Modified work intervention and musculoskeletal sickness absence

Miranda van Duijn

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Modified Work Intervention and Musculoskeletal Sickness Absence

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Contents

Chapter 1

General introduction

1.1 Introduction

Definition of musculoskeletal complaints

Musculoskeletal complaints refer to a large group of conditions that affect one or more parts of the musculoskeletal system. The most frequently self reported type of musculoskeletal complaint is low back pain. For approximately 90% of all patients with low back pain, this pain is not caused by a specific pathophysiologic mechanism and therefore is referred as non-specific low back pain.[1-3] Other non-specific musculoskeletal complaints comprise complaints of the upper extremities, i.e. neck, shoulder, elbow, hand, wrist, and the lower extremities, specified as hip, knee, ankle, foot.[4,5]

Prevalence of musculoskeletal complaints

Muscoloskeletal complaints are a common, disabling condition. In the general Dutch population aged 25 years and over almost three-quarters reported musculoskeletal pain in the past 12 months; 44% of the subjects reported low back pain, 45% neck/shoulder pain, 23% elbow/wrist/hand pain, 28% hip/knee pain, and 15% ankle/foot pain.[5] In the Dutch working population more or less similar results were found, with a 12-months prevalence for low back pain of 44% among men and 48% among women.[6] However, in specific occupational groups considerably higher prevalence has been observed, most notably in those occupations with a high exposure to physical and psychosocial load at work.[7]

Consequences of musculoskeletal complaints

The work-related consequences of musculoskeletal complaints are considerable. For 11% of the Dutch workers low back pain was the reason for the most recent period of sickness absence, and neck/shoulder/hand complaints accounted for 6% of the sickness absence prevalence.[8] In comparison with most other causes of sickness absence, the average duration of a sickness absence period due to musculoskeletal complaints is long and, hence, musculoskeletal complaints contribute substantially to the overall burden of sickness absence. On average, it was estimated that approximately 80% of the workers with low back pain will return to work after 1 month, and 93% of the workers is back at work within six months.[9] This high proportion of return to work in de first month indicates that most workers with low back pain absence improve rapidly. For most patients low back pain is a self-limiting disease. However, a small minority of workers will

develop long-term sickness absence and some of them may become permanently disabled.

Costs of musculoskeletal complaints

The high prevalence of musculoskeletal complaints and the consequences in terms of medical consumption and sickness absence are responsible for high costs. Of all allocated health care costs in the Netherlands, 7.3% is related to musculoskeletal complaints, which are therefore one of the most expensive health care areas.[10] It has been estimated that the total *direct medical costs* of low back pain account for 7% of the total cost and that *indirect costs* related to absenteeism and disability of low back pain constitute the other 93% of the total cost.[11] Since most costs are caused by production loss due to musculoskeletal complaints, the development and evaluation of interventions promoting timely return to work for workers on sickness absence due to non-specific muskuloskeletal disorders has become an important area of research.

Return to work interventions

There is a clear need for programmes aimed to reduce the duration of sickness absence as well as the physical and psychological consequences of musculoskeletal complaints. Offering modified work is one of the options widely used by occupational physicians and companies to accelerate the return to work for workers on sickness absence.[12] Modified work programmes, adjusted to the functional capacities of the worker, are interventions that take place in the workplace, in contrast with clinical-based programmes.[13] Modified work can be characterized as light duty, whereby the worker performs a job in less than regular or full duty. Another key element is graded activity, whereby the worker gradually increases frequency and duration of work activities until regular or full duty. According to the 'Dutch occupational health guideline for low back pain' an advice for temporarily modified work, with a reduction in work tasks or working hours, is recommended for workers with non specific low back pain.[14] Guidelines also suggest a time contingent return to work intervention rather than pacing the return to work to the magnitude of pain.[15] This mirrors the evidence to stay active as treatment for low back pain.[16] In the Netherlands, legal requirements for the management of workers on sickleave put a strong emphasis on the

provision of modified work to sick-listed employees. Employer and employee are both responsible for rehabilitation of the worker on sickness absence, first within the own company or otherwise elsewhere.
However, little is known on the effectiveness of modified work as advised by the occupational physician to workers on sickness absence due to musculoskeletal complaints. In this thesis modified work is defined by four criteria: (i) the elective allocation of modified work at discretion of the occupational physician, (ii) where work is adjusted to the functional capacity of the worker, (iii) with work activities carried out during the sick leave period, (iv) and work that can be characterized as light duty in physical demanding jobs. The worker performs a job in less than regular or full duty through a reduction in cumulative physical load of at least 50% by reducing the working hours or by eliminating strenuous work tasks.

Parameters used to determine return to work interventions
The occupational health physician can use different parameters to support treatment decisions. For musculoskeletal complaints at least four different health dimensions can be considered; pain, disability (often referred to as functional limitations), general health, and overall quality of life.[17] Improvement in one dimension does not necessarily correlate with improvement in another dimension and these measures of health may be influenced by individual and environmental factors.[18] According to the Dutch occupational health guidelines for low back pain the occupational physician has to evaluate the worker's coping strategies, psychosocial problems, perceived disabilities due to pain, work environment and the relationship with physical and mental strains in order to determine the appropriate return to work strategy.[14] For workers on sickness absence for 2-6 weeks other parameters may be important than for workers with a longer duration of sickness absence. In a population of workers on sickness absence due to musculoskeletal complaints the question remains how different measures are interrelated and which measures seem to be most appropriate for use in an occupational health setting with different patient populations.

Timing of return to work interventions
In the Netherlands, in principle, all workers have access to occupational health care and in most companies workers on sickness absence are contacted by an occupational health service within two weeks. The occupational physician will set

out the treatment regime, in co-operation with the company and the worker. After six weeks of sickness absence a formal evaluation is mandatory and a plan of action must be agreed upon by worker and employer to facilitate return to work. Thus, in most companies the first six weeks of sickleave are regarded as the essential period for intervention in order to prevent long-term sickleave. As stated before, the overall picture of sickness absence due to musculoskeletal complaints demonstrates a high return to work in the first month and an exponential decrease after this period.[9] Most workers will return to work within the first weeks without any specific treatment. Information is needed about the appropriate timing of an intervention by the occupational physician; at which time during the sickness absence period it may be assumed that the worker will not return to work within the usual timeframe and an additional intervention is needed to promote return to work.

1.2 Objective of this thesis

The focus of this thesis is on modified work as a return to work intervention for workers on sickness absence due to musculoskeletal complaints. The following research questions will be addressed:

1) Which measures of health are useful outcome measures in the evaluation of occupational health management options for workers on sickness absence due to musculoskeletal complaints for 2-6 weeks?
2) What is the influence of modified work on return to work among workers on sickness absence due to musculoskeletal complaints?
3) What is the effect of different timing of interventions on return to work and cost-effectiveness in workers with sickness absence due to musculoskeletal complaints?

1.3 Outline of this thesis

Chapter 2 provides information on the interrelationships among different health questionnaires and answers the question which dimension of health seems to be most appropriate for measuring health in an occupational health setting.

The influence of allocation of modified work on prognosis for return to work among workers on sickness absence for musculoskeletal complaints is reported in Chapters 3, 4, and 5. In Chapter 3 barriers for allocation of modified work, as established in 44 different companies, were identified. These barriers also play a

part in the study design used to determine the effects of modified work. In Chapter 4 the influence of modified work on prognosis for return to work after sickness absence is reported. In a prognostic study, 137 workers on sickness absence for 2-6 weeks due to musculoskeletal complaints were included and completed 3 questionnaires; shortly after inclusion, when full return to work was established, and at 12 months after inclusion. Of all workers, 54 performed modified work during their sickness absence and 83 workers returned to work directly in full duty. The influence of modified work on the recurrence of sickness absence due to musculoskeletal complaints is presented in Chapter 5. Chapter 6 describes a theoretical approach to estimate the theoretical effects on the return to work rates of different timing of interventions and to evaluate its consequences for cost-effectiveness of intervention programmes.
Chapter 7 presents a general discussion and recommendations for occupational health practice and research.

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Chapter 2

Interrelationships between pain, disability, general health, and quality of life and associations with work-related and individual factors

A study among workers on sickness absence due to musculoskeletal complaints

Adapted from:
van Duijn M, Lötters F, Burdorf A.
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Abstract

Study Design A cross-sectional study.

Objectives To measure interrelationships among pain, functional disability, general health, and overall quality of life for workers on sickness absence for 2 to 6 weeks due to musculoskeletal complaints, and to assess the impact of work-related and individual characteristics on these different health dimensions. The results of this study will contribute to a better understanding of the relation between health and function.

Summary of Background Data When choosing a patient-based outcome measure different health dimensions must be considered. For musculoskeletal complaints four health dimensions are important; pain, disability, general health, and overall quality of life. Improvement at one dimension does not necessarily correlate with better health on another dimension. Moreover, correlations between different instruments may be influenced by individual and environmental factors. However, it is not known whether these factors influence different health dimensions differently.

Results Moderate correlations ($r < 0.50$) among dimensions of pain, disability, general health, and quality of life were found. These health dimensions were not influenced by work-related physical and psychosocial workload, suggesting no impact of reporting bias in studies for work-related musculoskeletal complaints. Self-perceived work ability within 6 weeks explained 21-26% of the variance in the outcomes on pain and disability and contributed less to the generic measures of health.

Conclusion Within a population of workers on sickness absence for 2-6 weeks, specific dimensions of pain and disability seem to be more appropriate for use by occupational health physicians than generic instruments of general health and quality of life.

2.1 Introduction

The number and type of assessments to evaluate the outcome of musculoskeletal complaints is growing rapidly. Clinicians and researchers are faced with several measures of health status, which are available for almost every condition and body part. In recent years the features of measures have been evaluated among patients with musculoskeletal complaints and a considerable number of instruments is available for use in clinical and research settings.[1, 2]

When choosing an instrument different health dimensions must be considered. For musculoskeletal complaints four health dimensions are important.[1,3] The first dimension is related to symptom status and in case of musculoskeletal complaints measures primarily pain severity. The second type of outcome refers to the functional status of the patient. It measures the ability to perform specified tasks, covering the domains of physical, social, role and psychological functioning. General health perceptions integrate various aspects of health and reflect the third dimension of health. The fourth dimension represents overall quality of life. For musculoskeletal complaints most of the measurements on the first and second health dimensions are marked as disease-specific and are sensitive to the disorder under consideration. General health and quality of life are considered as generic instruments, which provide a summary of the overall health status. Although the four health dimensions are related to each other, improvement at one dimension does not necessarily correlate with better health on another dimension, e.g. radiating pain could be correlated with disability but may have a weak relationship with overall quality of life.[1,3]

Although the simultaneous use of specific and generic instruments has been advocated,[4,5] comparisons across health dimensions in one population are scarce. Within the same health dimension, different measures of generic health status among workers with musculoskeletal injuries have shown moderate to good correlations (0.37-0.86).[6] However, correlations across different health dimensions have been reported to be considerably lower. Disability and pain were moderately correlated (0.3-0.4) in a study of work-related upper extremity disorders among US federal civilian workers who had not returned to their normal work.[7] Specific and generic instruments among patients with low back pain in a clinical setting also showed moderate correlations (< 0.6).[8] In a recent study among a Japanese population, predominantly consisting of elderly people, there

was no significant relation between pain and general health and a moderate correlation (<0.5) between pain and functional status.[9]
It has been suggested that the moderate correlations between different health dimensions can partly be explained by individual and environmental factors, which may be seen as intervening variables that mediate outcomes on different health dimensions.[1,3] Several studies have shown that gender, age, body mass index, and personal stress were correlated with outcomes of disability and general health.[10,11] Considering the impact of work-related factors on the occurrence of musculoskeletal complaints, it may be expected that risk factors at work also partly determine the health status perceived by patients with musculoskeletal complaints. However, it is not known whether these variables influence different health dimensions differently. Therefore, the objectives of this study were to measure interrelationships among pain, functional disability, general health, and overall quality of life for workers on sickness absence due to musculoskeletal complaints, and to assess the impact of work-related and individual characteristics on these different health dimensions. The results of this study will contribute to a better understanding of the relation between health and functional disability. Specific variables that influence the clinical presentation of health will be identified for workers with a recent onset of sickness absence due to musculoskeletal diseases.

2.2 Methods

Study population and data collection

The subjects of the study were workers on sickness absence due to musculoskeletal complaints for 2-6 weeks at the moment of inclusion. Workers were excluded if they had specific underlying pathology, such as a fractured leg or discus prolaps. Subjects were enrolled in the study by occupational health physicians during their consults or selected from the absenteeism register of a large Dutch occupational health service. If the worker on sickness absence 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) to be filled out immediately or at home. Non-responders were send a reminder after two weeks and a second reminder with questionnaire after

three weeks. The questionnaire gathered information on different dimensions of health, personal characteristics, and work-related factors.

Instruments

Symptoms: We choose a Numerical Rating Scale (NRS) for pain as the outcome for symptoms of musculoskeletal complaints. 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.[12] Patients were asked to indicate which number best represented the pain intensity for the body part underlying the initial diagnosis of sickness absence.

