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ORIGINAL ARTICLE

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Cost-effectiveness of multidisciplinary treatment in sick-listed patients with upper extremity musculoskeletal disorders: a randomized, controlled trial with one-year follow-up

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Abstract *Objective*: To determine the effectiveness and cost-effectiveness of a return-to-work outpatient multidisciplinary treatment programme for sick-listed workers with non-specific upper extremity musculoskeletal complaints. *Methods*: A randomized controlled trial with a 1-year follow-up was carried out. Thirty-eight subjects were allocated to multidisciplinary treatment (intervention, $n=23$), or to usual care provided by occupational health services ($n=15$). The intervention consisted of psychological and physical sessions provided by a medical specialist, a psychologist, a physiotherapist and an occupational therapist. It aims at reconditioning, ''de-medicalizing'', unrestrained moving and return-to-work. The intervention process was evaluated on compliance to the protocol and the effectiveness of its components. The individual outcome variable was the severity of complaints. The societal outcomes included return-to-work and costs. Measurements were performed at baseline and after 2, 6 and 12 months. Mixed model analyses were used for analysis. *Results*: The intervention achieves its aims: physical disabilities ($P=0.039$), kinesiophobia ($P<0.001$) and physical functioning ($P=0.016$) improved significantly as compared to usual care. In addition, the intervention was significantly more effective in reducing the severity of complaints than usual care. The intervention was equally effective compared to usual care in terms of return-to-work (86% in the intervention group vs. 73% in the usual care group). The extra total costs and the extra gains in terms of return-to-work were not significantly higher for the intervention as compared to usual care after 12 months. *Conclusion*: Multidisciplinary treatment affects individuals positively, but shows no significant difference in (cost-) effectiveness on the societal level as compared to usual care.

Keywords Repetitive strain injury · RCT · Process evaluation · Return-to-work · Cost-effectiveness

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Introduction

High incidence rates for work-related musculoskeletal disorders of the upper extremity have been reported for office workers (Gerr et al. 2002). Employee sick leaves are a major consequence of chronic musculoskeletal complaints and the amount of time lost from work due to a work-related musculoskeletal problem of the upper extremity is longer than for other musculoskeletal disorders (Cheadle et al. 1994; Burdorf et al. 1998; Van der Weide et al. 1999).

Sick leaves have negative psychological impacts on employees (Kendall and Thompson 1998). Moreover, epidemiological studies among employees with 100% sick leave due to low back pain have shown that the longer the sick leave, the more difficult it is for the employee to return-to-work and the more economic impact due to the indirect costs the society incurs (Hildebrandt et al. 1997; Frank et al. 1998; Verbeek 2001). In the light of that, effective treatment that enables a swift and durable return-to-work is important to society, as well as to the individual patient. When a variety of treatments are available, it would seem logical to use the one with the best results. It is tempting to view the most effective treatment as the one with the best results, but

effectiveness often comes at a price. Once cost-effectiveness has been measured, it can be determined which treatment offers the best results.

Little is known about the treatments for sick-listed workers with non-specific musculoskeletal complaints in the upper extremity. A recent systematic review concluded that current evidence is inconsistent regarding the effectiveness of return-to-work treatment programmes (Meijer et al. 2005). Most of the high-quality studies reviewed (64%) examined the effect of treatment on return-to-work in patients with low back pain and no studies examined the effect of return-to-work treatment exclusively among patients with non-specific upper extremity musculoskeletal disorders (Meijer et al. 2005). Although there appear to be similarities between low back pain and upper extremity musculoskeletal disorders (Ijzelenberg and Burdorf 2004), the conclusion so far is that thoroughly convincing evidence is still lacking.

An uncontrolled pilot study demonstrated that an outpatient multidisciplinary treatment programme improves general health, reduces disability and facilitates return-to-work in patients with non-specific upper extremity musculoskeletal disorders (Schakenraad et al. 2004). The composition of such treatment is often a black box. This makes the interpretation of the findings and drawing generalized conclusions regarding the occupational physician's practice difficult. In evidence-based medicine, it is important to identify and clearly report the treatment components. To carry out a detailed evaluation of the process of the aforementioned multidisciplinary treatment, it is necessary to determine compliance with the protocol and the effects that come close to its aims. This randomized controlled study aims primarily to determine the effectiveness and cost-effectiveness of the multidisciplinary treatment programme on individual (in terms of complaints) and societal levels (in terms of return-to-work) in sick-listed patients with non-specific upper extremity musculoskeletal complaints.

