as a part of a multidisciplinary treatment reduce sick leave in patients with non-specific non-acute LBP. The effects are greater in more

severely disabled patients and tend to decline with increasing follow-up duration. It remains unclear whether the number of patients receiving a disability allowance is reduced, and there is insufficient research comparing the effectiveness of different treatments.

The methodological quality of the included studies shows flaws (Table III). In approximately 50% of the studies randomization was not concealed, assessment was not blinded and the authors did not apply or describe analysis by intention-to-treat. Eight out of 10 treatment comparisons showed non-significant differences in the number of sick days during the first follow-up year (Fig. 1). Considering the effect sizes found in this meta-analysis, the statistical power of the individual studies was too small because the number of patients and the homogeneity of the groups were insufficient. In addition, measurement of the number of sick days seems inappropriate when the number of sick days under usual care is small, leading to a floor effect and a decrease in power.

Previous reviews addressed the effects of vocational rehabilitation (62), multidisciplinary biopsychosocial rehabilitation (63), conservative (10) or behavioural treatment (11) without specifically investigating whether sick leave can be reduced. In 1997, conflicting evidence regarding the beneficial influence of back schools and exercise therapy on vocational outcome was found (62). Since then, several new studies were performed reporting return to work.

A recent review by Guzman reported a dose-response relationship and concluded that especially multidisciplinary rehabilitation of more than 100 hours is effective in reducing pain and function (12). This review shows, that treatments of much shorter duration can reduce sick leave. Guzman however, only included RCTs evaluating multidisciplinary rehabilitation. This review includes all RCTs using exercise alone or as a part of a multidisciplinary treatment, reporting sick leave. Some RCTs included by Guzman were excluded from this review because they did not report sick leave outcome (24, 64–67) or included patients with thoracic or cervical pain (24).

We applied a limit of 5 or more out of the maximal obtainable 8 points as a cut-off point for good methodological quality. Although this choice is arguable, it accords with other reviews (10–12). The presentation of information about methodological quality and outcome allows the reader to form his or her own opinion. Correlation coefficients between the methodological quality and the treatment effect can be used to investigate