Functional status: For low back pain complaints the Roland-Morris Disability Questionnaire was used as a condition-specific health status measure to assess physical disability. This questionnaire measures the presence of 24 activity limitations on a dichotomous scale. The number of negative items was converted into a sum score ranging from 0 (no disability) to 24 (maximum disability).[13] For other musculoskeletal complaints we used a comparable questionnaire, changing the 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) to address disability due to upper extremity disorders. The Sickness Impact Profile is a general health questionnaire, which formed the basis for the Roland-Morris Disability Questionnaire for low back pain. [13,14] The SIP as well as comparable modified version of the sip have good reliability coefficients of 0.7 and higher.[15]

General Health: We measured general health with the SF12, an instrument that is derived from the SF36. This is a generic measure of health with eight dimensions, i.e. General Health, Physical Functioning, Role-Physical, Bodily Pain, Vitality, Role-Emotional, Social Functioning, and Mental Health. The dimensions can be aggregated into two scores; the Physical Component Summery scale (PCS12) and the Mental Component Summary scale (MCS12).[16]

Quality of life: The EuroQol 5 dimensions (EQ-5d) are used as a measurement for preference-based quality of life. This questionnaire evaluates five domains; mobility, self care, activity, pain, and depression/anxiety. Each of these domains has three possible levels: no impairment, mild to moderate impairment, and

severe impairment. An overall index score was computed and the preference scores for each worker were calculated using weights for different health states as obtained from a general population in the United Kingdom.[17, 18]

Additional Questions: The main personal factors obtained were age, gender, body mass index, marital status, and education.[19] For the psychosocial factors at work the Job Content Questionnaire was used.[20] Within this model three aspects can be distinguished: work demands, skill discretion, and decision authority. Work demands were measured by 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 questions pertinent to aspects such as required skills, task variety, learning new things, and amount of repetitive work.[20, 21] Work-related physical factors were obtained from a self-reported questionnaire of physical load at work[22, 23] Perceived physical workload was also measured by using a 10-point Numerical Rating Scale, varying from no exertion at all (0) to maximal exertion (10). Questions on number of regular working hours per week and the duration of current employment were also included in the questionnaire. We used a modified Nordic Questionnaire for the nature and severity of musculoskeletal complaints. Chronic complaints were defined as pain that was present almost every day in the previous 12 months with a minimal presence for at least 3 months.[21, 24] The workers' own perception of their ability to return to work within 6 weeks was measured on a 10 point Numerical Rating Scale. Scores lower than 5 indicates no problems in performing their regular function within 6 weeks, scores above 5 reflect difficulties with working within 6 weeks.[25]

Analysis

Pearson and Spearman correlation coefficients were used to measure the association between pain, disability, general health, and quality of life, and to assess the impact of work-related and individual characteristics on these health dimensions. The impact of environmental factors was also estimated with a linear regression analysis. Variables with a significance level of $p < 0.10$ were retained in the final multivariate regression models and the explained variances (R^2) was presented as an overall measure of association.

2.3 Results

Study population

Subjects were on sickness absence because of low back pain (48%), upper extremity disorders (36%), and lower extremity (16%). The majority of the population was male (66%), married (83%), and had a lower education (58%). The mean age was 42±9, the body mass index was 26±4 kg/m^2, the average duration of current employment was 14±11 years, and the number of working hours per week was 36±11. About 32% of all subjects had experienced chronic musculoskeletal complaints, resulting in the current period of sickness absence. More than half of the workers (64%) thought they would experience problems with performing their regular jobs within 6 weeks.

Dimensions of health

The distribution of pain, disability, general health and quality of life are shown in Table 1. Most of these health outcomes had a normal distribution. However, the EQ-5d was negatively skewed. Table 2 shows the observed moderate correlations among the different dimensions of health, with the highest correlation of 0.5 between disability and quality of life. The negative correlations between specific measures and generic measures of health resulted from the opposite directions of the scales. A negative associations was observed between the PCS12 and the MCS12, indicating that that subjects with a good mental health rated their physical health worse.

Table 1. Measurement of pain, disability, general health, and quality of life among workers on sickness absence resulting from musculoskeletal complaints (n=218).

	Range in scale	*Mean (SD)*	*Range sample*	*Scores related to better health*
Pain rating scale	0-10	6.2 (2.0)	0 - 10	low scores
Disability scale	0-24	13.0 (4.9)	0 - 24	low scores
General health - PCS12 [1]	0-100	32.8 (7.2)	15.7 – 57.4	high scores
General health - MCS12 [2]	0-100	47.6 (10.4)	22.9 – 69.2	high scores
Quality of life - EQ-5d [3]	-0.5 - 1	0.5 (0.3)	-0.32 - 1	high scores

[1] Physical Component Summary scale of SF12, [2] Mental Component Summery scale of SF12, [3] EuroQol 5 dimensions (preference based).

Table 2. Correlations among measures of pain, disability, general health and quality of life among workers on sickness absence resulting from musculoskeletal complaints (n=218).

	Disability scale	*PCS12*	*MCS12*	*EQ-5d*
Pain rating scale	0.41 (<.0001)	-0.30 (<.0001)	-0.11 (0.13)	-0.26 (<.0001)
Disability scale	1.00	-0.44 (<.0001)	-0.34 (<.0001)	-0.50 (<.0001)
General health - PCS12		1.00	- 0.21 (<.001)	0.41 (<.0001)
General health - MCS12			1.00	0.23 (<.004)
Quality of life - EQ-5d				1.00

Work-related and individual factors

Table 3 shows the physical and psychosocial workload as perceived by the workers on sickness absence. In general, the subjects experienced a high level of physical workload, with more than 79% of the workers reporting standing frequently or always in their regular jobs and 71% reporting bending and twisting of the trunk as common movements at work. Lifting heavy weights occurred frequently, with more than half of the workers lifting weights over 25 kg during their work.

Table 3. Physical workload and psychosocial job characteristics of the regular jobs of workers on sickness absence resulting from musculoskeletal complaints (n=218).

	Never(%)	*Sometimes(%)*	*Frequently(%)*	*Always(%)*
Physical workload				
Prolonged standing	10	11	23	56
Lifting 10-25 kg	14	30	32	24
Lifting > 25 kg	47	27	18	8
Kneeling	37	37	13	13
Bending – twisting	6	23	29	42
Pushing – pulling	36	39	13	12
Work above shoulder level	32	38	17	13

Psychosocial job characteristics	*Range in scale*	*Mean*	*SD*
Work demands	0-36	15.3	5.0
Decision authority	0-33	15.9	6.9
Skill discretion	0-18	8.9	3.6

Table 4 presents correlations between individual and work-related factors and the distinguished health dimensions. Some significant associations were found between physical workload and health outcomes, but the correlation coefficients were all below 0.2. Among the psychosocial factors at work, work demands were consistently associated with several health outcomes, but the magnitude of these associations remained low. Self-perceived ability to return to work within 6 weeks was correlated with all outcomes and strongest with pain (r=0.46) and disability (r=0.33). Age and duration of employment were moderately associated with health outcomes.

Table 4. Associations (correlation coefficients) between pain, disability, general health, and quality of life and work-related and individual characteristics of workers on sickness absence resulting from musculoskeletal complaints (n=218).

	Pain rating scale	*Disability scale*	*PCS12*	*MCS12*	*EQ-5d*
Physical workload					
Prolonged Standing	-0.12*	0.00	0.15**	0.04	0.11
Lifting 10-25 kg	-0.14*	-0.05	0.11	-0.07	0.06
Lifting >25 kg	0.02	0.06	-0.03	-0.16**	-0.09
Kneeling	-0.05	0.05	-0.03	-0.04	-0.02
Bending-twisting	0.04	0.03	-0.02	0.05	-0.03
Pushing-Pulling	-0.02	-0.07	0.05	-0.02	0.02
Work above shoulder level	-0.06	-0.04	0.13*	-0.04	0.05
Psychosocial job characteristics					
Work demands	-0.01	0.12*	-0.15**	-0.12*	-0.19**
Decision authority	0.06	0.01	-0.03	-0.11	-0.07
Skill discretion	0.07	0.06	-0.03	0.00	-0.06
Individual factors					
Gender	-0.02	0.02	-0.02	0.07	0.05
Age	0.09	0.24**	-0.09	-0.20**	-0.15**
Body Mass Index	0.11	0.13*	-0.05	-0.08	-0.06
Married	0.10	0.11	0.00	-0.09	-0.04
Education	0.01	0.07	-0.17**	-0.01	0.00
Working hours	-0.01	-0.08	0.05	-0.05	-0.07
Duration of employment	0.06	0.15**	-0.12*	-0.08	-0.13*
Chronic complaints	0.24**	0.04	-0.05	-0.19**	0.00
Perceived ability to return to work at 6 weeks	0.46**	0.33**	-0.13*	-0.28**	-0.18**

* P <0.1, ** P<0.05

Table 5 shows that individual and work-related characteristics explained up to 26% of the variance for disability and pain, with self-perceived ability to return to work as single most important factor. For general physical health and quality of life, a maximum of 12% of the variance was explained. Overall, physical and psychosocial work-related factors explained 4% or less of the observed variance in pain, disability, general health, and quality of life.

Table 5. Percentage explained variance of individual and work-related factors within five health outcomes among workers on sickness absence resulting from musculoskeletal complaints (n=218).

	Pain rating scale(%)	*Disability scale(%)*	*PCS12 (%)*	*MCS12 (%)*	*EQ-5d (%)*
Standing	4	------	------	------	------
Lifting > 25 kg	------	------	------	3	------
Work above shoulder level	------	------	2	------	------
Psychosocial work demands	------	2	3	------	2
Age	------	7	------	4	------
Duration of employment	------	------	3	------	4
Chronic complaints	1	------	------	3	------
Self perceived ability to return to work within 6 weeks	21	12	4	11	4
Total explained variance (R^2)	26	21	12	21	10

2.4 Discussion

This study showed moderate correlations (r=0.11-0.50) among measures of pain, disability, general health, and quality of life. These specific and generic health dimensions were not influenced by work-related physical and psychosocial workload. Age had some effect on disability and general health. Self-perceived work ability within 6 weeks explained 21-26% of variance in the outcomes on pain and disability and was associated less with the generic measures of health.

Dimensions of health

When interpreting the results, we need to consider the selected population, i.e., workers on sickness absence for 2 to 6 weeks. This selection will limit the generalizability of the results on sick leave. The measurement outcomes observed in this study were comparable with other studies among workers with sickness absence.[7, 8, 26] The pain score (6.2±2.0) and the physical component of the SF12 (32.8±7.2) indicated a population that experienced much pain and physical limitations but did very well considering their mental health (47.6±10.4).

In general, the interrelationships among different health dimensions in this study are consistent with findings in other studies, where also low to moderate correlations were reported.[7-9,27] These results may be partly explained by the selection of workers on sickness absence for 2 to 6 weeks with a limited range in health status. More diversity in health status is expected in studies among workers currently on the job, which may explain reported associations of 0.6 or higher between pain, disability and physical general health.[10] Higher correlations were also found in a study among workers with wage replacements, with a large variation in time since sickness absence. In the latter study these stronger associations may be explained by the fact that the comparison between different health outcomes was limited to the same health dimension.[6]

To explain the observed moderate correlations among different health dimensions, we must allow for the psychometric characteristics of the individual instruments.[28] For most instruments, the reliability has been extensively tested. For the Roland Morris questionnaire test-retest analysis showed a reliability coefficient of 0.8.[29] The reliability of the SF36, which is the extended version of the SF12, has been estimated in several studies and test-retest reliability coefficients exceeded 0.8 in most of the cases.[16,30] A reliability coefficient of 0.8 implies that the correlation between two different instruments will never exceed this reliability coefficient and, thus, one instrument will explain at most 64% of the variance in similar measurements obtained with another instrument. Hence, it is expected that instruments that do not measure exactly the same traits have correlation coefficients well below the upper boundary value of 0.8.

Another explanation for the moderate correlations between health dimensions can be sought in different underlying constructs for each instrument, resulting in different health outcome.[3] In our specific population of workers on sick leave it may be questioned which outcomes will adequately reflect changes in health

status. Since self-perceived ability to return to work was strongly associated with pain and disability and the explained variance of general health and quality of life was rather low, we suggest that in studies on return to work specific measures of pain and disability are more applicable than measures of other health dimensions.

Individual and work-related characteristics

In our cross-sectional study among workers on sickness absence for 2-6 weeks, we found a limited influence of self-reported physical workload on health outcomes. Among the psychosocial factors at work, only work demands were consistently associated with several health outcomes, but correlations remained low. This indicates that the subjective rating of physical and psychosocial workload did not bias perceived health status. Hence, the health status of subjects will not be confounded by differences in self reported workload and, thus, may be compared across the workforce.

In this study, the cross-sectional design does not permit further interpretation of self-perceived ability to work as a personal trait[31], predicting pain and disability, or as a consequence of experienced pain and disability. The strong associations of self-perceived work ability with pain and disability may support both interpretations. It can be expected that pain and disability will influence the worker's expectation about return to work and, hence, may be an important prognostic factor for return to work.This suggestion is supported by other studies which have shown associations between subjective ability to return to work and early retirement[32] and disability pensions[33]. Future studies are recommended to include self-perceived ability to return to work as a potential prognostic factor for return to work. Attitudes, beliefs, and expectations about pain have received already attention as potential areas for intervention and predictors of outcome,[34] while the workers' own perception of their ability to return to work still seems rather neglected. The fact that the variance in outcomes on pain and disability could be explained for only 21% to 26% strongly suggests including also personal traits underlying pain and disability appreciation, such as catastrophizing and maladaptive coping.[35, 36]

Conclusion

In this cross-sectional study among workers on sickness absence for 2 to 6 weeks due to musculoskeletal complaints, we found only a small influence of physical and psychosocial workload on pain intensity, functional disability, general health, and quality of life. This suggests the absence of reporting bias in studies on work-related musculoskeletal complaints. Self-perceived ability to return to work within 6 weeks was strongly associated with pain and disability and explained a substantial part of the variance in these outcomes. Within a population of workers on sickness absence, specific dimensions of pain and disability seem to be more appropriate than generic instruments of general health and quality of life.

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Chapter 3

Barriers for early return-to-work of workers with musculoskeletal disorders according to occupational health physicians and human resource managers

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Abstract

Recent studies have indicated positive effects of modified work for workers with musculoskeletal complaints. The question remains how effectively modified work can be implemented in companies. This study describes barriers for introducing modified work for workers on sickness absence due to musculoskeletal complaints.

Modified work was defined as gradually increasing the physical demands at work until the worker is ready for full duty in his regular job. In order to describe barriers in implementation of modified work, a model based on health education was used, consisting of six successive stages. A questionnaire derived from this model was sent to human resource managers of different companies and their occupational health physicians. The internal consistency was estimated with the Cronbach's alpha.

The results showed a large number of barriers for modified work. According to 52% of the company management and 54 % of the occupational health physicians evident barriers were found due to lack of knowledge on modified work and negative attitudes of the employees. Both companies and physicians reported a barrier in the possibilities to change the work tasks (45%-54%) or the organization of the work (45%-38%). About 62% of the companies reported barriers due to a mismatch between the education of the sick worker and the specific requirements of modified work.

Despite the assumed positive effects of modified work, the implementation process is hampered by a large number of barriers. A maximum effort from all parties involved is required for a successful rehabilitation process.