Three research questions were formulated:

1. Is the process of an outpatient multidisciplinary treatment for sick-listed patients with non-specific upper extremity musculoskeletal complaints effective?
   a. Is the treatment carried out in accordance with the protocol?
   b. Do the treatment components achieve their aims?
2. Is an outpatient multidisciplinary treatment effective as compared to the usual care provided by occupational health services for individual sick-listed workers with non-specific upper extremity musculoskeletal complaints?
3. Is an outpatient multidisciplinary treatment (cost-) effective as compared to the usual care provided by occupational health services at the societal level for sick-listed patients with non-specific upper extremity musculoskeletal complaints?

Methods

Study population and recruitment procedure

Patients were recruited from a population of 160,000 bank employees throughout the Netherlands and workers at one of the two universities in Amsterdam. The occupational health services' management at the participating organizations assigned 66 of their in-company occupational physicians the task of referring patients to this study. All occupational physicians were informed face-to-face about the research aims and the logistic pathway and could refer patients between August 2002 and August 2003 by sending in a standardized registration form, which contained the inclusion criteria.

Patients with non-specific upper extremity musculoskeletal disorders were eligible to participate. "Non-specific" was defined as a combination of symptoms and signs that did not match a specific (upper extremity) disorder (Sluiter et al. 2001). Other inclusion criteria were: employment on a contract of at least 50% of full-time working hours and sick leave for over 50% of the contractual hours during a period between 4 and 20 weeks. Participants ranged between 18 and 65 years and were required to comprehend and have communication skills in Dutch.

Interventions

Multidisciplinary treatment programme (= intervention)

The intervention was an outpatient training programme carried out by a Dutch rehabilitation centre (Winnock). Thirteen of its 20 locations were assigned to participate in this study. All these locations followed the same standardized treatment protocol. The protocol was developed in keeping with the visions of Mayer and Gatchel (1988), Fordyce (1976) and Feuerstein et al. (1993) and aims at achieving a normal pattern of functioning, including a return-to-work.

The main part of the intervention took 13 full days (from 9.00 to 17.00 hours), 5 return-to-work sessions and 1 feedback session, all of which took place within 2 months. Patients were treated in groups of about eight individuals. Each day's schedule consisted of four (1.5 h) sessions: two physical sessions and two psychological sessions, twice a week supplemented with a fifth session consisting of 30 min of relaxation exercises. The physical sessions aimed at restoring muscle strength and endurance, as well as aerobic fitness, using graded activity training starting at 30% of the patients' MVC. Education was provided to eliminate inappropriate pain behaviour. Sports activities outside the building, such as bowling were part of the treatment.

One of the daily psychological sessions aimed at "de-medicalizing", setting (and achieving) goals and improving coping strategies using cognitive techniques and education. The other psychological session prepared the participants to return-to-work, or to discuss work experiences. In the third week of treatment, a workplace visit could be arranged. The treatment protocol included certain additional sessions: evaluations and training on how to use and receive energy. Table 1 presents the duration and frequencies of the programme's contents. Four months and 1 year after starting the treatment, two feedback sessions were scheduled. The intervention was performed by a team representing four disciplines: a physical therapist, a psychologist, a medical specialist and an occupational therapist.

Usual care: supervision by occupational health services

Usual care was coordinated by the occupational physician at the occupational health services. Usual care could include treatment at the workplace and in the regular health care system, initiated by a general practitioner, or medical specialist.

Both treatments took place at a location closest to the patient's workplace or home. All patients were allowed to receive other treatments in addition to the assigned treatment, a fact that was mentioned in the informational talk.

Outcomes

To evaluate the process of the intervention, outcomes were selected close to the intervention components. Outcomes that were relevant to the individual and societal levels were also defined. All outcomes were assessed at baseline and at three follow-up assessments at 2, 6 and 12 months after baseline.

Process evaluation

To determine compliance with the intervention protocol, all team members marked all activities performed and/or discussed on a checklist after every session. These activities were later classified into physical and psychological components, return-to-work, relaxation and energy components. The percentage of the planned sessions that actually took place was calculated. The golden standard was the protocol provided by the rehabilitation centre's management. Compliance was determined to be good if more than 74% of the scheduled sessions took place, moderate between 50–74% and poor if less than 50% of the treatment protocol was carried out.

To determine the composition of the control treatment provided by the occupational health service, a questionnaire about treatment (components) provided by the occupational physician and prescribed therapies was sent to the occupational physicians 2 and 6 months following the baseline assessment. Furthermore, the patients were asked what treatment were followed at 2, 6 and 12 months

Physical functioning was defined as physical disability, physical functioning and handgrip strength and was measured by questionnaires as well as by physical examination.