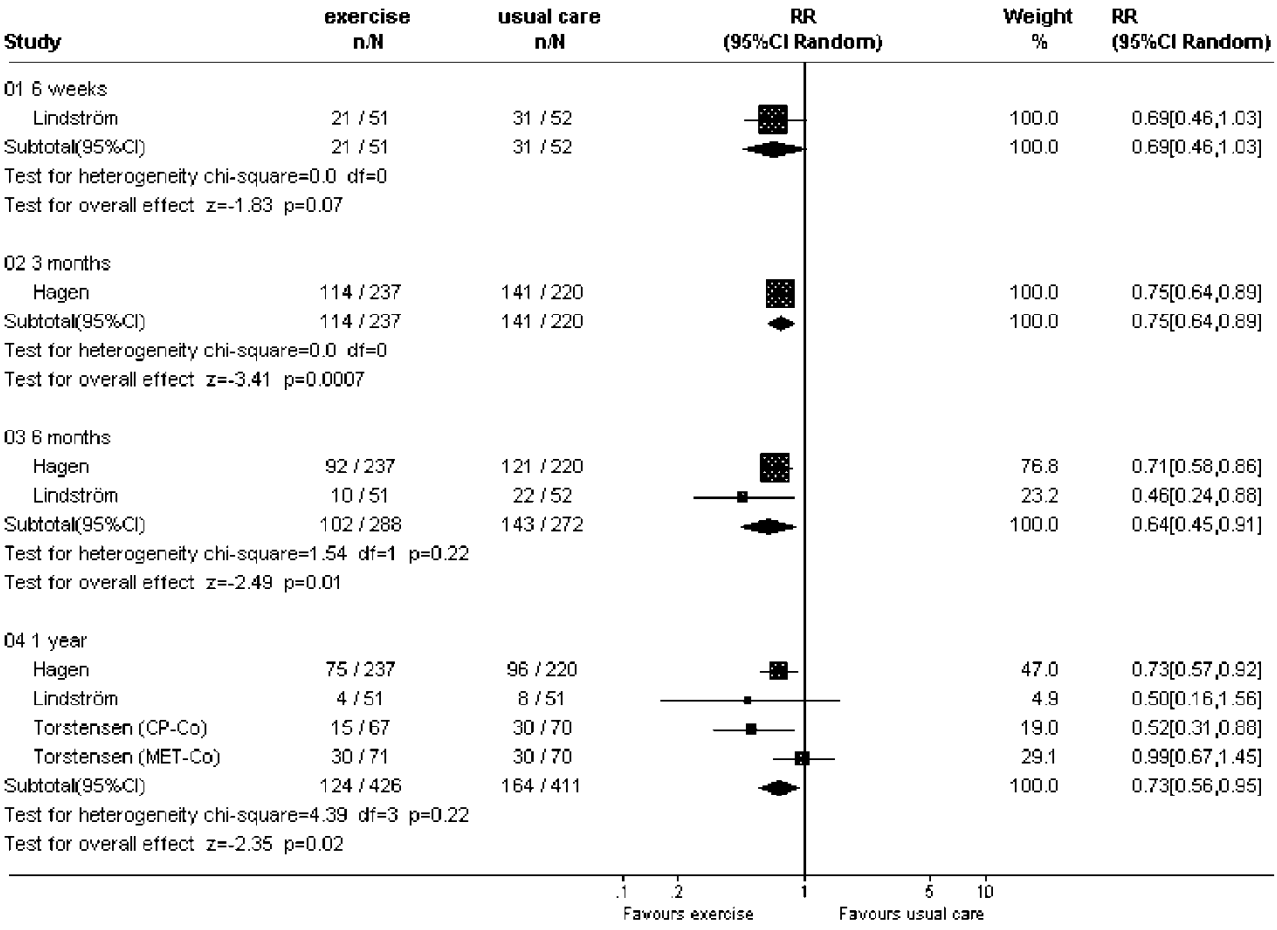

Fig. 3. Proportion of patients not at work, comparisons between experimental treatments and usual care. CP = conventional physiotherapy, MET = medical exercise therapy, Co: controls.

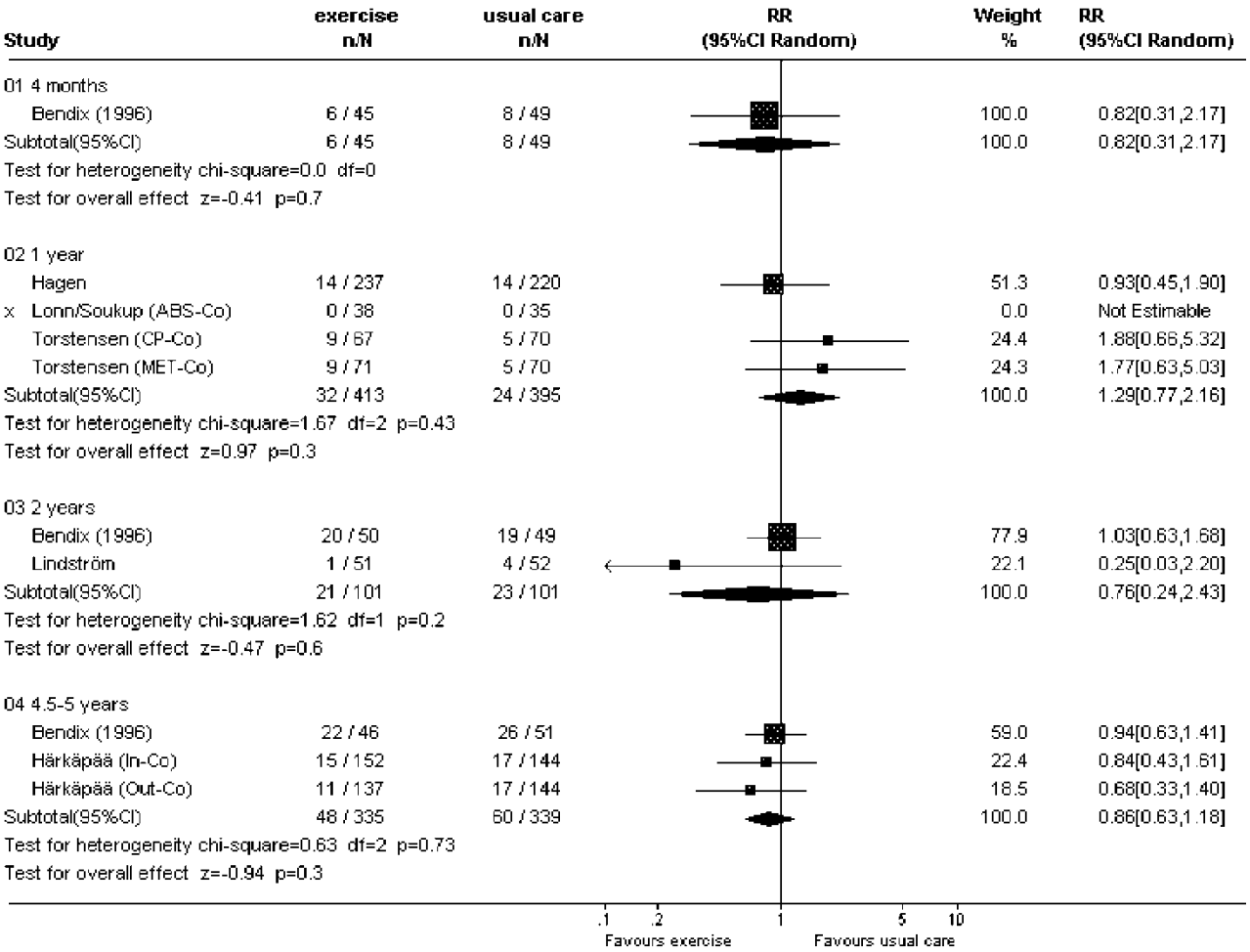

Fig. 4. Disability allowances, comparisons between experimental treatments and usual care. ABS = active back school, co = control group, CP = conventional physiotherapy, MET = medical exercise therapy, In = inpatient rehabilitation, Out = outpatient rehabilitation.