3.1 Introduction

In recent years many return-to-work interventions have been developed for workers with musculoskeletal complaints possibly related to high physical workload. A large part of these interventions used modified work as a key-element in the rehabilitation process.[1] The job activities are adapted to the possibilities of a disabled employee. Physical demands are gradually increased until the worker is ready for full duty in his regular job. Several reviews suggest a positive effect of modified work. Studies have reported that the number of lost days from work was reduced by 50% and that employees with temporary modified work returned to work twice as often as employees without access to any form of modified work.[2, 3]

Clinical guidelines on the management of low back pain have been issued in various countries to take account of emerging scientific evidence and to improve the effectiveness, efficiency, and consistency of patient care. Several guidelines show similarity in the recommendations about the level of activity for patients with musculoskeletal complaints.[4] Patients should be advised to stay active and to progressively increase their activity level. This advice is supported by several controlled trials.[5-7] Return-to-work is not a major issue in the guidelines, but in line with the recommendations on activity levels some guidelines report that in order to facilitate early return-to-work and to minimize the risk of prolonged disability, reasonable accommodations for modified duties or activities must be available.[8] A low physical workload is strongly recommended at initial return-to-work, and could be achieved by adjusting the work tasks, the working hours, or a combination of both.[9] Although some reviews reported positive effects, the possibilities for implementation of modified work within companies are not clear. Other studies have shown that the implementation of ergonomic improvements was not always successful and that compliance of management and employees to ergonomic advice was less than the 60%.[10,11] In addition, workers with musculoskeletal complaints perceived minor support from their colleagues towards ergonomic changes in the workplace.[12] A study from Norway reported that government options to support early return-to-work were hardly used.[13, 14] The underlying factors for these poor implementation results are not known.

Closing the gap between research and practice in the health care sector remains a topic of interest. The development and evaluation of intervention strategies that facilitate implementation of research outcomes in clinical practice has been the

central theme of many studies as indicated by Grol et al.[15] Adaptation of research findings to practical use is required for successful implementation.[16] Dealing with the implementation of research findings into occupational health services includes an additional stakeholder; the employer of the sick worker. A closer look into the implementation process within companies is needed for a better understanding of the impact of this extra dimension.

Theoretical frameworks for the implementation of research findings are usually based on an approach for health promotion. This approach defines the conditions that are necessary for changing the behavior of patients, in case of health attitudes, and the behavior of physicians, in case of medical care. Kok et al. constructed a model, based on social-psychological and communication theories, about changing attitudes and behavior through information.[17] Urlings et al. applied this model for the implementation of ergonomic improvements (figure I).[10] She described the implementation of standing aids at the workplace in accordance with the six consecutive stages of Kok, including being aware of the information (1), understanding the information (2), changing attitudes (3), changing the intention (4), changing behavior (5), and maintenance of the new behavior (6). This model could be an appropriate conceptual framework suitable for a better insight in implementation processes.

Research has shown positive effects of modified work on return-to-work for workers with sickness absence due to musculoskeletal complaints. However, how successful this intervention can be applied at the workplace is unclear. The objective of this study is to identify barriers for early return-to-work among workers with musculoskeletal complaints who are offered modified work with a gradual increase in physical workload.

3.2 Methods

Model

In this study we fitted the implementation process of modified work to the six stages of the model of Kok (figure 1). Open interviews were held within 20 companies to identify several barriers for the introduction of modified work for subjects on sick leave. These barriers were assigned to six consecutive stages in the implementation process. This approach does not analyze the actual behavioral changes per stage, but determines the barriers that influence certain changes, in order to identify conditional factors for positive implementation.

In the first stage of the model the central theme is being aware of the existence of information. With regard to modified work a conditional factor is the availability of information and information exchange between the occupational health physician, the worker on sick leave, and the employer. In the second stage the parties involved must understand the information and acknowledge the effects of modified work. The third stage concerns the positive and negative attitudes towards the intervention. The fourth step in the process is related to the intention of employees and their social environment to support modified work. Lack of support from the worker on sick leave, from colleagues, and from managers could hamper the implementation process. The requirements to perform the new behavior are part of the fifth stage; actual changing of behavior. This includes the possibilities to modify tasks and working hours, organizational factors within the company, and job requirement in relation to the educational level of the worker on sick leave. The final stage in the model of Kok is the stage of maintenance. Conditional factors are the positive experience with workplace modification and specified procedures for return-to-work.

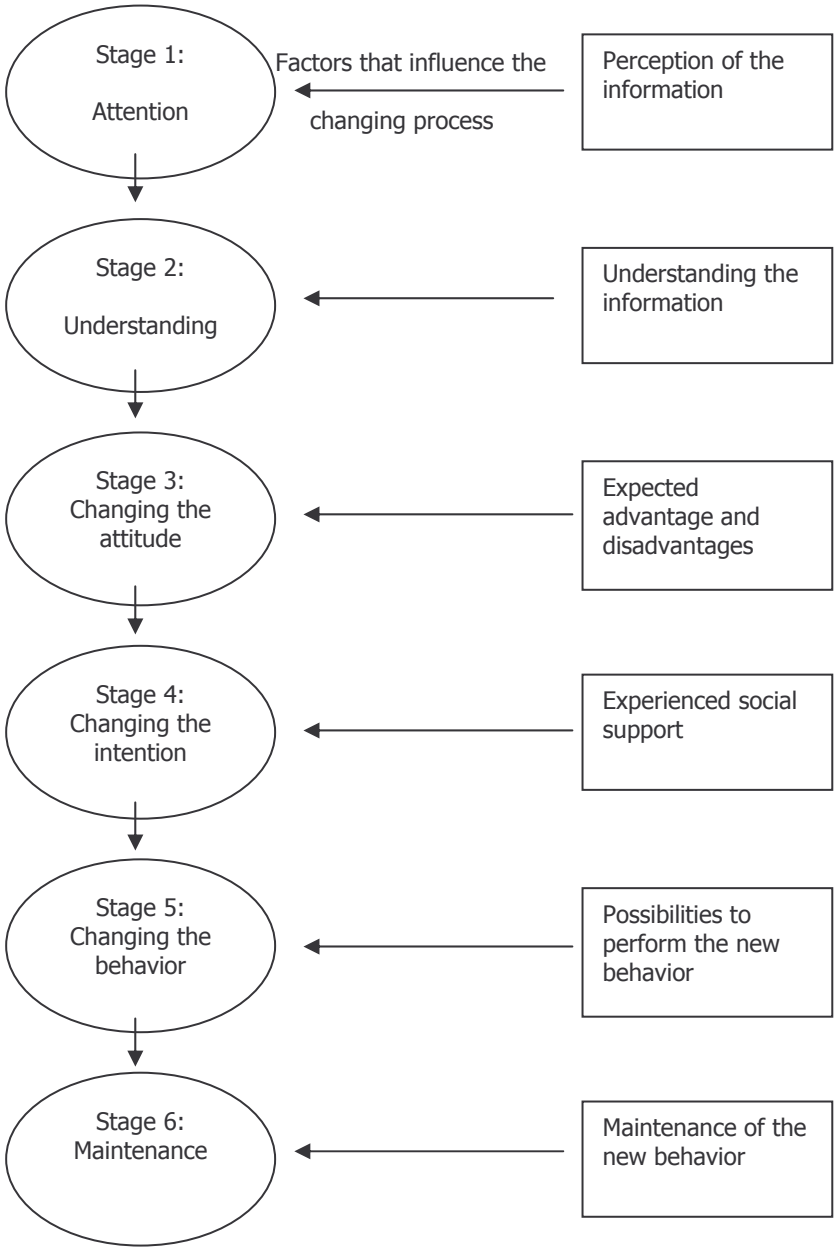

Figure 1. Model of planned behavior and factors that may influence each stage.

Questionnaire

We developed a questionnaire, based on the model of Kok et al. For every conditional factor for modified work presence in the company was asked for (yes-no answers). In case of absence of the conditional factor, the next step in the questionnaire was to determine the frequency of the barrier on a 4-point scale (not-sometimes-often-always). The questionnaire items were structured per stage of the model. The question about stage three was not structured but an open question about attitudes towards modified work.

Reduction of the physical workload is a key element of modified work. This could be a strong benefit for workers with musculoskeletal complaints, since these complaints are usually associated with high physical strains, such as frequently bending and twisting and frequently lifting workload more than 5 kilo.[18] We have primarily selected companies with workers performing heavy workload, mainly based on job title. Hence, we expected that in these companies workers were at high risk of sickness absence due to musculoskeletal complaints. We asked the human resource department of the companies to take part in the study and to return the questionnaire. When there was no response, a reminder was sent. When a company agreed with participation in the study, permission was asked to contact the occupational health physician that provides services for this company. Subsequently, the same questionnaire was sent to this occupational health physician.

Analysis

The internal consistency of the questionnaire was estimated with the Cronbach's alpha. In order to calculate this alpha, the data of the companies were classified into two categories; barriers and no barriers. The alpha was computed for the various stages separately and for the total questionnaire. The barriers as experienced by company management and occupational health physicians were reported in percentages.

3.3 Results

We invited 117 companies to participate in the study; originating from the health sector (44), building industry (20), roofing companies (22), security companies (20), and miscellaneous companies (10). The response was 40%. The response in the healthcare sector and the building industry was consistently higher (15-

20%). The company size showed large variation. Nursing homes with more than 100 employees were very common. This was in contrast with the other sectors, which included mostly small companies, with less than 20 workers. Finally, 44 questionnaires were available for the data-analysis. Seventy-nine percent of the company management gave informed consent to contact their occupational health physicians. Data from 13 occupational health physicians were available, yielding a response of 54%.

Table 1 displays the model and the internal consistency per stage of the questionnaire. For the stages with more than one item the Cronbach's alpha varied between –0.10 and 0.67. For the first stage as well as stage 3, calculation of Cronbach's alpha was not possible. The first stage was just one item and stage 3 concerned two open questions about the advantage and disadvantage of modified work.

Table 2 shows the presence of conditional factors for modified work inside the company, followed by the proportion of questionnaires that identified the absence of these conditions as actual barriers in the company. A large number of barriers were reported in stage two. The knowledge of the employee was a barrier according to 52% of the companies and 77% of the occupational health physicians. In stage 4, both occupational health physicians and companies (54%-52%) reported a negative attitude of the worker on sick leave as a barrier. In addition, lack of support of the colleagues was mentioned as a barrier (40%). Most barriers were reported in stage five. Approximately 45% of the companies reported lack of possibilities to change the work tasks, or to change the organization of the work as an obstruction. The proportion of the companies that reported high job requirement in relation to the educational level of the disabled worker as a barrier was 62%.

Questions in stage 3 addressed the advantages and disadvantages of modified work as mentioned by the company management and occupational health physicians in an open question. About 21% of the companies and 46% of the occupational health physicians expected that a recurrence of the sickness absence would occur, if the worker returned to his regular work too early. In 32% of the companies the attitude of workers and colleagues at the workplace was mentioned as a barrier for modified work. The lack of support of the colleagues for the sick worker was given as example. Difficulties to modify the work, such as the amount of work, were reported by 27% of the company management.

Table 1. Summary of the model, the items of the questionnaire and the internal consistency (Cronbach's Alpha).

Process of changing	*Factors influencing the changing process*	*Conditional factors for modified work*	*Items*	*Alpha*
1- Attention	Perception of the information	information from association /occupational health services	1	-----[1]
2- Understanding	Understanding the information	…employee …employer	2	-0.02
3- Changing the attitude	Expected advantages and disadvantages	disadvantages according to the employer and the physician	open	-----[2]
4-Changing the intention	Experienced social support from…	…the manager …the worker on sick leave …colleagues	3	0.55
5-Changing the behavior	Possibilities to perform the new behavior and to change…	…the working hours …the work tasks …the organization …the educational level of the worker	4	0.67
6-Maintenance	Maintenance of the new behavior	…specified rehabilitation procedures …positive experiences	2	-0.10
Total			12	0.55

[1] Not calculated, just one item.

[2] Not calculated, open question.

Table 2. Items of modified work; presence and barriers.

Factor	*Barrier for modified work*[1]	
	Companies (n=44)	*Occupational physicians (n=13)*
1-Attention		
Information from the association / occupational health services	26	15
2-Understanding		
Knowledge of the employer about modified work	5	23
Knowledge of the employee about modified work	52	77
3-Changing the attitude		
Physical demands employee	21[2]	46[2]
Attitude of workers	32[2]	39[2]
Elements of modified work	27[2]	0[2]
4- Changing the intention		
Support of management	21	31
Attitude of sick worker	52	54
Support of colleagues	40	------
5- Changing the behavior		
Changing work tasks	45	54
Changing working hours	4	5
Organizational possibilities	45	38
Educational level of the worker	62	54
6- Maintenance		
Lack of specified return-to-work procedures	21	50
Lack of positive experience	40	17

[1] Percentages according to the total number of companies and occupational physicians.
[2] Open question, percentage concerns the disadvantages according to information of the companies, and the occupational physicians.

Differences in opinion about modified work between occupational health physicians and company management are indicated in table 2. Occupational health physicians reported more barriers due to lack of knowledge of the employer and the employees and, in addition, the absence of a clear return-to-work procedure. Companies reported fewer barriers related to the physical work

load. In contrast, they indicated more often elements of the modified duties as a barrier, such as the amount of modified work. Data of the companies suggested a slower implementation process due to a lack of positive experience with modified work.

3.4 Discussion

Barriers for modified work

The implementation of modified work within companies is hampered by a number of barriers. In this project evident obstructions were found, possibly responsible for stagnation of the implementation process. The main barriers that were reported were the lack of knowledge of the effects of modified work, lack of social support from employees and colleagues, and lack of possibilities for modification of work tasks. Taking into account the sequence of the stages in the model, the outcome in stage 2 is conditional for the outcome in the next stages. Basic knowledge about purpose and effects of modified work is necessary among employees at the workplace. Human resource managers feel that without this knowledge, sick workers and their colleagues will not react positively to modified duties as part of a return-to-work program. However, in this study it was not feasible to ask the workers for their own opinion. Results from other studies show that in case of self-report of the workers on sick leave more than half of them were positive about early return-to-work. [13] An inventory among employees is recommended to gain more insight in difficulties to start to work in modified duties.

It was interesting to note that, in contrast to the assumed lack of knowledge among employees, the management of the companies as well as the occupational health physicians were quite satisfied with the information provided to themselves. These results suggest that sufficient information is available from guidelines and occupational health services.