Physical disability was measured, using the Dutch version of the Disability Arm Shoulder Hand questionnaire (DASH) (Hudak et al. 1996). Physical functioning was determined with the Dutch version of the SF-36 Health Survey (Ware and Sherbourne 1992; Aaronson et al. 1998) and handgrip strength was assessed with a Jamar hand dynamometer (Sammons Preston, Bolingbrook 2005). Handgrip strength was measured three times in a standing position, with the handgrip in the second position (Boadella et al. 2005). The mean score of the three attempts was calculated.

Table 1 Contents, duration and frequencies for the main part of the intervention (2 months)

Session type	Aim	Activity	Frequency and duration of sessions (hours)	Total No. (hours)
Physical	*Reconditioning	Graded activity training	16×1.5 = 24	34.5
	*Unrestrained moving	Education	7×1.5 = 10.5	
Psychological	*De-medicalization	Cognitive techniques (RET)	2×1.5 = 3	24
	*Stress reduction	Education	10×1.5 = 15	
		Individual counselling	1×1.5 = 1.5	
		Goal setting	3×1.5 = 4.5	
	*Return-to-work	Preparation for return-to-work	6×1.5 = 9	15
		Working experiences	1×1.5 = 1.5	
		Workplace visit	1×1.5 = 1.5	
		Open session to fill in during the programme	1×1.5 = 1.5	
		Follow-up meetings	5	
Relaxation	*Relaxation	Introduction of relaxation techniques	4×0.5 = 2	2
		Energy engineering	2×1.5 = 4.5	
		Evaluation	3×1.5 = 4.5	7.5
		Total number of hours		83

Kinesiophobia was measured, using the Dutch version of the Tampa Scale for kinesiophobia (Kori et al. 1990; Vlaeyen et al. 1995).

Outcome on individual level

Complaints were assessed as pain and as other complaints (e.g. paraesthesia, stiffness, coldness). Pain, as well as other complaints, was measured as the mean severity during the last 24 h. A visual analogue scale (VAS) (Carlsson 1983) was used to determine pain (0 = absolutely no pain, 10 = most pain imaginable) and a second VAS was used to determine other complaints. The distance from 0 to the self-reported mark was measured in millimetres.

Outcome on societal level

Return-to-work was defined as the mean percentage of return to work, where 100 was total return to regular work at the original number of hours. Four questions in the questionnaires were used to determine the return-to-work percentage: 1) the actual number of working hours per day; 2) the number of contractual hours; 3) the number of extra rest breaks during a working day; and 4) the number of working hours spent performing tasks other than the usual work. All hours not devoted to regular work were considered to comprise sick leave.

Costs were divided into the direct medical costs of treatment and medicines, the direct non-medical costs of expedients and the indirect non-medical costs of productivity losses, loss of free time and other costs (Oostenbrink et al. 2002). Costs were calculated for each period between the questionnaires. Costs and benefits were restricted to the study period.

The average costs per day (€491.67) for the intervention were calculated by dividing the total costs of the intervention (€8,850) by the total number of treatment days (18 days). The costs of usual care per patient were calculated by multiplying the total number of treatments per treatment type (e.g. physiotherapy) during that period with the costs of those specific treatments. The number of treatments was asked for in the questionnaire. Costs per treatment type were set equal to the maximum rate for those treatments (Dutch Board on Medical Tariffs CTG, http://www.ctg-zaio.nl, 2004).

Medication costs were determined by taking the standardized costs for the average self-reported medications use during the treatment period (Medicine Compensation System GVS, http://www.medicijnkosten.nl, Dutch Health Care Insurance Board CVZ, http://www.cvz.nl, 2004).

The costs of expedients were determined by the actual costs of expedients that patients reported in the questionnaire (e.g., adjustable desk chairs, feet rests and pillows).

Costs of productivity losses were determined by the Human Capital Method (Koopmanschap and Rutten 1993). The costs of the productivity losses were calculated as the number of sick leave hours multiplied by the gross hourly wage level. Sick leave hours during the 2 weeks prior to the assessments were reported in the questionnaires. Gross hourly wages were derived from reported net wages per week, month or year by using standard tax rules. Where individual information on wages was missing, the average wage for all the patients was used.

The costs of loss of free time were determined as the costs of the extra time that was needed for domestic activities and specified whether they personally invested that extra time or whether that was done by family members or friends. Domestic activities included cleaning, cooking, personal care and the care for children or other family members. When the extra time was spent by patients, the costs of each extra hour needed for domestic activities were set at the patient's net hourly wage. When others were helping out, the costs per extra hour were set at the partner's net hourly wage rate. Where individual information on (partner's) wages was missing, the average wage for all patients (partner) was used.

Other costs included professional domestic aid and travel costs. These were set equal to the amount the patients reported in the assessments.

