

# INFLUENCE OF MODIFIED WORK ON RETURN TO WORK FOR EMPLOYEES ON SICK LEAVE DUE TO MUSCULOSKELETAL COMPLAINTS

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**Objective:** To determine which individual and work-related factors are associated with performing modified work and to evaluate the influence of modified work on the duration of sick leave and health-related outcomes among employees with musculoskeletal complaints.

**Study design:** A prospective study with 12 months follow-up.

**Methods:** In this prospective study a total of 164 employees on sick leave for 2–6 weeks due to musculoskeletal complaints completed 2 questionnaires. At baseline we gathered information about individual characteristics, physical and psychosocial workload, and disease specific and general health. The follow-up questionnaire, sent to respondents who returned to their original job on full duty, collected information about having performed modified work, and disease-specific and general health.

**Results:** Employees were less likely to perform modified work when their regular work was characterized by frequent lifting and their relationship with colleagues was less than good. Employees were more likely to return to modified work when they had a better mental health, had prolonged periods of standing in their regular job and had less skill discretion. Duration of sick leave was influenced by chronicity of complaints and disability, but not by modified work.

**Conclusion:** Modified work, as the only advice given by a occupational health physician, did not influence the total duration of sick leave nor the improvement in health during sick leave for employees on sick leave due to musculoskeletal complaints.

**Key words:** modified work, sick leave, occupational health management, musculoskeletal complaints.

J Rehabil Med 2005; 37: 172–179

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Submitted March 18, 2004; accepted August 16, 2004

## INTRODUCTION

Programmes for the timely return to work of employees with musculoskeletal complaints have received much attention in the past decade. A key element in these programmes is the provision of modified work whereby activities in the job are

adapted to the potential of the disabled employee. In general, the worker will start with a strongly reduced workload, which will be increased gradually until full duties are commenced (1). Since high physical load at work is a risk factor for the onset of musculoskeletal complaints (2), modified work seems to be highly relevant for employees on sick leave due to musculoskeletal disorders.

There is some evidence that the provision of modified work may reduce the duration of sick leave. In 2 reviews it has been suggested that employees with temporarily modified work are twice as likely to return as employees without access to any form of modified work (1, 3). Moreover, it was estimated that, on average, a 50% reduction in days lost from work could be expected for those employees with modified job activities. However, these results summarize a wide range of different interventions, ranging from modified work as the only advice given to modified work as 1 of the elements in a multi-disciplinary rehabilitation programme.

In the Netherlands every employee is tied to an occupational health service and, generally, is called up when on sick leave for more than 2 weeks. When appropriate, the occupational health physician will advise the employee to return to work with a strong reduction in work tasks and/or working hours. Occupational health physicians will discuss the advice for modified work with the worker on sick leave and the supervisor. Together, they will plan the temporary work situation, determine which work tasks should be carried out, and what should be the maximum number of working hours.

Based on results of randomized controlled trials, existing guidelines on musculoskeletal complaints within occupational healthcare recommend that patients stay active or become active as soon as possible (4–7). However, questions remain about the use of modified work as part of return-to-work programmes. On the one hand, occupational physicians are positive about modified work since it enables employer and employee to keep in touch. On the other hand, there is some doubt that a recurrence of complaints might be the consequence of a too early return to work. In addition, recent studies have shown that implementation of modified work is complicated by a substantial number of work-related barriers (8–11). According to occupational health physicians and human resource managers, lack of possibilities to change the work tasks and insufficient knowledge about the effects hamper the introduction of modified work (8). Studies also suggest that individual characteristics of the worker on sick leave may play an important role in the decision to return to work with modified duties (9, 11, 12).

In order to evaluate the influence of modified work on return to work a longitudinal study was performed among employees on sick leave due to musculoskeletal complaints. In this study 2 questions will be answered:

1. Which individual and work-related factors are associated with performing modified work?
2. Is there a difference in duration of sick leave and health outcomes for employees performing modified work compared with employees returning to their regular job with full duties?