Barriers were found in the possibilities to perform modified work at the workplace. Lack of possibilities for changing work tasks and organization of the work within a company, and the discrepancy between the low educational level of the worker on sick leave and available tasks with less physical load were experienced as major barriers for the implementation of modified work. Since the stages of the model we used are consecutive, the assumed minor support and negative attitudes of the employees and their colleagues may precede these

barriers to perform modified work. However, also practical obstructions could cause the stagnation of the implementation process. Determinants such as the size of the company, the number of jobs, and the diversity of tasks within a job could influence the possibility and availability to perform modified work. Companies described many examples of modified work. In general, a larger company is more often able to offer jobs with a low physical workload; e.g. the sick worker could do administrative tasks or take care for the depot. In small companies a colleague already performs these activities and there is no need for assistance in that respect. With respect to the diversity in tasks, for a nurse the physical work load may be easily reduced, e.g. by only reporting about the patients in dossiers and meetings, and supporting the patients with drug intake or with their meals. In contrast, the job of a roofer requires work on the roof at a specific location, and there are hardly other tasks with a low physical work load. Examples given by companies emphasize the importance of the size of the company and the availability of modified work in relation to the jobs present and the diversity in tasks. Still, further research is required to establish the consequences of these determinants.

In general, the occupational health physicians perceived similar barriers as the company management. However, with regard to the barriers related to the knowledge about modified work of the employees and the employer, the occupational health physicians indicated more barriers than the company management. In addition, occupational health physicians experienced a higher percentage of barriers related to the absence of clear return-to-work procedures. An explanation for these differences may be that the company management judged their situation as too positive. Furthermore, the occupational health physician seemed to be more cautious about a potential recurrence of disorder and resulting sickness absence. Physicians regarded physical overload as a barrier in 46%, while only 21% of the company management reported this as a disadvantage.

Less than 5% of the companies reported problems in adapting the working hours of an employee. This may indicate that whenever other modifications are not possible, changing the working hours could be a next best solution.
Although representing the opinion of primary care physicians, two recently published studies show similar results as found in our study. Unavailable light

duty in the workplace was an barrier according to 73% of primary care physicians in Massachusetts, USA.[19] Of family physicians in Manitoba Canada, 48% indicated that better workplace job accommodation was the most wanted change. Also mentioned as a barrier were non-supportive co-workers and workers misunderstandings and fear about their injury.[20]

A shortcoming in this study was the low response rate; only 40% of the companies involved were willing to take part in the study. This low percentage is partly explained by the response among nursing homes. All these nursing homes were individually invited to complete the questionnaire. However, a number of the nursing homes belong to the same health care foundation and responded with only one questionnaire. Compared to companies in the construction and security branches, the response rate in the health sector was rather high. A clear explanation for this difference could not be given. The low response rate of occupational health physicians can be mainly explained by the selection procedure and the work setting of the physicians. We only asked physicians to participate when the human resource management had already decided to take part in the study. Furthermore, physicians within a health care foundation not always responded for each individual nursing home.
Another limitation in this study is the fact that all the companies were located in the Southwest of the Netherlands. In this region we invited a random selection of companies and we were not able to estimate the influence on the results. Just a few branches of industry with expected high physical workload were invited. The study does not represent a random sample of all jobs with high physical strains. The results only indicate possible barriers to implement modified work in some common occupational groups.

The support from the sick worker and colleagues was assumed to be a barrier according to more than 50% of the occupational health physicians and the companies. A study to determine obstacles for return-to-work of low back pain patients sick listed for 3-4 months showed comparable findings.[21] According to the occupational health physicians non co-operative employees had an inhibitory effect on return-to-work in 33% of cases and, therefore, a passive attitude was an important factor inhibiting return-to-work. However, the workers were not ask for their own opinion and as already mentioned a self-report of employees is recommended.

The gap between the knowledge of occupational health physicians and companies at one side and knowledge, attitudes, and support of the workers and their colleagues at the other side, might be reduced by adopting key elements of the participatory ergonomics approach. This approach relies on the workers' active involvement in implementing ergonomic knowledge and interventions in the workplace. Hence, supervisors and managers support workers, in order to improve working conditions.[22] Participative activities of workers should lead to a shared understanding of the problems, involvement in the decision-making and, as a result, acceptance of the redesigned jobs. Such interventions have mostly been applied to primary prevention intervention but could also be used in a secondary prevention setting such as a return-to-work procedure.[23]
The large numbers of barriers indicated by the company management suggest a slow implementation process of modified work at the workplace. This is supported by studies of participatory ergonomic programs and return-to-work. Loisel et al. evaluated the perceptions of participants on the implementation of ergonomic solutions in the workplace and showed a complete implementation in only 33% of all cases according to employer representatives as well as 27% according to the disabled workers.[11] Possible explanations for the low percentages could be the uninformed middle management and the mistrust between workers and employers. This in accordance with our findings of barriers in stage 2 (understanding the information) and 4 (intention to change).

The Model

We applied the model of Kok and analyzed the elements of this model in the context of return-to-work interventions. This may not always reflect the dynamic process at the workplace, where different stages of the model can interact within the same time. Besides, the human resource department or the occupational health physician may not continuously notice informal modifications. The model could have missed the positive influence of this informal workplace adjustments.
The Cronbach's alpha for the whole questionnaire showed a moderate internal consistency since all alpha values were below 0.7. Still, the alpha for the stages 4 and 5 suggest a relationship between the stage-related items. The results for stage 2 indicate that there is no relationship between the supposed knowledge of the employers and the supposed knowledge of employees considering modified work. However, results are based on self-reported information of the employer

and negative opinions about the worker on sick leave could be an explanation for the low internal consistency. The alpha for all items was 0.55, suggesting a moderate consistency. Within the current data it was not possible to analyze which factor explained the relationships between different stages, but company-specific characteristics such as management structure and work culture may partly determine barriers for early return- to-work.

Recently, there has been a widespread interest in theories about changing health behavior of patients.[15] Although parts of these theories may be of interest for changing the behavior of health care workers, none of the theories was developed in particular for changing the behavior in an occupational health care setting. The study of Urlings was one of the first efforts to develop a model for implementation of ergonomic improvements.[10] In our study we have presented an additional model, which can been seen as a next step. Yet, further development is necessary to make a broader application of this model possible.

The main objective of this study was to identify barriers for the implementation of modified work and the actual behavioral changes per stage were not analyzed. The barriers that influence certain changes were determined, in order to identify conditional factors for implementation. However, for the development and evaluation of interventions it may also be essential to determine the actual behavioral changes.

Despite the positive effects shown in intervention studies, occupational health physicians and companies experience many barriers with regard to the implementation of modified work in the workplace. In order to encourage an early return-to-work for workers on sick leave due to musculoskeletal disorders, it is necessary to provide clear instructions to the employer and the employees. In this respect, we must increase the knowledge of modified work of the employees and employer and offer solutions for practical difficulties at the workplace. Successful rehabilitation may benefit from clear procedures and mutual understanding of all parties involved in the implementation process regarding modified work. Changing behavior on this point will be a future challenge for occupational health care.

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Chapter 4

The influence of modified work on return to work for employees on sick leave due to musculoskeletal complaints

Adapted from:
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Abstract

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 in 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 characterised by frequent lifting and their relationship with colleagues was less than good. Employees were more likely to perform 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 the 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.

4.1 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 work load which will be gradually increased until full duty is 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 reduction of 50% 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 multidisciplinary 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 temporarily 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 health care 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?

4.2 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 four 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 by 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 sumscore 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 characterised 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 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 which 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 two scores: the physical component summery 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 status as possible.[20]
The EuroQol5 dimensions (EQ5d) were used as a measure of preference-based quality of life, evaluating 5 domains: mobility, selfcare, 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 United Kingdom.[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 four criteria: (i) the elective allocation of modified work at discretion of the occupational physician, (ii) where work is adjusted to the functional capacity of the worker, (iii)with work activities carried out during the sick leave period, (iv) and a substantial reduction in strenuous work tasks or working hours. The occupational physician ensured by expert opinion that the modified work resulted in a reduction in cumulative physical load of at least 50% by reducing the working hours or by eliminating strenuous work tasks.

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 full 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 characteristics and 0 for absence of the characteristics, 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 scale. 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, irrespectively of the level of significance.

4.3 Results

Study population

A total of 196 respondents 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 job towards 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 to work straight into their original job.

Table 1 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 workes, from a wide range of companies, including construction work, post delivery services, food services and security firms. A substantial part of the subjects works 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 2. Employees were less likely to perform modified work when their regular work was characterised 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 in 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 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 3). 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.

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*
Individual characteristics			
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^2 (%)	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
Work-related factors			
Fulltime (%)	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) [1]	9.8 (3.9)	8.5 (3.2)	0.02*
Decision authority, mean (SD) (0-33) [1]	15.8 (7.3)	16.4 (6.9)	0.56
Work demands, mean (SD) (0-33) [1]	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
Health outcomes			
Chronic complaints, (%)	16	36	0.005*
Pain, mean (SD) (0-10) [1]	5.9 (1.8)	6.4 (2.1)	0.18
Disability, mean (SD) (0-24) [1]	12.9 (5.2)	12.8 (4.8)	0.88
General physical health- PCS, mean (SD) (0-100)[2]	32.1 (7.1)	32.8 (7.3)	0.55
General mental health- MCS, mean (SD) (0-100) [2]	52.6 (9.2)	46.8 (10.3)	0.0004*
Quality of life- EQ5-d, mean (SD) (0– 1) [2]	0.52 (0.3)	0.52 (0.3)	0.93

* p <0,05

[1]A higher score indicates a worse status. [2]A higher score indicates a better status.

Table 2. 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[1]	*95% CI*	*p*	*OR*[1]	*95% CI*	*p*
Individual characteristics						
Female (1/0)	1.74	0.91-3.34	0.10	---	---	---
Single (1/0)	2.15	0.98-4.74	0.06	---	---	---
Physical work load						
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	<.0001	0.16	0.07-0.40	<0.0001
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	---	---	---
Psychosocial work characteristics						
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
Health outcome						
Chronic complaints (1/0)	0. 33	0.15-0.74	0.007			
General mental health - MCS (0-10)[2]	1.83	1.28-2.61	0.0009	1.89	1.22-2.93	0.004

[1] OR > 1 indicates a higher probability of performing modified work.
[2] One scale unit represents 10 points on the original scale.

Table 3. 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	*Modified work*		*No modified work*	
	Baseline (t_1)	After return to work (t_2)	Baseline (t_1)	After return to work (t_2)
Pain (0-10) [1]	5.9	3.6*	6.4	4.7*
Disability (0-24) [1]	12.9	6.6*	12.8	6.6*
General health - PCS (0-100) [2]	32.1	43.9*	32.8	45.9*
General health – MCS (0-100) [2,3]	52.6	55.1*	46.8	41.4
Quality of life EQ-5d (0 –1.0) [2]	0.52	0.78*	0.51	0.73*

* $p < 0.05$

[1] A higher score indicate a worser health.

[2] A higher score indicate a better health.

[3] Improvement on mental general health was significantly (p<0001) better among employees with modified work than those without.

Duration of sick leave

Figure 1 depicts the survival curves for returning to work among employees wit musculoskeletal complaints. There was no difference in duration of sick leave for employees performing modified duties compared with employees returning to full duties. The duration of sick leave was not affected by the type of modified duty, i.e. reduction in work time or change towards less strenuous tasks. However, the time of onset with modified work had an significant impact on the duration of sick leave (Fig.2). Onset with 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 4 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 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.

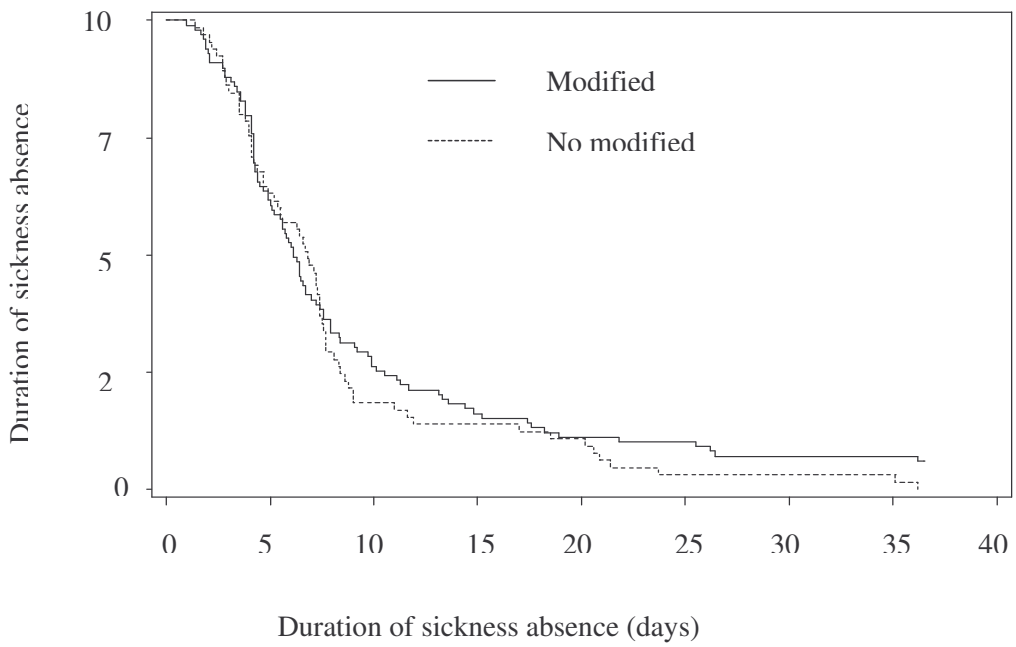

Figure 1. Survival curves for return to work among subjects with modified work (n=65) and employees without modified work (n=99) during their sick leave.