The cost-effectiveness of the intervention (I) as compared to usual care (U) at any time t was defined as the difference in total costs (TC) associated with the complaints following the start of treatment until time t between the intervention and usual care, divided by the difference in extra units of outcome (OC) in the same period between I and U. Formally, this definition can be stated as: $CE(t) = (TCI(t) - TCU(t)) / (OCI(t) - OCU(t))$

Effectiveness in terms of extra units of outcome was defined as: (1) One extra half-day return-to-work; (2) One unit lower on the VAS with respect to pain; (3) One unit lower on the VAS with respect to complaints other than pain. In addition, cost-effectiveness was calculated in terms of extra treatment costs per half-day return-to-work per week, as an approximation of the cost-benefit consideration of employers.

Randomization and blinding

After receiving the written informed consent, the baseline examination was performed. Thereafter, patients were randomized. Allocation was based on block randomization (six blocks) with respect to the size of the participating organizations. A computer-generated random sequence table was made before the start of the inclusion period. The information was kept in opaque, sealed envelopes by one of the researchers (JS), who had no contact with the therapists, physicians or patients. The envelopes were allocated to the patients based on the patients' consecutive registration numbers. The envelopes were opened by the first researcher (EM) to conclude the allocation. Both the occupational physi-

cians and the patients were informed about the treatment group by regular mail. Double blinding for treatment after baseline was not possible. The study was performed according to the Helsinki Declaration and was approved by the Medical Ethics Committee of the Academic Medical Center, Amsterdam, The Netherlands.

Statistical analyses

Intention-to-treat analyses were conducted with SPSS 12.0.1. A significant difference was defined as $P < 0.05$ for all outcome measurements. Significant differences between the two treatment groups were tested, using the mixed model analysis. In each model, one of the seven outcome variables (physical functioning, physical disability, handgrip strength, kinesiophobia, pain, complaints other than pain, return-to-work) was a dependent variable. Per dependent variable the best fitting covariance–variance model was tested before the mixed model analysis was applied. The four measurements were the within-subjects factor; the treatment was the between-subjects factor in the model. When one measurement was missing, the three others were included in the analysis. The cost components are analysed with dependent t tests to compare the costs per period (after 2, 6 and 12 months) between the groups.

Results

Participants

In total, 52 patients (37 females) were referred to the research project and were informed about the treatment randomization and assessments. Eight patients did not meet all inclusion criteria and six refused to participate. Therefore, 38 patients were randomized. Of these, 23 patients (16 females) were allocated to the intervention and 15 were assigned (10 females) to usual care. Figure 1 presents the flow of participants. Four participants were excluded from the analysis due to the following reasons. Two patients were excluded after randomization: one did not match the inclusion criteria of this study anymore because the arm complaints could have been due to a myocardial infarction and the other was referred to the intervention by the occupational physician while randomized to the usual care group. Furthermore, in two participants only baseline measures have been performed. All measurements were performed for 13 control patients and for 19 patients in the intervention