## METHODS

### *Study population and data collection*

The subjects of the study were employees on sick leave due to musculoskeletal complaints for 2–6 weeks at the time of inclusion. Employees were excluded if they suffered from specific underlying pathology, such as a fractured leg or prolapsed disc. Subjects were enrolled in the study by occupational health physicians during their consultations or selected from the absenteeism register of a large Dutch occupational health service. If the worker on sick leave was willing to participate, an informed consent was signed. Based on the initial diagnosis by the occupational physician, subjects received a diagnosis-specific questionnaire (i.e. low back, hip, knee, ankle/foot, neck, shoulder, or wrist/hand/elbow). Non-responders were sent a reminder after 2 weeks and a second reminder with questionnaire after 3 weeks. Follow-up questionnaires were sent to respondents when full return-to-work was established or 1 year after inclusion. The date of full recovery and the first day of sick leave were obtained from the occupational health services.

### *Questionnaire*

At baseline we gathered information about individual characteristics, physical and psychosocial workload, disease specific and general health, and medical consumption. The main individual characteristics obtained were age, gender, body mass index, marital status and education.

Work-related physical factors were derived from a self-reported assessment of physical load at work. The questions primarily concerned lifting of loads, pushing/pulling, working with hands above shoulder level, bending/ twisting of the trunk and standing for long periods during a regular workday. On a 4-point scale respondents were asked about the frequency of these activities during a normal working day; “never”, “sometimes”, “frequently”, and “always” (13, 14). For lifting weights over 25 kg the answer “never” was considered as low workload. With regard to standing “never”, “sometimes” and “frequently” were defined as a low workload. For all other work-related physical factors the answers “never” and “sometimes” were considered as low workload. Perceived physical workload was also measured using a 10-point Numerical Rating Scale (NRS), ranging from very, very light [0] to very, very heavy [10]. Regular working hours per week and the duration of employment were included in the questionnaire. For psychosocial factors at work the Job Content Questionnaire was used (15). In this questionnaire 3 dimensions can be distinguished: work demands, skill discretion and decision authority. Work demands were measured by 11 questions related to working fast, working hard, excessive work, insufficient time to complete the work and conflicting demands. Skill discretion and decision authority were measured by 6 and 11 questions pertaining to aspects such as required skills, task variety, learning new things, and amount of repetitive work. All items used a 4-point scale, ranging from “seldom-never” to “always”, and a sum score was calculated for each dimension. The perceived relationship with colleagues and with supervisors was measured on a 10-point scale, and a score below the mean of the population was characterized as less than good.

We used a modified Nordic Questionnaire for the nature and severity of musculoskeletal complaints (16). Chronic complaints were defined as pain which was present almost every day in the preceding 12 months with a minimal presence for at least 3 months. We chose a NRS for pain as measure of the intensity of musculoskeletal complaints (17). The NRS involves asking patients to rate their pain from 0 to 10, with

the understanding that 0 represents no pain at all, and 10 pain as bad as it can be. Patients were asked to rate the pain intensity at the moment of filling in the questionnaire for the body part underlying the initial diagnosis.

For low back pain the Roland-Morris Disability Questionnaire was used as a condition-specific health status measure, designed to assess physical disability through the presence of 24 activity limitations on a dichotomous scale. Subsequently, the number of positive limitations has to be converted into a sum score ranging from 0 (no functional limitations) to 24 (maximum functional limitations) (18). For other musculoskeletal complaints we used a comparable questionnaire. For the latter purpose we changed the addition “because of my back” into “because of my neck”, “because of my knee”, etc. Furthermore, for use of neck, shoulder, and elbow/wrist/ hand complaints 6 items concerning walking and standing were substituted by corresponding items from the physical dimension of the Sickness Impact Profile (SIP). The SIP is a general health questionnaire that formed the basis for the Roland-Morris Disability Questionnaire. The SIP as well as a similarly modified version of the SIP have reliability coefficients of 0.7 and higher (18, 19).

We measured general health with the SF12, an instrument that is derived from the SF36 (20, 21). It is a generic measure of health with 12 items covering 8 dimensions, i.e. general health, physical functioning, role-physical, bodily pain, vitality, role-emotional, social functioning and mental health. These dimensions were aggregated into 2 scores: the physical component summary scale (PCS12), and the mental component summary scale (MCS12). Each component is expressed on a 0–100 scale with 0 representing the worst health status as possible and 100 the best health status as possible (20).