whether methodological quality is related with the magnitude of the treatment effect. Significant negative correlations might hint at bias, prompting the inclusion of only the high quality studies. Ten treatment comparisons reported sick days during the first follow-up year. The methodological quality ranged from 5 to 7. Higher quality was associated with a greater effect size, indicated by a significant positive correlation (Spearman Rho = 0.68, $p = 0.033$). The other outcomes were reported in less than 6 comparisons and the determination of a correlation coefficient was considered inappropriate.

Using mean values and standard deviations for further statistical analysis in data with a skewed distribution is usually regarded as inappropriate. Data regarding sick days have a skewed distribution. The skewedness is probably similar across studies and does not bias the direction of the results in pooling (68). Other authors have advocated the use of parametric statistics in skewed data under these circumstances (69).

An important point of consideration is the degree of heterogeneity of studies. We seriously considered this possible limitation but concluded that patients, treatments and outcome measurements showed satisfactory homogeneity. First of all, 13 of the 14 included studies were performed in Scandinavian countries among employed persons. The medical diagnosis is non-acute non-specific low back pain in all patients. The main conclusions of this review are all based on comparisons of an experimental treatment with usual care. Exercise, usually as a part of a multidisciplinary treatment, was applied in all studies. Different professions were involved in the treatment, but this was not considered to introduce serious heterogeneity since recent studies could not show a difference in effectiveness between behavioural treatments provided by lay leaders and comparable treatments provided by psychologists (70). A further indication of the homogeneity of the studies is the fact that the results of each outcome are similar across studies.

The inclusion of all studies using exercise alone or as a part of multidisciplinary treatment was also supported by previous research that could not identify any specific type of exercise as being more effective than another, leading to the conclusion that increasing activity seems to be the crucial element (71). This conclusion further relieves the concern about the heterogeneity

of types of exercise in this review. Another remark must be made to the statements about treatments being "behavioural" or "based on the biopsychosocial concept". These statements can easily be misunderstood and do not mean that other treatments do not change behaviour. The authors strongly support the importance of behavioural aspects of treatment and think patient behaviour is not only changed by multidisciplinary treatment claiming to provide behavioural treatment. All forms of activity and exercise may change behaviour. A recent RCT in patients without clinical signs of specific LBP of 6 weeks duration showed that taking X-rays increased pain and reduced health status. Patients were not less worried about serious disease causing their low back pain (72). Even the advice to stay active has small beneficial effects for patients with acute non-specific LBP (73).

Differences in psychosocial prognostic factors among studies probably are the most justifiable factor that may have introduced heterogeneity in this review. Only a few psychosocial prognostic factors were mentioned in most studies and comparisons between studies were impossible. For future studies, a core set of predictive factors to describe participants in a standardized way would enable comparison of different study populations. Recommended predictive factors are age, sick days during the year prior to treatment, depression, workload, job satisfaction, fear avoidance beliefs and education (74).

For future RCTs the number of days lost from work is probably the single most important measure, constituted by the sum of sick days, the time on a disability allowance and unemployment time. Each measure should be recorded during the year before treatment and during the follow-up period. The response to treatment is the between-group difference in the status before and after treatment. None of the reviewed studies reported the response to treatment as previously defined.

There is no evidence in this review for the assumption that early intervention is more effective. The reduction in the number of sick days is greater in patients who had more sick leave. Future research should investigate which patients might benefit from expensive treatments. Some clinical tests have been investigated and their prognostic validity was confirmed, allowing their use as screening tests to exclude patients with less than a 5% probability to return to work and thereby increase cost-effectiveness (75).

CONCLUSION

There is strong evidence that sick days are reduced during the first year after treatment (SMD = −0.24, 95%CI = −0.11, −0.36) especially in severely disabled patients with >90 sick days per year under usual care in the control group (SMD = −0.30, 95%CI = −0.17, −0.42). There was insufficient research regarding the effect on sick days beyond 1 year and the number of patients receiving a disability allowance at any follow-up time.

Further research is needed regarding the relative cost-effectiveness of different treatments. The single most important sick leave outcome recommended is the number of days lost from work due to sick leave. Research is needed to identify political and psychosocial factors in relation to the effectiveness of treatment. The reduction of LBP-related costs for society is an action demanding integrated efforts from health professionals, politicians and economists.

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