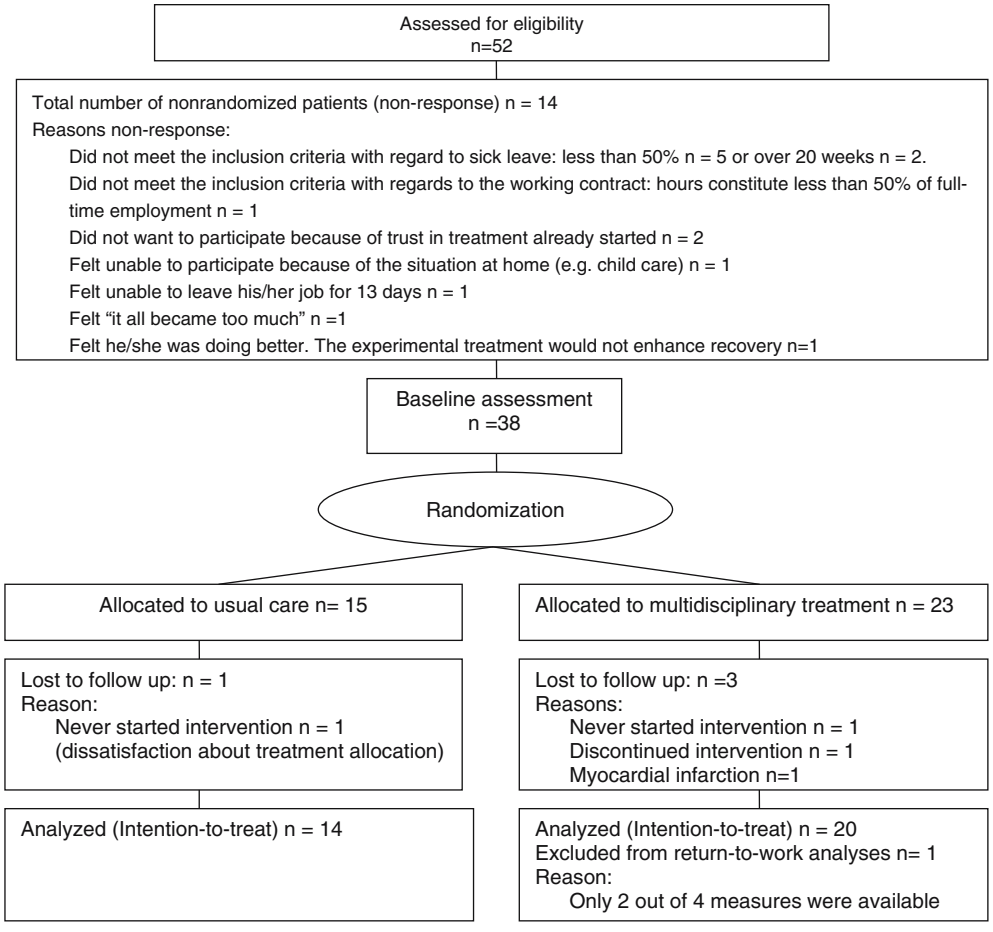

Fig. 1 Participants flow

group and for 34 patients at least three measurements were available and therefore included into the analysis.

Table 2 presents the patients' characteristics at baseline. There were no significant differences between the groups at baseline.

Process evaluation

In total, 18 of the 21 intervention randomized patients showed good compliance. The other three attended 50–75% of all sessions (min. 31 sessions). Compliance to the intervention protocol among the team members was good. All the major components (physical, psychological, return-to-work) were provided with over 75% compliance with the protocol. The total number of physical sessions provided was on average 26 instead of the 23 required by the protocol. On average, 14 of the 16 psychological sessions took place. Return-to-work was discussed on average 12 times rather than 14 times, as prescribed by the protocol. The number of energy sessions showed 76% compliance with the protocol. The relaxation exercise sessions showed a 12% compliance with the protocol.

During the first 2 months of usual care, all patients visited their occupational physician. In total, 93% of the patients participated in physical therapy; in 33%, this was supplemented by manual therapy (see Table 3). The general physician was consulted by 67%.

Physical functioning

The functional disability scores decrease significantly over time for both groups (see Table 4). These physical disability scores differ significantly between the groups ($P = 0.016$); the intervention group reports less. Physical functioning also differs significantly between the groups over time ($P = 0.039$). In both groups, physical functioning increases significantly over time ($P < 0.001$); the intervention group reported better physical functioning. Even though handgrip strength increases significantly over time ($P < 0.001$), no significant difference was found between the groups ($P = 0.097$).

Table 3 Frequency of contents in the usual care in number (percentage) of patients

Usual care	Between baseline and 2 months after baseline	Between 2 and 12 months after baseline
Occupational physician	14 (100%)	14 (100%)
Physical therapy	14 (100%)	13 (93%)
General physician	10 (71%)	7 (50%)
Manual therapy	5 (36%)	2 (14%)
Mensendieck/ceasar therapy	4 (29%)	4 (29%)
Psychologist	4 (29%)	3 (21%)
Medical specialist	4 (29%)	3 (21%)
Human resource consultant	3 (21%)	0 (0%)
Occupational therapist	2 (14%)	2 (14%)
Social worker	2 (14%)	3 (21%)
Chiropractor	1 (7%)	0 (0%)

Kinesiophobia

The kinesiophobia scores reveal a significant difference between the groups over time ($P < 0.001$). After the intervention, patients scored significantly lower on kinesiophobia as compared to the controls (26 vs 40, $P < 0.001$). In the control group, no differences were found on kinesiophobia between pre- and post-measurements.

Outcome on individual level

Table 4 reports the scores with confidence intervals between brackets of all outcomes per treatment group, per assessment.

Complaints

In both groups, pain as well as other complaints decreased significantly over time (both $P < 0.001$). Two

Table 2 Participants' characteristics: mean scores and standard deviation (SD) at baseline