The EuroQoL5 dimensions (EQ5d) were used as a measure of preference-based quality of life, evaluating 5 domains: mobility, self-care, activity, pain, and depression/anxiety (22). Each of these domains has 3 possible levels: no impairment, mild to moderate impairment, and severe impairment. An overall index score was computed. The preference scores for each worker were calculated using weights for different health states as obtained from a general population in the UK (23). A score of 0 represents the worst possible health status and 1 the best possible health status. Since in some extreme situations the preference-adjustment may result in a negative score, scores below 0 were rounded off to 0.

### *Modified work*

The follow-up questionnaire, sent to respondents who returned in their original job on full duty or 1 year after inclusion, was a shorter form of the baseline questionnaire and gathered information about having performed modified work, and disease specific and general health. The presence of modified work was defined by 3 criteria: (i) work activities were carried out during the sick leave period; (ii) this work was characterized by a substantial reduction in work tasks or working hours; and (iii) the modified work during sick leave was advised by the occupational health physician.

### *Sick leave*

The most important outcome was time until return-to-work on full duty in the regular job. In The Netherlands the endpoint of an episode of sick leave is marked by the date of fully return to work in the regular job. In almost all situations of sick leave the worker will be paid a full salary during the first year of sick leave. Under the collective labour agreements companies are responsible to pay full wages during sick leave and, in general, do not have the possibility of terminating employment of sick-listed employees. Companies are legally bound to report the date of full recovery to the occupational health service.

### *Statistics*

Differences between continuous variables were tested with the Student *t*-test and differences between dichotomous variables with the chi-square test. All health outcomes were measured on the original ordinal scales, but treated as continuous variables after ensuring that each variable did not violate the assumption of normality. Dichotomous variables were all coded as 1 for presence of the characteristic and 0 for absence of the characteristic, with the latter value as reference in the statistical analysis.

Kaplan-Meier curves were produced to describe the proportion of employees returning to work as a function of duration of sick leave. A logistic regression model was used to identify determinants for performing modified work during sick leave. For the initial selection of variables a  $p < 0.10$  was considered as relevant. In the final model only variables with  $p < 0.05$  were retained. An odds ratio above 1 indicates an increased likelihood of having performed modified work. In order to present comparable results for each prognostic factor of interest, all continuous variables were transformed to a similar 10-point scale. This implies that the score on the Roland Morris Disability Questionnaire was converted from 24 to 10, with 1 scale unit in the logistic regression analysis equalling 2.4 points on the original disability scale. Likewise the measures of physical and mental general health from the SF-12 questionnaire were converted with 1 scale unit in the logistic regression analysis representing 10 points on the original scales. We used Cox Proportional Hazards (PH) regression analysis to determine prognostic factors for duration of sick leave. Since subjects were considered not at risk between the first date of sick leave and the fill-in date of the questionnaire, this time lag was omitted from the total duration of sick leave in the Cox PH-regression model. Subjects were right censored when they did not return to work after 12 months of follow-up. Variables were coded in such a manner that a Hazard Ratio (HR) above 1 indicates an increased risk for slower return to work. For the initial selection of variables a  $p < 0.10$  was considered and in the final multivariate model only variables with  $p < 0.05$  were retained. Age was forced into the multivariate model, irrespective of the level of significance.

## RESULTS

### Study population

A total of 196 respondents who had been on sick leave for 2–6 weeks with musculoskeletal complaints were included in the study by their occupational health physicians. Another 116 employees were selected from absenteeism registers from occupational health services and 66 subjects agreed to participate in the study (57%). In total, 262 employees received the baseline questionnaire, of which 225 subjects returned a complete questionnaire (86%). The follow-up questionnaire was completed by 164 (73%) subjects, of which 6 cases did not return to work within 12 months. Among the remaining 61 employees who did not respond to the follow-up questionnaire, 29 were lost to follow-up, 21 subjects changed jobs to less strenuous activities immediately after the date of full recovery, and 11 respondents were lost due to administrative loss at the occupational health services. Of the 164 employees who completed the study, 65 (40%) reported that they had performed modified work during their recent episode of sick leave. The remaining 99 (60%) respondents returned straight into their original job.