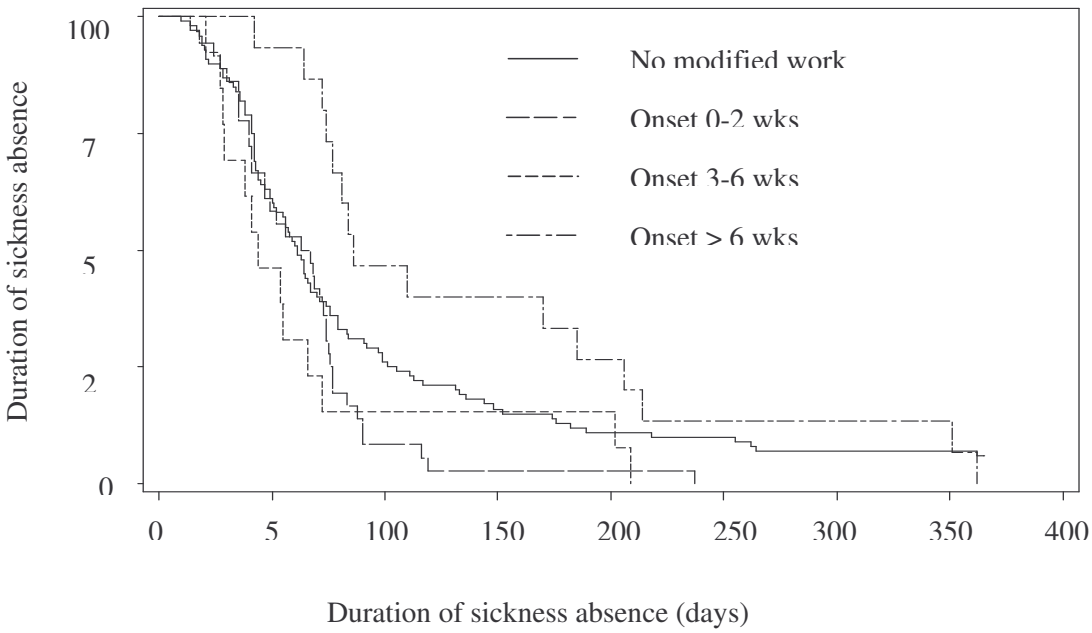

Figure 2. Survival curves for return to work among subjects with work-related factors, stratified for time of start with modified work.

Table 4. Prognostic factors for duration of sick leave (Cox proportional hazards regression analysis) among employees on sick leave due to musculoskeletal disorders.

	Univariate analysis			*Multivariate analysis*		
Prognostic factors	*HR*	*95% CI*	*p*	*HR*	*95%CI*	*p*
Modified work	1.11	0.80-1.53	0.53	(1.06	0.75- 1.51	0.73)[1]
Individual characteristics						
Older age (> 43) (1/0)	0.88	0.64-1.21	0.43	0.82	0.60-1.15	0.83
Work related factors						
Many years in same job (>14 yr) (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	---	---	---
Health outcome						
Chronic complaints (1/0)	1.60	1.20-2.32	0.01	1.55	1.06-2.27	0.02
Pain (0-10)	1.08	1.01-1.17	0.06	---	---	---
Disability (0-10)[2]	1.12	1.03-1.22	0.01	1.11	1.02-1.21	0.02
General health – PCS (0-10)[3]	0.81	0.63-1.04	0.10	---	---	---
Quality of life – EQ- 5d (0-10)[3]	0.94	0.89-1.0	0.04	---	---	---

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

[1] Effect of modified work when introduced into the multivariate model.

[2] One scale unit represents 2.4 points on the original scale.

[3] One scale unit represents 10 points on the orginal scale.

4.4 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 with 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 work load for employees with musculoskeletal complaints, since in these jobs all activities involved a considerable physical work load.[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 sicklisted 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 with 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 to 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 for the 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 into 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 on 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 at allocation of the occupational physician 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 assigned less often modified work by the occupational physician and more often returned directly in their regular job when sufficiently recovered. This is a rather suprising 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 work load to an acceptable level. Another explanation could be related to the physician's fear for 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 on 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 sicklisted 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 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 advise and was not part of a multidisciplinary programme. Modified work has been included in broader rehabilitation interventions that were evaluated as being effective, but its contribution to the effectiveness is unclear.[30, 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 with 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 as 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 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 work load 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 on 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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Chapter 5

Influence of modified work on recurrence of sick leave due to musculoskeletal complaints

Adapted from:
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Abstract

Objectives Some studies have suggested that workers with modified work during sick leave due to musculoskeletal complaints may return to work earlier in full duty than colleagues without modified work. This study evaluates whether modified work during sick leave influences the recurrence of a new episode of sick leave.

Methods Questionnaires on physical and psychosocial work load, musculoskeletal complaints, general health and sick leave were sent to 137 workers on sick leave for 2-6 weeks due to musculoskeletal complaints, shortly after full return to work, and 12 months after first day of sick leave.

Results About 45% of the participants experienced a recurrence of musculoskeletal sick leave within 12 months after start of the initial sick leave. Subjects with modified work during initial sick leave reported significantly less recurrence than those who had started immediately at full duty. Musculoskeletal sick leave prior to the start of the study also predicted the occurrence of recurrent sick leave. Many workers reported residual health problems at time of return to work, which in turn influenced recurrence of musculoskeletal sickness absence.

Conclusion This study suggests that, although full recovery of musculoskeletal complaints was not established at time of return to work, workers who had performed modified work had a lower risk of recurrence of musculoskeletal sick leave than workers who directly returned in full duty.

5.1 Introduction

In the past few decades various intervention programmes have been developed to facilitate early return to work after sickness absence from musculoskeletal disorders. These programmes are often multifactorial in nature and combine medical and non-medical interventions. Comprehensive multidisciplinary interventions have a documented effect on pain intensity and associated functional limitations but the evidence on effectiveness on return to work is limited.[1, 2] Most guidelines on musculoskeletal disorders, especially those on low-back pain, emphasize that musculoskeletal pain is a self-limiting condition and that, hence, an (early) return to work should be encouraged.[3] A crucial element in return to work interventions is gradually increasing the workload until full duty is commenced, whereby reduction of workload is achieved by modifying the content and duration of strenuous tasks and activities at work.[4]

In two reviews it has been concluded that workers on temporarily modified work have a higher probability to return to work earlier in full duty than colleagues without modified work.[4, 5] However, these reviews included interventions varying from modified work as sole intervention to multidisciplinary rehabilitation programmes including modified work. Recent studies on the isolated effect of modified work on musculoskeletal sickness absence did not observe any effect on return to work.[6, 7] In addition, few studies have documented what happens after return to work in full duty. This is important since it has been shown that many subjects who returned to work were not fully recovered from their initial complaints.[8-10] Several studies have reported recurrence of musculoskeletal sick leave up to 38% per year.[11-16] It has been suggested that the high recurrence of musculoskeletal sick leave is partly due to a too early start with modified work. Aggressive promotion of early return to work could yield an opposite result, with an increased likelihood of recurrence when job accommodation was not satisfactory.[9] On the other hand, prolonged work disability may lead to an increased reconditioning, needing a greater accommodation effort than employers are either able or willing to provide, and therefore also increase to the risk for recurrence.[17] Given the paucity of information on recurrence of musculoskeletal sick leave after return to work, a longitudinal study among workers on sick leave due to musculoskeletal complaints was performed with the primary aims to describe the likelihood of recurrence of sickness absence and to evaluate the impact of modified work and other risk factors on recurrence of sickness absence.

5.2 Methods

Study design and population

Workers on sick leave for 2-6 weeks due to musculoskeletal complaints were enrolled in the study by occupational physicians during their first consult or selected from the absenteeism register of two occupational health services with various local offices. In The Netherlands it is regular practice to be called up by an occupational physician after 2 weeks of sick leave and at 6 weeks there is a statutory requirement that worker and employer agree upon a written rehabilitation plan. Based on the initial diagnosis by the occupational physician, workers were excluded when suffering from a specific underlying pathology, such as fracture or discus prolapse. If the worker on sickness absence was willing to participate, an informed consent was signed. Participants received a diagnosis specific questionnaire (*i.e.*, low back, hip, knee, ankle/foot, neck, shoulder, or wrist/hand/elbow) to be returned to the research team. This baseline questionnaire gathered information on different dimensions of health, individual characteristics, and work-related factors. Subjects received a first follow-up questionnaire when return to work in full duty was established at the discretion of the occupational physician. This second questionnaire repeated the questions on dimensions of health and also asked questions on modified work performed during sick leave. About 12 months after the first day of the initial sick leave, a third questionnaire was sent, particularly addressing recurrence of any absence due to musculoskeletal complaints. The Medical Ethics Committee of the Erasmus MC, Rotterdam approved the study.

Modified work

The presence of modified work during sick leave was established in the second questionnaire. If modified work was indeed part of the period of sickness absence, specific questions were set about the content and circumstances of modified work. The presence of modified work was defined by three criteria: (1) work activities at the worksite were carried out during sickness absence, but workers were on restricted duty (2) these activities were characterized by a substantial reduction in physical load through adjusted work tasks and/or working hours, and (3) the modified work was officially advised by the occupational health physician.[6] In The Netherlands modified work is commonly offered to workers on sick leave in order to use their rest capacity to work. These work activities on

restricted duty are legally defined as part of the sick leave period. A sick leave will end when workers return to their original job in full duty or they have changed job. Modified work is comparable to concepts such as part time sick leave and work restrictions.[4,7]

Sickness absence

The first day of sickness absence as well as the day of return to work in full duty were obtained from occupational health services, based on the legal requirement to register the start and end of an episode of sickness absence. In The Netherlands in almost all situations the worker will be paid a full salary during the first year of sickness absence. Recurrence was defined as a new episode of musculoskeletal sick leave after the worker had returned to work in full duty for at least one complete workday. This new absence period could occur due to the original complaints as well as due to other musculoskeletal complaints. The information on recurrence was retrieved from the third questionnaire after 12 months of follow-up with questions about occurrence of a period of absence due to the original diagnosis as well as absence due to other musculoskeletal complaints. Workers were asked for the primary reason underlying their sick leave as well as musculoskeletal comorbidity. Duration of recurrence of absence was asked on a 4 point-scale: 0 days, 1-7 days, 8-14 days, and more than 2 weeks.[18]

Measurement of health and risk factors

All 3 questionnaires determined disease-specific and generic health measures. A detailed description of the interrelationships of the health measurements applied was published before.[19] The Nordic Questionnaire for the nature and severity of musculoskeletal complaints was used to define the presence of musculoskeletal complaints. A chronic complaint was defined as pain present almost every day in the preceding 12 months with a minimal presence for at least 3 months.[6] A Numerical Rating Scale (NRS) was used, ranging from 0 (no pain at all) to 10 (pain as bad as it can be), for pain as measure of the intensity of musculoskeletal complaints.[20] The sum score of the 24 dichotomous items in the Roland-Morris Disability Questionnaire defined functional limitations due to low back pain.[21] For other musculoskeletal complaints we used a comparable questionnaire, derived from the Sickness Impact Profile.[22] General health was measured with the short

form 12 (SF12) and the answers on the 12 items were aggregated into the physical component summary scale (PCS12) and the mental component summary scale (MCS12). Each component was expressed on a 0 (worst health status as possible) to 100 (best health status as possible) scale.[23] The EuroQol 5 dimensions (EQ5d) were used as a measure of preference based quality of life, using weights for different health states as obtained from the general population in the United Kingdom, to calculate the quality of life score ranging between 0 and 1.[24]

At baseline we collected information about age, gender, body mass index, marital status, education, and physical and psychosocial workload. The questions on physical load at work had a 4-point ordinal scale and answers "always" and "often" were classified as exposure.[25] The Job Content Questionnaire was used for the psychosocial dimensions work demands, skill discretion, and decision authority.[26] 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 had a 4-point ordinal scale ranging from 0 (never) to 3 (always) and a sum score across all items in each dimension was calculated.[26]

Statistical analysis

Differences between continuous variables were tested with the Student t-test and differences between dichotomous variables with the chi-square test. The generic measures of health were used as continuous variables, after ensuring that these variables were normally distributed. The sum score of the functional limitation scale was based on 24 dichotomous items and treated both as continuous variable as well as ordinal variable with cut-off values based on tertile scores of the study population distribution.

The risk factors for recurrence of sick leave due to musculoskeletal complaints were analysed with logistic regression analysis. Independent variables were individual characteristics, work-related factors, and health-related measures. The variables with a significance level of $p<0.20$ in the univariate analyses were considered for inclusion in the multivariate model, and variables with $p<0.05$ were retained in the final multivariate model. In addition, variables which caused

a change by 20 percent or more in the coefficients of significant factors were considered as confouders and also included in the final model. Age was included in the multivariate model by default, independent of its level of significance. An Odds Ratio above one indicates an increased likelihood of recurrence of a sickness absence period due to musculoskeletal complaints.

5.3 Results

Occupational health physicians included 196 respondents on sick leave for 2-6 weeks with non-specific musculoskeletal complaints. Another 116 workers were selected from absenteeism registers from occupational health services and 66 subjects agreed to participate in the study (57%). In total, 262 workers received the baseline questionnaire of which 225 subjects returned a complete questionnaire (86%). Most of the respondents were blue collar workers from a wide range of companies, including construction industry, mail delivery services, food services, security firms, and nursing homes and hospitals. The first follow-up questionnaire shortly after return to work in full duty was filled out by 158 (70% of baseline participation) subjects. The non-response (n=67) was due to loss to follow-up (n=40), permanent change of job towards less strenuous activities immediately after the date of full recovery (n=21), and subjects (n=6) who did not return to work within 12 months after the start of the initial sick leave episode. Non-response was not influenced by mode of enrolment or branch of industry. The second follow-up questionnaire after 12 months was filled out by 137 workers (61% of baseline participation).

Table 1 describes the characteristics of the workers on sick leave for 2-6 weeks. In total, 48% was diagnosed by the occupational physician with back pain, 30% upper extremity complaints, 19% lower extremity complaints, and 3% miscellaneous musculoskeletal complaints. During the initial sick leave period, about 80% of all subjects reporting to have experienced other musculoskeletal complaints as well. Workers returning to work in full duty after having performing modified duties (39%) reported at baseline less often physical load at work and also less often the presence of chronic musculoskeletal complaints in the 12 months prior to the initial sick leave.

Table 1. Characteristics of workers on sick leave for 2-6 weeks due to non-specific musculoskeletal complaints at start of the study, and health assessments at start of the study and at return to work (RTW) in full duty (n=137).