		Intervention		Usual care		All		*P* value
		N	(%)	*N*	(%)	*N*	(%)	
Sex	Female (%)	14	(60.9)	9	(39.1)	23	(67.6)	0.74
	Male (%)	6	(54.5)	5	(45.5)	11	(32.4)	
		Mean	(SD)	Mean	(SD)	Mean	(SD)	
Age	Female	37.4	(6.5)	39.1	(10.0)	38.0	(7.9)	
	Male	40.5	(10.7)	35.8	(7.5)	38.4	(9.3)	0.43
	All	38.3	(7.8)	37.9	(9.0)	38.2	(8.2)	
Process	Physical disability	47.5	(18.6)	48.5	(17.3)	47.8	(17.8)	0.88
	Physical functioning	70.3	(18.0)	67.1	(14.6)	69.0	(16.5)	0.60
	Handgrip strength	21.8	(14.6)	24.1	(14.0)	22.7	(14.2)	0.64
	Kinesiophobia	38.9	(6.9)	40.9	(4.4)	39.7	(6.0)	0.35
Individual	Pain	6.3	(1.9)	6.6	(2.0)	6.4	(1.9)	0.62
	Complaints	5.9	(2.9)	6.6	(2.2)	6.2	(2.6)	0.46
Societal	Percentage at work	28.3	(31.2)	29.2	(23.8)	28.7	(28.0)	0.93

Table 4 Mean scores (95% confidence interval) for all outcome variables per outcome , per group and per measurement and *P* values for the differences between the groups

Months elapsed	Intervention Baseline	2 months	6 months	12 months	Usual care Baseline	2 months	6 months	12 months	*P* value
Process evaluation									
Physical disability	47.5 (39.3–55.7)	21.8 13.7–29.8)	18.1 (8.4–27.8)	16.1 (4.6–27.5)	48.5 (38.6–58.3)	37.9 (28.3–47.5)	27.2 (15.7–38.7)	24.9 (11.3–38.6)	.016*
Physical functioning	70.3 (62.7–77.9)	82.8 (75.2–90.3)	86.1 (78.8–93.4)	86.0 (76.8–95.2)	67.1 (58.1–76.2)	68.7 (59.4–77.9)	76.4 (67.7–85.1)	77.9 (66.9–88.8)	.039*
Handgrip strength	21.8 (15.6–28.0)	26.5 (20.3–32.7)	26.4 (20.2–32.6)	30.1 (23.9–36.4)	24.1 (16.7–31.5)	25.5 (18.1–32.9)	26.4 (20.2–32.6)	30.6 (23.0–38.1)	.070
Kinesiophobia	38.9 (35.9–41.8)	29.1 (26.2–31.9)	25.8 (20.6–31.0)	26.4 (22.7–30.2)	40.9 (37.3–44.4)	41.0 (37.7–44.3)	39.9 (33.7–46.1)	40.4 (35.2–45.6)	.000*
Individual level									
Pain	6.3 (5.3–7.2)	3.1 (2.0–4.3)	2.7 (1.3–4.0)	2.0 (0.6–3.5)	6.6 (5.5–7.7)	5.7 (4.4–7.1)	3.7 (2.1–5.3)	2.8 (1.1–4.5)	.089
Complaints	5.8 (4.6–7.1)	2.7 (1.5–3.9)	2.7 (1.4–3.9)	2.1 (0.9–3.2)	6.6 (5.1–8.0)	5.7 (4.3–7.2)	3.8 (2.4–5.2)	1.7 (0.3–3.2)	.023*
Societal level									
RTW (%)	28.5 (15.0–42.0)	39.6 (25.1–54.1)	81.9 (65.4–98.3)	86.0 (68.5–103.4)	29.2 (13.4–44.9)	38.1 (21.3–55.0)	71.6 (52.5–90.8)	72.8 (52.5–93.2)	.840
Costs per week (€)	494.62 (401.81–588.42)	1,336.11 (1,247.46–1,424.76)	664.72 (589.35–740.09)	431.09 (361.09–501.09)	429.1 (322.76–541.31	447.87 (344.59–551.14)	359.35 (271.55–447.15)	315.65 (234.11–397.20)	.905

RTW Return-to-work

*Significant difference between the intervention and the control group ($P < 0.05$), *P* values as a result of the mixed model analyses (for costs, paired *T* test between baseline and after 12 months is presented)

months after baseline, pain decreased from 6.3 before treatment to 3.1, to 2.0 after 12 months in the intervention group. After 1 year, the differences between the groups were not statistically significant ($P = 0.089$). The decrease in the severity of complaints other than pain differed significantly between the groups ($P = 0.023$). The complaints other than pain showed a slower decrease over time in the control group compared to the intervention group.

Outcome on societal level

Return-to-work

The increase in percentage of return-to-work over time was significant for both groups ($P < 0.001$). However, no significant differences were found between the two groups ($P = 0.840$). At baseline, patients in both groups were working 29% of their regular working hours. In the intervention group, that figure rose to 82% after 6 months and 86% after 12 months. In the usual care group, the percentage of working hours increased to 72% after 6 months and 73% after 12 months.