Table 1. Characteristics of employees on sick leave for 2–6 weeks due to musculoskeletal complaints, stratified by performing modified work during sick leave ( $n = 164$ )

Characteristics	Modified work ( $n = 65$ )	No modified work ( $n = 99$ )	$p$ -value
<i>Individual characteristics</i>			
Sex, woman (%)	43	30	0.09
Age, mean (SD)	43.0 (8.5)	43.0 (9.1)	0.99
Body mass index $>30$ kg/m <sup>2</sup> (%)	11	20	0.13
Single (%)	26	14	0.06
Low education (%)	62	57	0.53
Sick leave 12 months prior to current absence (%)	33	25	0.30
<i>Work-related factors</i>			
Full-time (%)	66	68	0.84
Years in same job, mean (SD)	12.3 (10.3)	14.8 (11.3)	0.17
Prolonged standing (%)	70	43	0.0006*
Frequently lifting 10–25 kg (%)	45	66	0.009*
Frequently lifting $>25$ kg (%)	26	65	$<0.0001^*$
Frequently kneeling (%)	17	31	0.05*
Frequently bending/twisting (%)	64	72	0.31
Frequently pushing/pulling (%)	17	24	0.30
Arms frequently above shoulder level (%)	21	35	0.07
Perceived physical workload, mean (SD) (0–10)	6.5 (2.1)	7.3 (2.0)	0.008*
Skill discretion, mean (SD) (0–18) <sup>1</sup>	9.8 (3.9)	8.5 (3.2)	0.02*
Decision authority, mean (SD) (0–33) <sup>1</sup>	15.8 (7.3)	16.4 (6.9)	0.56
Work demands, mean (SD) (0–33) <sup>1</sup>	14.5 (5.0)	15.4 (4.9)	0.25
Less good relationship with colleagues (%)	35	57	0.005*
Less good relationship with supervisor (%)	52	42	0.21
<i>Health outcomes<sup>3</sup></i>			
Chronic complaints (%)	16	36	0.005*
Severity of pain, mean (SD) (0–10) <sup>1</sup>	5.9 (1.8)	6.4 (2.1)	0.18
Disability, mean (SD) (0–24) <sup>1</sup>	12.9 (5.2)	12.8 (4.8)	0.88
General physical health, mean (SD) (0–100) <sup>2</sup>	32.1 (7.1)	32.8 (7.3)	0.55
General mental health, mean (SD) (0–100) <sup>2</sup>	52.6 (9.2)	46.8 (10.3)	0.0004*
Quality of life, mean (SD) (0–1) <sup>2</sup>	0.52 (0.3)	0.52 (0.3)	0.93

\*  $p < 0.05$ .

<sup>1</sup> A higher score indicates a worse status.

<sup>2</sup> A higher score indicates a better status.

<sup>3</sup> Disability = functional limitations of Roland-Morris disability questionnaire; general physical health = physical component summary scale of SF-12 questionnaire; general mental health = mental component summary scale of SF-12 questionnaire; Quality of life = EuroQol 5d preference-based quality of life.

Table II. Prognostic factors for performing modified work during sick leave among employees on sick leave due to musculoskeletal disorders (n = 164)

Prognostic factors	Univariate analysis			Multivariate analysis		
	OR <sup>1</sup>	95% CI	p	OR <sup>1</sup>	95% CI	p
<i>Individual characteristics</i>						
Female (1/0)	1.74	0.91–3.34	0.10	–	–	–
Single (1/0)	2.15	0.98–4.74	0.06	–	–	–
<i>Physical workload</i>						
Prolonged standing (1/0)	3.18	1.62–6.22	0.0007	5.21	2.13–12.75	0.0003
Frequently lifting 10–25 kg (1/0)	0.43	0.22–0.82	0.01	–	–	–
Frequently lifting >25 kg (1/0)	0.20	0.10–0.40	<0.0001	0.16	0.07–0.40	<0.001
Frequently kneeling (1/0)	0.46	0.21–1.00	0.05	–	–	–
Frequently working above shoulder level (1/0)	0.51	0.25–1.05	0.07	–	–	–
Perceived physical workload (0–10)	0.81	0.69–0.95	0.01	–	–	–
<i>Psychosocial work characteristics</i>						
Skill discretion (0–18)	1.21	1.02–1.42	0.03	1.24	1.01–1.52	0.04
Less good relationship with colleagues (1/0)	0.40	0.21–0.77	0.006	0.29	0.12–0.69	0.005
<i>Health outcome<sup>2</sup></i>						
Chronic complaints (1/0)	0.33	0.15–0.74	0.007	–	–	–
General mental health (0–10) <sup>3</sup>	1.83	1.28–2.61	0.0009	1.89	1.22–2.93	0.004