Characteristics	*Modified work (n=54)*		*No modified work (n=83)*	
Age, mean (SD)	43	(7)	44	(7)
Sex, female, n (%)	25	(46)*	24	(29)
Lower education, n (%)	32	(59)	47	(57)
Marital status, single, n (%)	16	(30)*	10	(12)
Prolonged standing, n (%)	39	(74)*	36	(44)
Frequently lifting 10-25 kg, n (%)	24	(44)*	54	(67)
Frequently lifting > 25 kg, n (%)	13	(24)*	52	(63)
Frequently kneeling, n (%)	8	(15)*	25	(30)
Frequently arms above shoulders, n (%)	10	(19)*	29	(36)
Skill discretion, mean (SD (0-18)[1]	10	(4) #	8	(3)
Decision authority, mean (SD) (0-33)[1]	16	(7)	16	(7)
Work demands, mean (SD) (0-33)[1]	15	(5)	14	(5)
Less good relation with colleagues, n (%)	16	(30)*	48	(58)
Less good relation with supervisor, n (%)	25	(46)	36	(44)
Chronic musculoskeletal complaint in past 12 mnths, n (%)	9	(17)*	29	(35)
Musculoskeletal sick leave in past 12 months, n (%)	18	(33)	17	(20)
Severity of pain, baseline, mean (SD) (0-10)[1]	6	(2)	6	(2)
Severity of pain, RTW, mean (SD) (0-10)[1]	4	(3)	5	(3)
Functional limitations, baseline, mean (SD) (0-24)[1]	13	(5)	13	(5)
Functional limitations, RTW, mean (SD) (0-24)[1]	7	(5)	7	(6)
General physical health, baseline, mean (SD) (0-100)[2]	32	(7)	32	(7)
General physical health, RTW, mean (SD) (0-100)[2]	44	(9)	43	(9)
General mental health, baseline, mean (SD) (0-100)[2]	52	(10)	50	(12)
General mental health, RTW, mean (SD) (0-100)[2]	55	(8)	53	(10)
Quality of life, baseline, mean (SD) (0-1)[2]	0.5	(0.3)	0.5	(0.3)
Quality of life, RTW, mean (SD) (0-1)[2]	0.8	(0.2)	0.7	(0.2)

* χ^2 – test, $p < 0.05$, # *t* test, $p < 0.05$

[1] A higher score indicates a worse health status

[2] A higher score indicates a better health status

The mean follow-up period after return to work on full duty in the regular job was approximately 9 months. During this period about 45% (n=66) of the participants experienced a recurrence of sick leave due to musculoskeletal complaints.

Subjects who had performed modified work during their initial sick leave experienced significantly less recurrence of musculoskeletal sick leave than those who had started immediately at full duty (Table 2). In 19 out of 66 episodes (29%) workers attributed their recurrent sick leave to both the musculoskeletal complaint of the initial sick leave as well as another musculoskeletal complaints.

Table 2. Recurrence of sick leave due to non-specific musculoskeletal complaints during the follow-up period, stratified by having performed modified work during initial sick leave (n=137).

Recurrence	*Modified work n (%)*	*No modified work n (%)*
Recurrent episode of sick leave due to any musculoskeletal complaint	18 (34)*	48 (58)
Recurrent episode of sick leave primarily due to the same musculoskeletal complaint	15 (29)	29 (36)
Recurrent episode of sick leave primarily due to another musculoskeletal complaint	11 (20)*	30 (37)

* χ^2 – test, $p < 0.05$

Table 3 shows the risk factors for musculoskeletal sick leave during the follow-up period. Return to work after modified work was associated with less recurrence (OR = 0.35, 95% CI 0.16-0.78). Musculoskeletal sick leave in the 12 months prior to the initial sick leave period increased the probability of recurrence (OR = 3.35, 95% CI 1.36-8.24). Prolonged standing and heavy lifting were inversely associated with recurrence, but due to the strong inverse relation between both work-related risk factors, only prolonged standing (OR = 0.34, 95% CI 0.20-0.94) remained statistically significant in the multivariate model whereas lifting was of borderline significance (p=0.09). Among the health measures shortly after return to work functional limitations and general physical health predicted recurrence, but after adjustment for other risk factors both health measures were not statistically significant (p>0.10). With categorisation into tertiles, workers with the highest and intermediate levels of functional limitations had significantly increased risks on recurrence with odds ratios of 2.64 (95% CI 1.12-6.21) and 2.80 (95% CI 1.17-6.69), respectively, compared with workers without or with low levels of functional limitations. However, in the multivariate analysis these associations become statistically insignificant with ORs of 2.26 (95% CI 0.88-5.77, p=0.37) and 2.47 (95% CI 0.94-6.46, p=0.24).

Table 3. Risk factors for recurrence of sick leave due to non-specific musculoskeletal complaints during the follow-up period (n=137) as determined by logistic regression analysis.

Risk factor	*Univariate associations*		*Multivariate model*	
	OR	*95% CI*	*OR*	*95% CI*
Individual characteristics				
Age 40 years or older	0.84	0.41-1.73	0.76	0.34-1.67
Sex, female	0.72	0.36-1.45	---	
Lower education	0.99	0.50-1.96	---	
Marital status, single	0.50**	0.21-1.22	---	
Work-related factors				
Modified work	0.37*	0.18-0.75	0.35*	0.16-0.78
Prolonged standing	0.43*	0.21-0.86	0.43*	0.20-0.94
Frequent lifting 10-25 kg	1.21	0.61-2.42	---	
Frequent lifting > 25 kg	2.27*	1.14-4.56	---	
Frequent kneeling	0.98	0.45-2.15	---	
Frequently arms above shoulders	1.53	0.72-3.24	---	
Skill discretion (per unit)	0.82	0.42-1.61	---	
Decision authority (per unit)	0.72	0.38-1.41	---	
Work demands (per unit)	1.14	0.58-2.24	---	
Less good relation with colleagues	1.60**	0.81-3.15	---	
Less good relation with supervisor	1.05	0.53-2.06	---	
Health measures				
Chronic complaints in past 12 months	2.83*	1.29-6.22	---	
Musculoskeletal sick leave in 12 months before initial sick leave	2.04**	0.93-4.46	3.35*	1.36-8.24
Severity of pain at RTW (per unit)	1.06	0.93-1.20	---	
Functional limitations at RTW (per unit)	1.06**	0.99-1.12	---	
General physical health at RTW (per unit)	0.97**	0.93-1.01	---	
General mental health at RTW (per unit)	1.00	0.97-1.04	---	
Quality of life at RTW (per unit)	0.59	0.12-2.86	---	

* Wald χ^2 – test, $p < 0.05$

** Wald χ^2 – test, $0.05 <= p < 0.20$

5.4 Discussion

This study among workers on sick leave due to musculoskeletal complaints showed that about 45% experienced a recurrence of musculoskeletal sick leave within 12 months after start of the initial sick leave. Subjects with modified work during initial sick leave reported significantly less recurrence than those who had started immediately at full duty. Musculoskeletal sick leave in the 12 months prior to the start of the study was a strong predictive factor for recurrent sick leave.

This prospective study has several limitations. First, the results could have suffered from confounding, i.e. workers who performed modified work during their initial sick leave were generally in better health and, thus, it is expected that these workers are less likely to have a recurrent episode. An additional analysis showed that workers who had performed modified work reported a better mental health at baseline, but this health measure was not predictive for recurrence of sick leave. At baseline no differences were observed for physical health and functional limitations, which were predictive for recurrence, albeit not statistically significant. Hence, the decision of the occupational physician to assign a sicklisted worker to modified work was not influenced by the health measures that predicted recurrence of sick leave. Modified work was more often assigned to workers without frequent lifting of heavy loads as part of their job activities (table 1) and frequent lifting over 25 kg was also a risk factor for recurrence of musculoskeletal sick leave in the univariate analysis (table 3). However, the estimate of the effect of modified work on recurrence did not change after adjustment for frequent lifting over 25 kg and, thus, this differential allocation of modified work will not have confounded the results to a large extent.

A second limitation is that the information on recurrence of sick leave could not be retrieved from company-based registries, but was based on self-reports of recurrence of sick leave and its underlying complaints. Self-reports on sick leave are less reliable for short periods of absence.[18] Also, the self-assigned musculoskeletal cause may have been influenced by the initial sick leave whereby workers may attribute a new episode of sick leave more often to a musculoskeletal cause, resulting in an overestimation of the recurrence.

A third limitation was the response and loss-to-follow-up. At baseline, two methods of enrolment were used. A substantial part of the subjects were selected from the absenteeism register of two occupational health services and approached directly by the research team. These employees had a response of

57% at inclusion, which was partly explained by subjects who had already returned to work when receiving an invitation to participate in the study. For the enrolment through occupational physicians, it was not possible to estimate the eligible number of participants since it was not recorded by the occupational health services which workers attended their scheduled appointment and which workers were asked during the consult to participate in the study. However, the route of entry in the study population, whether through an occupational physician or through a sick leave register, 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. The loss-to-follow-up during the initial sick leave period was 30% and the additional loss during follow-up after initial return to work was 13%. Both the initial loss and the additional loss was not influenced by baseline characteristics or characteristics at initial return to work.

The study population of workers on sick leave for 2-6 weeks had comparable pain intensity, functional limitations and general health than workers on sick leave due to back pain between 7 and 12 weeks.[10,27-28] Within this population 45% of the workers experienced a recurrence of musculoskeletal sick leave within the follow-up period, which was on average approximately 9 months. A similar recurrence of 38% over 6 months was reported among Canadian workers.[12] When limiting the definition of recurrence to the specific musculoskeletal complaint underlying the initial sick leave, recurrence was 32%, which is slightly higher than previous reports on recurrence of 19%-24% among workers on sick leave for back pain.[11,14-17] However, in these studies a substantial part of the employees with musculoskeletal complaints had already returned to work within 2 weeks. Since our study population consisted of workers on sickness absence for 2-6 weeks at time of inclusion, we have selected the more severe cases of sick leave and this may partly explain the higher recurrence. The high recurrence is also expressed in the highly predictive value of a musculoskeletal sick leave in the 12 months prior to the initial sick leave.[14] Interestingly, in our analysis the duration of the initial sick leave was not associated with a higher likelihood of recurrence and also did not influence the magnitude of risk factors for recurrence. Hence, the differences among workers with shorter and longer initial sick leave in time at risk for recurrence did not influence the results presented.

This study showed that recurrence of musculoskeletal sick leave is not always related to the original complaint, since a substantial part of recurrence was attributed to another musculoskeletal complaint. Other studies have pointed at the considerable overlap between musculoskeletal pain experienced in different sites and at the high prevalence of comorbidity of neck and upper extremities with low back pain.[29-30] For some patients musculoskeletal complaints express the presence of chronic widespread pain, that may be driven by a central process of sensitization.[29,31] This may explain the observed cross-over of localized musculoskeletal causes of sick leave. In future epidemiological studies on musculoskeletal sick leave it is advised to study interrelations among specific musculoskeletal causes of sick leave.

Workers who performed modified work during sick leave had a lower risk on recurrence of musculoskeletal sick leave. A similar indication was found in a study among employees of an utility company in the United States, where workers on back pain sick leave with work restrictions set by the occupational physician were at lower risk for recurrence than workers without work restrictions.[7] Evidence that the provision of modified work may reduce the duration of initial sick leave has been presented in two recent reviews.[4, 5] Our study suggests that modified work also has beneficial long term effects. A possible explanation for this finding is that employees on modified work during sick leave will learn how to cope with their musculoskeletal problems while at work and, hence, are less prone to take absence again during a recurrent period of their musculoskeletal complaints.

The effects of physical load on recurrence showed that prolonged standing remained statistically significant in the multivariate model, whereas frequent lifting of heavy loads was no longer included in the final model. This has to be interpreted with caution, since prolonged standing and frequent lifting had a reverse association and the OR of frequent lifting only changed from 2.27 to 2.03 (less than 11% change). Since a wide array of jobs was involved in this study, no attempt was made to confirm the self-reported exposure to physical load by workplace visits.

The assessment of musculoskeletal and generic health at time of return to work showed that most workers still had complaints when returning to full duty. Worse physical health was of borderline statistical significance ($P < 0.10$) in the prediction of a recurrent period of absence and worse functional limitations was significant when comparing workers with higher levels against those without or

minor limitations. The importance of general health, physical health, and functional limitations for recurrence has been stressed in several studies.[12,16,32] However, the observation that these health measures did not contribute to the predictive power in the multivariate analysis is an indication that recurrence will be partly explained by coping strategies. Modified work may increase the awareness of the worker that it is possible to continue working with musculoskeletal complaints and, as such, contributes to effective coping with complaints. Several studies have shown that coping styles and beliefs in control over pain can influence the treatment outcomes for patients with low back pain.[33,34] These coping styles may differ across individual characteristics and socio-economic position[35] which should be taken into account when supporting workers to return to work. In addition, coping could be influenced by job characteristics not included in this study and work organisation factors, such as machine-paced work and team-based production system.

Return to work is not equal to full recovery from musculoskeletal complaints. In this study many workers reported residual health problems at time of return to work, which in turn influenced recurrence of musculoskeletal sickness absence. A longitudinal study among workers with a lost-time claim injury due to a back or upper extremity disorder showed that workers with a sustained return to work reported a better health and less functional limitations than those who experienced a recurrence of work absence.[12] Another study among workers on musculoskeletal sick leave demonstrated that pain, functional limitations, and general health were improved at time of return to work, but also improved again significantly in the first months at work.[36] These findings suggest that additional medical guidance is needed for workers after return in full duty to further improve their musculoskeletal health in order to reduce the risk of recurrence of sick leave. This guidance should incorporate coping strategies but also address residual pain and functional limitations in work-place prevention programmes.[37]

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Chapter 6

The effects of timing on the cost-effectiveness of interventions for workers on sick leave due to low-back pain

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Abstract

Objective To examine the theoretical effects of different timing of structured interventions for workers on sick leave due to low back pain on return to work, and to evaluate the consequences for costs and benefits of return to work interventions.

Design Modelling approach to evaluate the theoretical effects of intervention studies on observed distributions of durations to return to work

Setting Literature review

Participants Workers on sick leave due to low back pain

Main outcome measures Reduction in the average number of days on sick leave per worker on sick leave and a benefit cost ratio

Results The cost-benefits of a RTW intervention among workers on sick leave due to low back pain will be determined by the estimated effectiveness of the intervention, the costs of the programme, the natural course of RTW in the target population, the timing of the enrollment of persons into the RTW intervention programme, and the duration of the intervention. The latter three factors are seldom taken into consideration, whereas their impact may easily exceed the influence of the classical measures of effectiveness, such as effect size or hazard ratio. Before implementing an intervention, it should be verified whether the features of the RTW pattern in the target population as well as the nature and timing of the intervention will permit positive expectations.