Table 5 presents the effect sizes per treatment outcome and measurement

Costs

Table 6 presents developments in average costs per group. After 12 months, the main costs in both groups involve production losses (61%), treatment costs (26%) and loss of free time (11%). Medication costs, costs of expedients and other costs together amount to less than 3% of the total costs.

After 12 months, treatment costs increased to €170 per week for the intervention group and to €25 per week for the usual care group ($P < 0.001$). Production losses decreased from €391 per week at baseline to €219 per week after 12 months for the intervention group, and from €363 to €239 for the control group. The decrease was not significantly different between the groups ($P = 0.307$). Loss of free time decreased in both groups, whereby the intervention group decreased significantly more than the controls ($P = 0.032$). The change in total average costs per week compared to baseline costs was significantly higher in the intervention group after 2 months ($P < 0.001$) and 6 months ($P < 0.001$). After 12 months, the difference in total costs was insignificant compared to baseline costs between both groups ($P = 0.905$).

Table 5 Absolute effect sizes (Cohen's *d*) for all outcomes and measurements

		Short term	Middle	Long term
Process	Physical disability	0.92	0.40	0.34
	Physical functioning	0.74	0.63	0.39
	Handgrip strength	0.07	0.13	0.07
	Kinesiophobia	2.07	1.37	1.71
Individual	Pain	0.97	0.32	0.24
	Complaints	1.20	0.41	0.11
Societal	Percent at work	0.05	0.26	0.35

Effect size is small if $d = 0.2$, medium if $d = 0.5$ and large if $d = 0.8$ (Cohen 1988, 1992)

Cost-effectiveness

Since the extra total costs and the extra gains in terms of return-to-work after 12 months were not significantly higher in the intervention group, the cost-effectiveness in terms of total costs per half-day return-to-work is not significantly different from zero. The intervention is, therefore, not cost-effective. Ignoring the uncertainty with regard to the cost-effectiveness, to attain an extra half-day per week of return-to-work €39 per week is needed to be invested over 12 months. That includes the costs of treatment and the gains in terms of lower productivity losses and lower loss of free time. Table 7 shows the cost-effectiveness. In return-to-work as well as in the VAS outcomes, the intervention leads to better outcomes, but at higher costs.

Discussion

This randomized controlled study evaluates the process of a multidisciplinary treatment and its effects on the individual and societal level in sick-listed patients with non-specific upper extremity musculoskeletal complaints. Compliance with this treatment proved to be good. The treatment also achieves its aims: better physical functioning, fewer physical disabilities and less kinesiophobia as compared to usual care. Usual care and multidisciplinary treatment both result in pain reduction and return-to-work after 12 months. The multidisciplinary treatment showed a non-significant benefit in facilitating return-to-work; however, even in the long term (12 months), multidisciplinary treatment is not cost-effective in terms of total costs of percentage of return-to-work.

The results of this study are in keeping with the findings of Guzmán's (2001) systematic review of multidisciplinary treatment in patients with chronic low back pain. He concluded that intensive multidisciplinary treatment decreases pain and improves functioning, while no effect was found on return-to-work. By contrast, the intervention group patients in our study returned to work insignificantly more after 6 months than the usual care patients. Differences in the speed of return-to-work can be considered important, since the longer a worker is on sick leave, the more difficult it is to return to work (Hildebrandt et al. 1997; Frank et al. 1998; Verbeek 2001). It should be noted that return-to-work does not always occur as a result of a patients'

Table 6 Average costs per week

	Intervention				Usual care				Difference compared to *T*0		
Months elapsed	0	2	6	12	0	2	6	12	2	6	12
Direct medical costs (€)									(*P* values)		
Treatments	0	907	330	170	0	38	33	25	0.000*	0.000*	0.000*
Medicines	0	0	1	1	0	1	1	1	0.171	0.350	0.764
Direct non-medical costs (€)											
Expedients	16	0	4	2	3	1	1	1	0.449	0.585	0.529
Indirect non-medical costs (€)											
Production loss	391	366	277	219	363	344	273	239	0.845	0.528	0.307
Loss of free time	78	58	47	34	54	59	49	47	0.035*	0.065	0.032*
Other costs	10	4	5	4	9	5	2	2	0.870	0.859	0.905
Total (€)	495	1,335	664	430	429	448	359	315	0.000*	0.000*	0.905

*Significant difference between the intervention and the control group ($P < 0.05$)

health improvement (Pransky et al. 2002; Van der Klink et al. 2003). Complaints and functioning are, therefore, both relevant outcomes for the individual patients.