<sup>1</sup> OR>1 indicates a higher probability of performing modified work.

<sup>2</sup> Disability = functional limitations of Roland-Morris disability questionnaire; general physical health = physical component summary scale of SF-12 questionnaire; general mental health = mental component summary scale of SF-12 questionnaire; Quality of life = EuroQol 5d preference-based quality of life.

<sup>3</sup> One scale unit represents 10 points on the original scale.

Table I shows the baseline characteristics of the employees on sickness for 2–6 weeks at the time of inclusion. Most of the respondents were blue-collar workers, from a wide range of companies, including construction work, post delivery services, food services and security firms. Another substantial part of the subjects worked in nursing homes or hospitals. Of all employees, 48% had low back pain complaints, 36% were on sick leave due to upper extremity disorders, and another 16% due to lower extremity complaints. Employees returning in modified duties reported at baseline less chronic complaints and a better mental health than those without modified work during the follow-up. Employees with modified work also reported less physical workload such as heavy lifting, kneeling, and working above shoulder level in the regular job.

#### Modified work

The odds ratios for performing modified work during sick leave due to musculoskeletal complaints are presented in Table II. Employees were less likely to perform modified work when their regular work was characterized by frequent lifting (OR 0.16, 95%CI 0.07–0.40) and their relationship with colleagues was less than good (OR 0.29, 95%CI 0.12–0.69). Employees were more likely to return to modified work when they had a better mental health (OR 1.89, 95%CI 1.22–2.93), had prolonged periods of standing in their regular job (OR 5.21, 95%CI 2.13–12.75) and had less skill discretion (OR 1.24, 95%CI 1.01–1.52). Health outcomes such as pain, disability, and general health were not related to performing modified work. The

Table III. Health outcomes of employees on sick leave due to musculoskeletal complaints at 2–6 weeks of sick leave and after return to work, stratified by performing modified work during sick leave (n = 164)

Health outcome <sup>1</sup>	Modified work		No modified work	
	Baseline (t <sub>1</sub> )	After return to work (t <sub>2</sub> )	Baseline (t <sub>1</sub> )	After return to work (t <sub>2</sub> )
Severity of pain (0–10) <sup>2</sup>	5.9	3.6	6.4	4.7
Disability (0–24) <sup>2</sup>	12.9	6.6	12.8	6.6
Physical general health (0–100) <sup>3</sup>	32.1	43.9	32.8	45.9
Mental general health (0–100) <sup>3,4</sup>	52.6	55.1	46.8	41.4
Quality of life (0–1.0) <sup>3</sup>	0.52	0.78	0.51	0.73

\*  $p < 0.05$ .

<sup>1</sup> Disability = functional limitations of Roland-Morris disability questionnaire; general physical health = physical component summary scale of SF-12 questionnaire; general mental health = mental component summary scale of SF-12 questionnaire; Quality of life = EuroQol 5d preference-based quality of life.

<sup>2</sup> A higher score indicates worse health.

<sup>3</sup> A higher score indicates better health.

<sup>4</sup> Improvement in mental general health was significantly ( $p < 0.001$ ) better among employees with modified work than those without.