Conclusion With a good RTW in the first weeks, the only early interventions likely to be cost-beneficial are inexpensive work-focused enhancements to early routine care, such as accommodating workplaces. Structured interventions are unnecessary at an early stage and are unlikely to have an additional impact on the already good prognosis when offered before the optimal time-window of approximately 8 and 12 weeks.

6.1 Introduction

Low back pain has long been recognised as an important source of morbidity and disability in many occupational populations.[1] Low back pain, for most people, is characterised by recurrent episodes of pain and consequent disability, varying in severity and impact.[2,3] Most episodes subside uneventfully within days or weeks, with or without medical intervention, though about half of the people will still experience some pain and functional limitations after 12 months.[2,3] Attempts to predict who will fail to recover in a timely manner have had limited success.[4] It has been argued that prevention and treatment should focus on preventing chronicity of low back pain and disability resulting from low back pain rather than on preventing the onset of pain.[5-6] In working populations low back pain may lead to a spell of sickness absence. Although work disability and sickness absence are different entities, sickness absence is increasingly being used as a health parameter of interest when studying the consequences of disability in occupational groups.[7] The Clinical Standards Advisory Group in the United Kingdom reported a return to work within 2 weeks of 75% of all back pain absence episodes and suggested that approximately 50% of all work days lost due to back pain in the working population are by the 85% of people who are off work for less then seven days.[1] In studies on the duration of compensation claims for lost-time due to back injury it has been estimated that 40% of all workers will have returned to work within 2 weeks, whereas less than 10% will still be off work at 6 months.[5] It is commonly observed that the probability of resuming work diminishes with time on sick leave.[8]

The return-to-work pattern over time has important consequences for the appropriate timing of the best window for effective clinical and occupational interventions. Current evidence on vocational rehabilitation indicates that a stepped care approach is required. Simple interventions involving effective coordination and cooperation between primary healthcare and the workplace will be sufficient to help the majority of workers to achieve an early return to work. The second step with more expensive, structured interventions is reserved for those who are having difficulties returning.[9] In the first step of rapid return to work, which may happen even without specific intervention, the cost-effectiveness of interventions will be difficult to establish[5,8] ,but, since only existing resources are required, this is of little consequence. In the second step, structured interventions typically have been provided between 4 weeks and 3

months [10], but there is little evidence on the optimal timing of such interventions for workers on sick leave due to low back pain. It might reasonably be anticipated that the specific combination of the sick leave pattern over time and the effectiveness of the intervention will largely determine the optimum time to structured interventions to the workers still off work. The aims of the present paper are to examine the theoretical effects of different timing of structured interventions for workers on sick leave due to low back pain on return to work, and to evaluate the consequences for costs and benefits of return to work interventions.

6.2 Methods

Study approach

The approach taken in this study consists of three steps. In the first step, a review of the literature was conducted to select two return to work (RTW) curves among workers on sick leave due to low back pain with sufficient contrast in RTW rates in order to demonstrate the influence of the differences on the effectiveness of interventions. In the second step, intervention studies among workers on sick leave due to low back pain were reviewed for a quantitative characterization of the effect of the intervention on the RTW rate, expressed in a measure of effect such as Hazard Ratio or Rate Ratio. In addition, the costs and benefits of the interventions selected were retrieved for further analysis. In the third step, the selected RTW curves were fitted to a mathematical model, that best described the RTW rate over time. The measures of effect of the interventions, derived from step 2, were used in the mathematical model to calculate the theoretical effects on the RTW rates of different timings for the start of the intervention. These theoretical effects on the RTW rates were linked to the costs and benefits of the interventions in order to evaluate their consequences for the cost-benefits of return to work interventions.

Selection of RTW curves

A literature search was carried out in Pubmed and Embase (1980-2006), using the following keywords: [MeSH] low back pain, sick leave, worker's compensation [Textword] back-ache, return-to-work, work loss. Studies were included if (i) the study population consisted of workers with low back pain in various occupations, (ii) sickness absence due to back pain among these workers was objectively

determined from the first day of sick leave onwards, and (iii) RTW after an episode of sickness absence due to back pain was the outcome measure. Studies were excluded if (i) the study design was a (randomised) controlled trial, since the focus of the analysis was on the natural course of RTW, and (ii) RTW was studied in a specific occupational group not representative for the general workforce. In total, four studies were identified with a suitable return to work (RTW) curve among workers on sick leave due to low back pain.[11-14] The two studies with the largest contrast in RTW rates were selected for further analysis.[12,14]

Selection of intervention studies

A literature search was carried out in Pubmed and Embase (1980-2006). In Pubmed the following keywords were used and modified for Embase: [MeSH-terms] low back pain, sick leave, worker's compensation, and randomized controlled trial (RCT). Studies were included if (i) the study design was an RCT, (ii) the study population consisted of workers on sick leave due to low back pain in various occupations, (iii) RTW was an outcome measure, and (iv) as measure of treatment effect a Hazard Ratio (HR) or Rate Ratio was presented in the original article. For the purpose of the current study, a RR was regarded as a good approximation of a HR. When available, costs and benefits of the interventions were also retrieved. In total, 10 RCT studies were identified with a quantitative measure of the intervention effect on RTW among workers on sick leave due to low back pain.[15-25] In 5 out of 10 studies information on costs and benefits was also available.[19,26-29]

Modelling approach for intervention effects on RTW curves

Differences in RTW between the intervention and reference groups are usually depicted with Kaplan-Meier estimates of the respective probability functions of remaining on sick leave. In the statistical analysis of these survival data, the Cox's proportional hazards regression model has become the established norm.[30] The model assumes that survival times are exponential in both groups with constant hazards over time and, hence, the HR represents the ratio of both hazards. In RCTs the effects of an intervention are usually presented by differences in median times until RTW, estimated from the Kaplan-Meier curve, or by a HR, estimated by a Cox regression analysis. However, both techniques do not present a

parametric approach that could be used to estimate the effect of the intervention on RTW when the complete RTW curve over time is not available. This may be the case in studies with follow-up too short for all workers to have returned to work.

When data are available on a partial RTW curve over time, a Weibull function can be fitted, characterised by a scale parameter λ and a shape parameter *k,* which allows the simultaneous description of treatment effects both in terms of hazard ratios and also in terms of the relative increase or decrease in survival time.[30] In case of a RTW curve, the latter term may reflect that the RTW rate will decrease with prolonged sick leave. Appendix A presents the mathematical formula for a Weibull function and the description of how the HR will influence the estimated survival times on sick leave.

The Weibull distribution, describing a RTW curve, enables the evaluation of the theoretical cost-benefits of different timings of interventions on workers on sick leave due to low back pain. This evaluation was carried out in 4 phases. First, the two RTW curves selected in step 1 were fitted to a Weibull model (basic model), with as measure of deviance the lowest overall sum of squares between observed and estimated proportion of workers returned to work every week. Second, the HR values of RTW interventions identified in the literature review, were used to adjust the scale parameter λ in the Weibull model and obtain an intervention Weibull model with a faster RTW (intervention model). The area under the RTW curve (AUC) represents the total volume of days on sick leave and the difference in AUCs between the intervention model and the basic model will give the improvement in sickness absence days due to the intervention. This gain was defined as the reduction in the average number of days on sick leave per worker. In order to investigate the influence of different times of starting the intervention among those workers still on sick leave, intervals of 2 weeks were used to calculate the reduction in sickness absence at each 2-week period of starting the intervention. Third, it is reasonably to assume that some time will elapse between the start of the intervention and its effect on the RTW. Hence, two time lags of 2 and 4 weeks, respectively, were introduced, reflecting a delayed effect of the intervention. Fourth, the reported costs and benefits of RTW interventions were linked to the calculated gains in sickness absence in order to evaluate the consequences of different timings of interventions. For each possible situation, a benefit cost ratio (BC ratio) was calculated, from a societal perspective, where

benefits were the costs saved due to a reduction in sick leave and costs were the expenditures for the intervention, as derived from the selected studies.

6.3 Results

Figure 1 depicts the two RTW curves selected from the literature. The slowest RTW curve was based on duration of lost-time claims due to a back injury among workers in Ontario, Canada.[11]

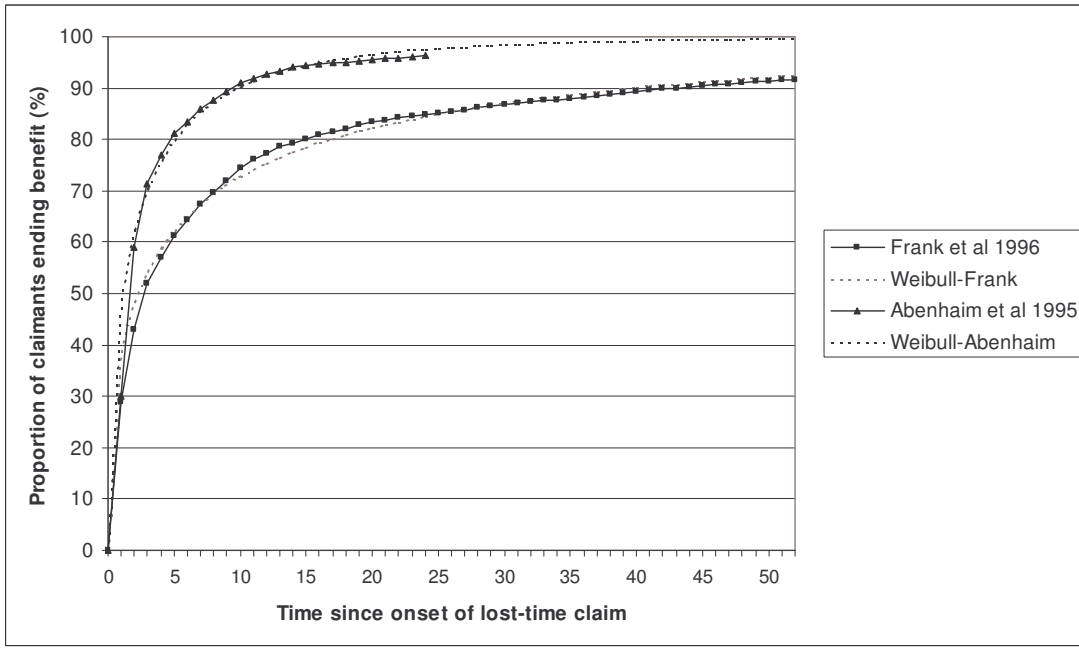

Figure 1. Observed Return to Work (RTW) curves after a sickness absence period due to low back pain, as presented in the scientific literature, and fitted curves according to a Weibull distribution.

The fastest RTW curve was based on duration of days of absence due to non-specific back pain among a random sample of workers in Quebec, Canada.[12] Both RTW curves showed a good fit to a Weibull model, with the slow RTW described by $\lambda = 5.4$ and $k = 0.42$, and the fast RTW curve by $\lambda = 2.1$ and $k = 0.54$.

Table 1 describes the results from 10 RCT studies on interventions on RTW. The effects on RTW varied from HR = 0.7 to 2.4, with 5 out of 10 studies demonstrating a statistically significant effect of the intervention on RTW. The start of the interventions varied from 10 days to 12 weeks after first day of sick leave, with a focus on 4 to 8 weeks. The duration of the interventions varied from a single session[17] to an intensive graded activity programme with maximum duration of 12 weeks.[20] The content of the interventions varied in intensity, with eight structured multimodal interventions with multiple sessions and 2 interventions with a single visit to a specialist physician.[17,25]

Table 2 presents the information on costs and benefits from 5 out of 10 studies described in table 1. The interventions costs ranged from €212 to €1614[26], with lower costs for workplace interventions than medical interventions.

Figure 2 presents the theoretical effects on reduction in sickness absence (days per worker) of interventions starting at different elapsed times of sick leave under the assumption of an immediate effect on RTW. The first observation is that the theoretical interventions were much more beneficial in the slow RTW curve than the fast RTW curve. In fact, a very powerful intervention with a HR = 2.5 among workers with a fast RTW had less effects on gains in sickness absence days than a considerably less powerful intervention with HR = 1.5 among workers with a slow RTW. For the fast RTW, the best intervention resulted in 1.5 - 1.7 times higher gains than the smallest intervention. The timing of different starting times of the intervention suggests that the most appropriate time-window is somewhere between 6 and 14 weeks, with less powerful interventions having a broader potential time window than the best intervention. For the slow RTW, the differences in gains varied a factor of 1.7 to 2 with the best time window approximately between 8 and 12 weeks.

Table 1. Assessment of the effects on return to work of interventions on workers on sick leave due to low back pain in randomized controlled trials.

Reference	*Study population*	*Duration of intervention*	*Follow-up months*	*Effect on return to work HR (95% CI)*
Anema[15] / Steenstra[16]	196 workers sicklisted for 2-6 weeks due to non-specific LBP	Graded activity (n=31) for 1 hour/day during 4 weeks after 8 weeks absence	12	HR = 0.4 (CI 0.3-0.6)
		Workplace intervention (n=22) after 6 weeks absence		HR = 1.7 (CI 1.2-2.3)
		Graded activity + workplace intervention		HR = 0.7 (CI 0.3-1.2)
Hagen[17]	457 workers sicklisted for 8-12 weeks because of non-specific LBP	One visit lasting 3 hours at spine clinic	3	RR = 1.5 (CI 1.2-1.8)
			6	RR = 1.4 (CI 1.1-1.6)
			12	RR = 1.2 (CI 1.1-1.4)
Halderson[18]	223 workers sicklisted for 8 weeks-6 months for non-specific LBP	Cognitive-behavioural treatment for 6 hours/day, 5 days/ week over 4 weeks	12	RR = 0.9 (CI 0.7-1.1)
Heymans[19]	299 workers sicklisted for 3-6 weeks for LBP	High intensity back school with 2 1 hour sessions/week for 8 weeks	12	HR = 1.0 (CI 0.7-1.4)
		Low intensity back school with a 2 hour session/week for 4 weeks	12	HR = 1.3 (CI 0.9-1.7)
Hlobil[20]	134 workers sicklisted at least 8 weeks with LBP	Graded activity with 2 1-hour sessions per week, maximum duration of intervention 12 weeks	12	HR = 1.9 (CI 1.2-3.1)
Indahl[21]	975 workers sicklisted for 8-12 weeks for LBP with or without radiating pain	Physical examination, reassurance, and advice to stay active during 3 visits over one year	12	HR = 2.2 (CI 1.8-2.8)
Loisel[22]	104 workers sicklisted 4-12 weeks for LBP	Graded activity (n=31) for 1 hour/day during 4 weeks after 8 weeks absence	12	HR = 1.1
		Workplace intervention (n=22) after 6 weeks absence	12	HR = 1.6
		Graded activity + workplace intervention	12	HR = 2.4 (CI 1.2-4.9)
Rossignol[23]	110 workers compensated for work related LBP with absence between 4-8 weeks.	Coordination of primary health care which included one examination, recommendations for clinical management and weekly support by telephone	6	HR = 1.3 (CI 0.6-1.7)
Staal[24]	134 workers sicklisted at least 4 weeks with non-specific LBP	Graded activity with 2 1-hour sessions per week, average duration of intervention 7 weeks	6	HR = 1.9 (CI 0.6-1.9)
Verbeek[25]	120 workers sicklisted 10-31 days with LBP	Appointment with occupational physician and subsequent guidance	12	HR = 1.3 (CI 0.9-1.9)

Table 2. Costs and benefits of return to work interventions on workers on sick leave due to low back pain, described in randomized controlled trials.