This study aimed at determining short-, middle and long-term effects of the intervention on social and individual level. Only long-term effects have been described because of the limited number of participants: With the use of mixed model analyses, it has been possible to use as many data as possible (data at 2, 6 and 12 months after baseline) but as few tests as needed. By looking at the post hoc data in more detail, the reduction of complaints, disability and kinesiophobia and the increase of physical functioning occur mostly during the first 2 months and significantly more in the intervention group. The return-to-work percentage increases the most between 2 and 6 months after baseline.

In considering costs, it is widely recommended to calculate cost-effectiveness from the societal perspective (Goossens et al. 2000). This perspective ensures that all costs imposed on members of society are considered. Since gains to society as a whole can always be redistributed among its members, this perspective provides decision makers with the most complete picture of the performance of treatments.

Randomized controlled trials (RCTs) are the ''golden standard'' for determining the effectiveness of treatments. A well-known problem in performing RCTs is the recruitment of participants. In this study, the number of patients included (38) is limited. Before the start, a power analysis based on the results of the pilot study (Schakenraad et al. 2004) was used to calculate that, with a power of 0.80, 50 subjects were needed per group. Post hoc, the power analysis on the SF-36 physical functioning, revealed that an almost medium effect size of 0.39 was attained even with 23 patients. Nevertheless, by including less than half of the planned number, the inflow of patients was disappointing. The population size was determined on the basis of the prevalence of sick leave due to non-specific upper extremity musculoskeletal complaints during the pilot study. With a prevalence of 0.1%, a potential population of 100,000 employees was expected to be sufficient. To recruit more patients, the study population was extended, occupational physicians were phoned and visited and mailings were sent out. A short questionnaire and an interview with the physicians revealed that the main reason for non-referral was the decrease in the prevalence of sick leaves in patients with upper extremity musculoskeletal complaints. Following the start of the study in the autumn of 2001, The Netherlands has witnessed important changes in safety and health policies and laws. Due to changes in sick leave benefits, reintegration subsidy for employers and a downturn in the business cycle in 2001, sick leave rates decreased. One of the changes in policies is the Safety and Health Covenants [agreements between employers' organizations, trade unions and the government (http://www.szw.nl)], which now focus more attention on preventive instruments aimed at decreasing sick leaves due to musculoskeletal complaints in the upper extremity.

Multidisciplinary treatment is used in a range of chronic musculoskeletal problems. In a study on specific upper extremity disorders (such as CTS), multidisciplinary work rehabilitation resulted in a higher return-to-work rate than usual care (Feuerstein 1993). It is conceivable that the same treatment for different musculoskeletal complaints may not result in the same desirable effects. In workers with musculoskeletal dis-

Table 7 Cost-effectiveness of multidisciplinary treatment as compared to usual care

Average extra total costs per week	After 2 months	After 6 months	After 12 months
Per extra half a day return-to-work	NA	€238	€39
Per extra unit decrease on VAS scale for pain	€1,426	€1,375	€66
Per extra unit decrease on VAS scale for other complaints	€1,375	€3,102	NA
Average extra treatment cost per week			
Per extra half a day return-to-work	NA	€349	€114

NA Effectiveness of the intervention is *lower* than usual care, no cost-effectiveness is reported

orders in the upper extremity, work components could be more important in facilitating return-to-work than in workers with low back pain. Katz et al. (2005) concluded that workplace interventions that address organizational culture could be useful in reducing sick leave due to specific upper extremity disorders. Pre-structured return-to-work time schedules also appear to be promising in managing sick-listed patients with adjustment disorders (Van der Klink et al. 2003).

In conducting a detailed assessment of the effectiveness of the multidisciplinary treatment, this study examined kinesiophobia. Pain-related fear and avoidance are important elements in developing chronic pain (Vlaeyen and Linton 2000). The assumption is that a high score on kinesiophobia results in avoidance of physical activity. The results show that in the intervention group, kinesiophobia decreased significantly, while the scores in the controls did not change during the study period. The educational and psychological sessions served to address and tackle inappropriate pain behaviour.

Feuerstein et al. (2004) found that an ergonomic intervention with or without a two-time job-stress management training decreased pain and functional disabilities in bank workers with work-related upper extremity musculoskeletal complaints. This result also indicates the importance of a workplace component in treatment. Inclusion of this component should be considered in the treatment evaluated, as it could benefit workers with upper extremity complaints in terms of enabling return-to-work.

Ignoring costs, it is recommended to continue multidisciplinary treatment in occupational health care. Even though the treatment is not more effective than usual care in terms of return-to-work for workers with complaints in the upper extremity, it is more effective on individuals. It significantly reduces physical disability, kinesiophobia and the intensity of complaints more, and increases physical functioning more than usual care. The multidisciplinary treatment is significantly more expensive than usual care. However, a higher reduction in productivity costs and a higher reduction in the loss of free time lead to insignificant total costs after 12 months.

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