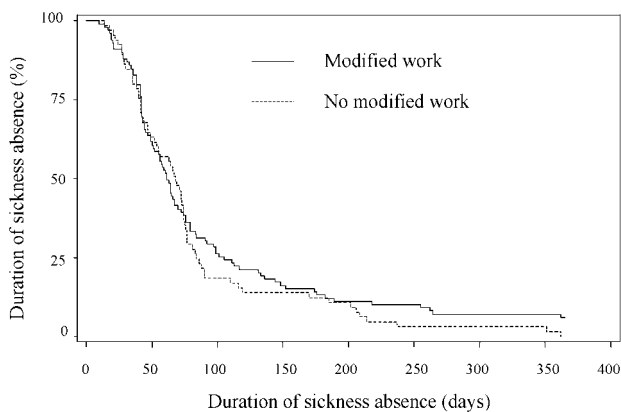


Fig. 1. Survival curves for return to work among subjects with modified work (----) ( $n = 65$ ) and employees without modified work (—) ( $n = 99$ ) during their sick leave.

location of musculoskeletal complaints also did not predict modified work.

#### Health-related outcomes

The respondents reported significant improvements for pain, disability, physical general health, and quality of life, irrespectively of performing modified duties (Table III). Employees staying home until full return to work showed a modest decrease in mental health, whereas employees on modified duty slightly improved in mental health.

#### Duration of sick leave

Figure 1 depicts the survival curves for returning to work among employees with musculoskeletal complaints. There was no difference in duration of sick leave for employees

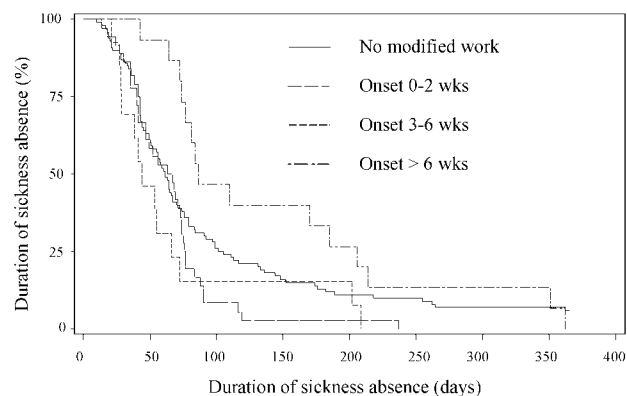


Fig. 2. Survival curves for return to work among subjects with work-related factors, stratified for time of start with modified work.

performing modified duties compared with employees returning to full duty. The duration of sick leave was not affected by the type of modified duty, i.e. reduction in work time or change to less strenuous tasks. However, the time of onset of modified work had a significant impact on the duration of sick leave (Fig. 2). Onset of modified work after 7 weeks was associated with a longer sick leave, whereas there was no difference in duration of sick leave between employees with onset of modified work before week 7 and employees without modified duties.

#### Prognostic factors for sick leave

Table IV shows the prognostic factors for the duration of sick leave. In the univariate analyses duration of employment in the same job (HR 1.41, 95%CI 1.01–1.95), sick leave due to musculoskeletal complaints in the 12 months before the current episode (HR 1.50, 95%CI 1.03–2.17), chronic musculoskeletal

Table IV. Prognostic factors for duration of sick leave (Cox proportional hazards regression analysis) among employees on sick leave due to musculoskeletal disorders

Prognostic factors	Univariate analysis			Multivariate analysis		
	HR	95% CI	<i>p</i>	HR	95%CI	<i>p</i>
Modified work	1.11	0.80–1.53	0.53	(1.06	0.75–1.51	0.73) <sup>1</sup>
<i>Individual characteristics</i>						
Older age (>43 years) (1/0)	0.88	0.64–1.21	0.43	0.82	0.60–1.15	0.83
<i>Work-related factors</i>						
Many years in same job (>14 years) (1/0)	1.41	1.01–1.95	0.04	–	–	–
Sick leave 12 months prior to current absence (1/0)	1.50	1.03–2.17	0.03	–	–	–
<i>Health outcome<sup>2</sup></i>						
Chronic complaints (1/0)	1.60	1.20–2.32	0.01	1.55	1.06–2.27	0.02
Severity of pain (0–10)	1.08	1.01–1.17	0.06	–	–	–
Disability (0–10) <sup>3</sup>	1.12	1.03–1.22	0.01	1.11	1.02–1.21	0.02
Physical general health (0–10) <sup>4</sup>	0.81	0.63–1.04	0.10	–	–	–
Quality of life (0–10) <sup>4</sup>	0.94	0.89–1.0	0.04	–	–	–

HR = hazard ratio, >1 means a higher risk for longer absence.

<sup>1</sup> Effect of modified work when introduced into the multivariate model.

<sup>2</sup> Disability = functional limitations of Roland-Morris disability questionnaire; general physical health = physical component summary scale of SF-12 questionnaire; general mental health = mental component summary scale of SF-12 questionnaire; Quality of life = EuroQol 5d preference-based quality of life.

<sup>3</sup> One scale unit represents 2.4 points on the original scale.

<sup>4</sup> One scale unit represents 10 points on the original scale.

complaints (HR 1.60, 95%CI 1.20–2.32), pain intensity (HR 1.08, 95%CI 1.01–1.17) and a high level of disability (HR 1.12, 95%CI 1.03–1.22) were associated with a longer duration of absence. A good quality of life (HR 0.94, 95%CI 0.89–1.0) and physical health (HR 0.81, 95% CI 0.63–1.04) resulted in a shorter duration of absence. In the multivariate analysis disability (HR 1.11, 95%CI 1.02–1.21) and chronic complaints (HR 1.55, 95%CI 1.06–2.27) showed the strongest associations with longer sick leave. Performing modified work, age, and gender were not related to duration of sick leave.

## DISCUSSION

### *Study design and study population*

The results of this study could be influenced by the study design. Although originally designed as a randomized controlled trial to evaluate the effect of modified work, major barriers to the randomization of respondents made it necessary to change the trial into a prospective study. In some occupations, for example roofers and scaffolders, it proved to be too difficult to define modified work with a strong reduction in workload for employees with musculoskeletal complaints, since in these jobs all activities involved a considerable physical workload (8). On the other hand, in several companies modified work was the point of departure in the management of sick leave, due to health-related as well as financial motives. In The Netherlands most employers are legally bound to pay full wages in the first and second year of sick leave. When their medical situation is not affected, employees are required to accept modified duties. During the study period a new law was enforced which put strong emphasis on the provision of modified work to sick-listed employees and, as a consequence, randomization was no longer acceptable in various companies. Only among companies with a less developed management system on sick leave, mostly small and medium-sized businesses, a reasonable proportion initially agreed to the required randomization procedure. A randomized controlled trial is traditionally the gold standard for judging the benefits of treatment. However, due to a strong selection by companies and occupational health physicians who would agree with randomization, which is partly considered as conflicting with common law, the basic principle of randomly selected groups would not have been reached in this study. A prospective study without randomization was regarded as the best alternative with potentially less selection bias. The inclusion in the study population was limited to subjects who in principle could perform modified work. As appears from the health outcomes at baseline, there was no strong *a priori* selection among those advised to undertake modified duty and those who were not, except for chronicity of complaints and general health. The choice of prospective study design also enabled us to analyse who performed modified work and who did not.

Although selection bias seems to be limited in our study, it could still have influenced the results. Some selection bias may

occur due to inclusion of cases from the absenteeism register of occupational health services. Employees selected from the absenteeism register had a lower response than those included by the occupational health physicians. Since most employees on sick leave due to musculoskeletal disorders will return to work within the first weeks of sick leave, the lower response may partly be explained by subjects already returned to work when receiving our invitation to participate in the study (24). However, the route of entry in the study population was not associated with the health status at baseline and also not a factor influencing the return to work and/or the possibilities of having performed modified work. In this study, 6 subjects in the control group had not returned to work after 1 year. Exclusion of this small number of cases will not change the overall findings.

In The Netherlands early return to work during sick leave is by law only possible on the advice of an occupational health physician, which is included in our definition of modified work. For the major part of the population modified work was initiated by an occupational health service, however, it is possible that the decision to undertake modified work was influenced by other parties involved in sickness management. The small number of respondents representing the 3 types of modified duties (reduced working hours, adjusted tasks, or a combination of both) is another methodological disadvantage of this study, since a clear distinction cannot be made between the effects of these 3 types of modified work on duration of sick leave.

### *Modified work*

Our findings of no impact of pain on the provision of modified work is supported by several studies suggesting that pain is not a barrier for return-to-work (4, 25). Our results also show no impact of functional disability on performing modified work. Although in various international occupational health guidelines the use of general health outcomes in return-to-work decisions is not advocated (25, 26), disabilities seem to be most relevant for deciding on the capabilities of a sick-listed worker to perform modified work. Our results suggest that disability as an outcome measure is not frequently used by occupational physicians advising on modified duties or that this measure of general disability is not specific enough to assess the presence of work-related disability as a potential obstacle for performing modified work.

Work-related physical factors were associated with performing modified work. Employees who were required to lift heavy loads were less often assigned modified work by the occupational physician and more often returned directly to their regular job when sufficiently recovered. This is a rather surprising finding. Since high physical load at work is a well-established risk factor for musculoskeletal complaints (2), modified work seems to be highly relevant for employees on sick leave due to musculoskeletal disorders. However, as already observed in other studies a lack of possibilities to change work tasks is a substantial barrier for realizing modified work (8–10). In jobs with a high physical load there may be fewer opportunities to reduce the heavy workload to an acceptable

level. Another explanation could be related to the physician's fear of recurrence or worsening of the complaints, which has been reported as a barrier for return to work (10, 12). Although the results of our study indicate a strong improvement in health-related outcomes for employees performing modified work as well as those returning directly to full duty, occupational physicians may act cautiously when advising modified work for employees with a high physical load in their regular job.

A good relationship with colleagues supported the implementation of modified work. When colleagues are willing to take over those tasks with a high physical load, it might be easier for a sick-listed worker to return to work in modified duties. In 2 other studies occupational physicians and general practitioners also reported social support of colleagues as a key element in recovery and return to work (8, 10).

#### *Sick leave*

Overall, in this study we found no difference in duration of sick leave for employees with modified work compared with employees returning directly to full duty in their regular job. This is in line with the results of some studies (27–29) but contradicts the conclusion drawn in 2 reviews (1, 3). The lack of any effect in our study may be explained by the fact that the recommendation for early return to work, given by the occupational physician, was most often the only advice and was not part of a multidisciplinary programme. Modified work as part of a broader rehabilitation intervention seems to be effective (30). A graded activity programme at a Dutch airline company showed a significant decrease in sick leave among employees sick-listed with back pain for more than 50 days (31). However, such an extensive type of rehabilitation is not common in small and medium-sized companies. There is still a need for an effective and simple intervention, such as provision of modified work.

Starting modified work after 7 weeks was associated with a longer sick leave. In the subgroup with delayed start substantially more employees had chronic complaints and their average level of disability was slightly higher than other employees. However, none of these differences were statistically significant but remained persistent after adjustment for chronic complaints and disability. The expectation of the occupational physician may have influenced these results. When a worker is absent for a prolonged period, the physician will assume serious health problems and most likely be more careful with advising return to work. Alternatively, when it is expected that the worker will return to work within 1 or 2 weeks, physicians may not see the need for modified work. However, the comparison of health outcomes at baseline suggests that those performing modified work had a similar health status to those returning to their original work.

Although a negative effect on return to work was found for a delayed start of modified work, there was no difference between employees with an early return to work compared with employees staying at home until return to full duties. Among the cases a high return-to-work rate is expected due to the natural

course of sick leave (24, 29). Our study population may be too small to detect meaningful differences between modified work and returning directly to full duties. The provision of modified work could, in principle, also have delayed the return to full duties. Working on modified duties may imply an accepted *status quo* for both employee and employer and, as a consequence, result in less pressure to return to the original job. Therefore, provision of modified work for a clearly limited period is advised (26).

In conclusion, employees on sick leave for musculoskeletal complaints in jobs characterized by a high physical workload were less often assigned modified work by the occupational physician. All employees showed a strong improvement in pain, disability and general health at return to work. Duration of sick leave was influenced by chronicity of complaints and disability. Modified work during sick leave did not influence the total duration of sick leave nor the improvement in health during sick leave.

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