Reference	*Average costs of interventions per person*	*Costs of sick leave per day*
Streenstra[26]	Clinical intervention €942 Workplace intervention €681	Worker's average income € 100/day (in 2002)
Hagen[27]	Intervention €303	Worker's average income € 92/day (in 1995)
Heymans[19]	Low intensity back school €920 High intensity back school €1180	Worker's average income €100/day (in 2001)
Hlobil[28]	Intervention €475	Worker's average income €100/day (in 2001)
Loisel[29]	Graded activity CND 2924 * Workplace intervention CND 384 Graded activity + workplace intervention CND 2965 (adjusted to 1998 prices)	Not available

* average exchange rate Canadian Dollar to Euro over 1998 was 0.552

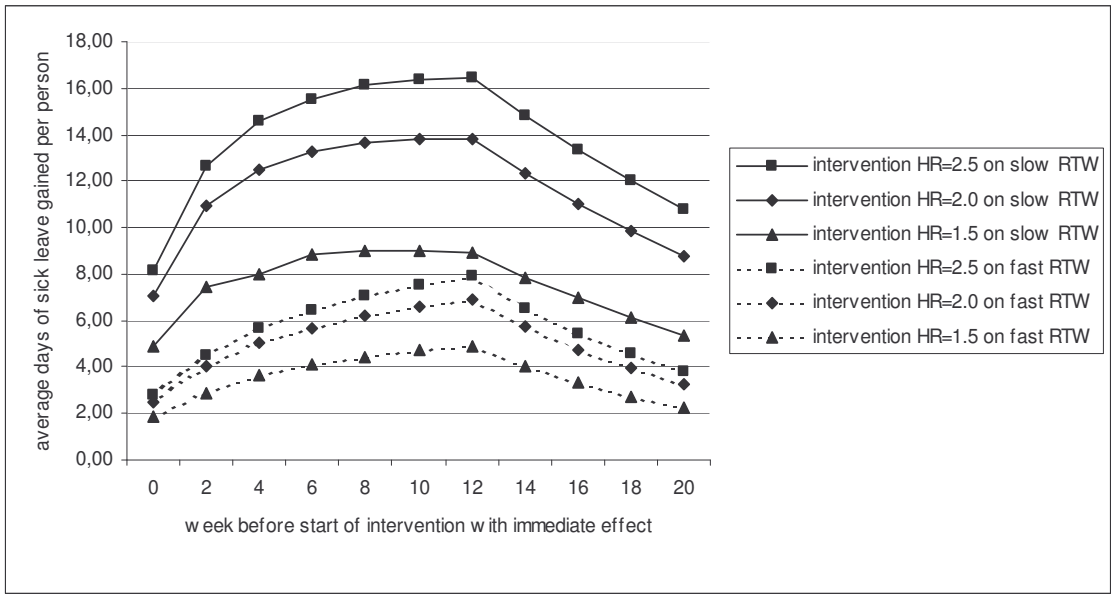

Figure 2. The estimated effects on reduction in sickness absence (days per worker) of interventions starting at different elapsed times of sick leave, with the assumption of an immediate effect on RTW, stratified by intervention effects and type of RTW curve.

Figure 3 describes the evaluation of the trade-off between benefits and costs, the actual starting time of the intervention, and the assumed delay in time before the intervention will have its effect on the RTW. This evaluation assumes an intervention with an effect size of HR = 2.0 and overall costs for the intervention of €1000 per worker involved. For all intervention situations with a natural fast RTW curve the BC ratio was below 1, indicating that the costs exceeded the benefits. When reducing the intervention costs to €500, all situations with a time delay in effect had BC ratio's below 1, except for an intervention starting after week 10 and a delay in effect of 2 weeks (BC ratio = 1.08). With a slow RTW curve, the assumption on the duration of the delay of effect also had a profound influence on the BC ratio. Without a delayed effect, all starting times after 2-18 weeks for an intervention with HR = 2.0 had beneficial BC ratio's above 1. However, when introducing a delay in effect of 2 weeks the appropriate time window reduced to 4 to 14 weeks and a delay in effect of 4 weeks reduced the time widow to 6 to 10 weeks. An increase in intervention costs from €1000 to €1500 resulted in all situations in a BC ratio less than 1.

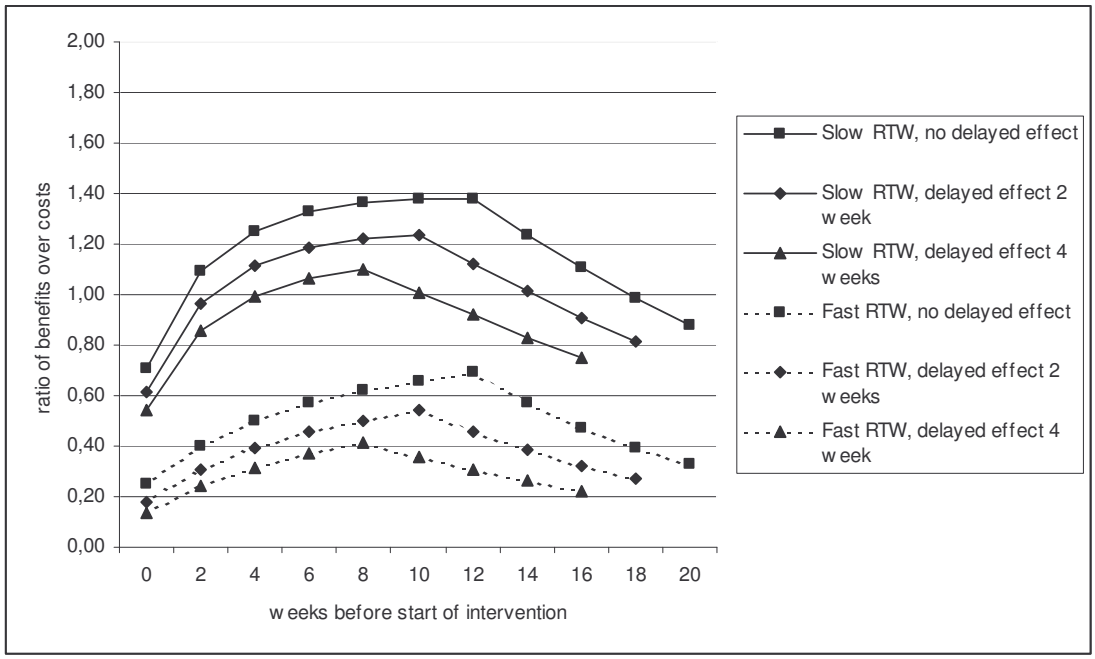

Figure 3. The benefit cost ratio of an intervention with an overall effect of HR = 2.0 and interventions costs of €1000 for a slow and fast RTW curve with time lags of 0, 2, and 4 weeks between the start of intervention and start of effects on RTW.

6.4 Discussion

This study showed that the cost-benefits of a RTW programme among workers on sick leave will be determined by the effectiveness of the intervention, the natural speed of RTW in the target population, the timing of the enrollment of persons into the RTW programme, and the costs of the programme.

Among workers absent due to low back pain a stepped care approach is attractive from a cost-benefit perspective, since it intends to deliver only what's needed when it's needed for the individual, whilst permitting allocation of resources to greatest effect at population level. This begs the question, however, of precisely when which intervention should be taken. The modelling showed that a powerful intervention (HR = 2.5) in a target population with a fast RTW was less effective than a less powerful intervention (HR = 1.5) in a target population with a slow RTW. The most appropriate time-window for a structured intervention was approximately between 8 and 12 weeks. In target populations with a fast RTW rate financial benefits will be difficult to achieve, even for interventions with costs below €500. However, this does not preclude the possibility that cost-neutral work-focused enhancements to early routine care may reduce the number of workers needing structured vocational rehabilitation interventions and, ultimately, contribute to cost savings.[9]

These conclusions are strongly influenced by three assumptions underlying the modelling approach, most notably the shape of the RTW curves, the magnitude of the structured intervention effect, and the costs and benefits of the intervention. The literature search on RTW curves resulted in four studies of which the two RTW curves with the strongest contrast were chosen as illustrative examples. The fastest RTW curve after a spell of sickness absence due to low back pain showed a RTW of 59% after 2 weeks and 93% after 3 months.[12] The slowest RTW curve had a RTW of 43% after 2 weeks and 79% after 3 months.[14] The difference between both RTW curves may stem from differences in the definition of RTW and in case-criteria of workers with low back pain. The fast RTW curve was based on duration of sickness absence period, whereas the often cited three-phase model of the Quebec task force was derived from length of time on compensation for lost work time. It has been shown that measures of lost workdays may substantially underestimate the duration of work disability with wage replacement benefits.[31] The RTW does not mark the end of (partial) sick leave for a sizable proportion.[3] The population of the fast RTW curve consisted of

workers with non-specific low back pain, whereas the slow RTW curve encompassed all cases of low back pain with lost-time claims. There is some evidence that workers who received a specific diagnosis from their physician were much more likely to recover slowly than those with a nonspecific initial diagnosis.[12,32] Other differences may also be important, such as variation in treatments regimen and characteristics of the compensation system, but further investigation of its impact on the observed patterns of RTW was outside the scope of the current study.

A second important assumption was the magnitude of the intervention effect, quantified by the hazard ratio. In the 10 intervention studies the effects on RTW varied from HR = 0.7 to 2.4, with five out of 10 studies demonstrating a statistically significant effect of the intervention on RTW. No attempt was made to evaluate the influence of differences in target populations, intervention contents, and timing of intervention on the observed heterogeneity in effectiveness. When keeping the results from table 1 in mind, with 5 out of 10 studies reporting a HR of 1.5 or less, assuming an intervention effect with a HR of 1.5 is possibly much closer to present reality than a HR of 2.5. However, this does not imply that considerable higher HRs are unachievable, since none of the interventions described embodied all the vocational principles that have been found essential for securing early RTW.[9]

The third assumption relates to the costs and benefits presented in the literature. The interventions costs ranged from €212 to €1614, with three interventions less than €500, 3 interventions between €500-€1000, and two interventions exceeded the €1000 costs per worker. The benefit cost ratio not only depends on the actual costs of the intervention, but also on the monetary value assigned to one lost work day. In the Dutch studies this value was put at about €100 per day, derived from the gross average annual income of a worker according to a national guideline for economic evaluations.[33] This value may be larger when the employer's costs associated with this loss of productivity exceeds the daily wage, for example due to damages incurred because of missing an important deadline. On the other hand, compensation mechanisms, such as colleagues taking over work or workers making up for lost work after return to work, may reduce the costs for absence.[34,35] It is also important to note that the cost-benefit ratio does not reflect the health effect from the intervention. Thus, a intervention with a poor cost-benefit ratio may have a good cost-effectiveness ratio when the

expenditure for the intervention results in a substantial improvement in quality of life.

The fitted Weibull distributions closely resembled the observed fast and slow RTW curves (see figure 1), with shape parameters of 0.54 and 0.42, respectively. These shape parameters reflect that the probability of returning to work diminishes with time on sick leave. It has been shown that the power and sample sizes for survival analysis are heavily dependent on the shape parameter of the Weibull distribution.[36] Hence, interventions that will reduce the time-dependent deceleration of RTW have a great potential to be cost-effective. Unfortunately, in RCTs on RTW interventions the treatment effect is usually presented by the hazard ratio which is linked to the scale parameter in the Weibull distribution. Thus, in our modelling approach the theoretical impact of an intervention could only be evaluated by assuming a change in the scale parameter and keeping the shape parameter constant. It is conceivable that the interventions described in table 1 also reduce the decreasing RTW rate over time, but this information is unfortunately not available from the scientific literature.

The analysis of the timing for structured interventions suggests that the optimum time-window for an effective intervention is approximately between 8 and 12 weeks. The steepness of the RTW curves in the first weeks demonstrates that most workers with low back pain absence will return to work rapidly. With a high RTW in the first weeks, the only early interventions likely to be cost-beneficial are inexpensive work-focused enhancements to early routine care, such as accommodating workplaces.[9] Structured interventions are unnecessary at an early stage and are unlikely to have an additional impact on the already good prognosis and, thus, will not be cost-benefical.[37] At the same time, interventions initiated too late will suffer from the diminished RTW rate after 12 weeks and the currently available interventions will at best have a low probability for success. At 3 months out of work the obstacles for return to work will be difficult to overcome and more complex, intensive interventions will be required that address social factors in addition to healthcare and workplace interventions.[6,9]

The conclusions about the cost-benefits of structured interventions were strongly influenced by the natural course of RTW. In figure 2 it was clearly shown that even a highly effective intervention (HR=2.5) in a source population with a naturally slow RTW will become cost-ineffective in a target population with a much faster RTW. It has been noted before that this phenomenon may partly

explain the contradictory results of similar intervention programmes in different occupational populations, since differences in RTW curves will greatly influence the overall effect size of the intervention.[21,38] for future studies, it is strongly encouraged to evaluate *a priori* the potential cost-effectiveness of an apparently effective intervention through comparison of the RTW curves in the source population and the target population. It is also recommended to publish the full Kaplan-Meier curves of intervention and reference groups in a RCT in order to facilitate such a comparison.

The results from introducing a time delay into the modelling between start of intervention and its effect on RTW points at another pitfall hampering the effectiveness of interventions. Enrollment in an intervention programme for several weeks may obstruct the natural RTW and, hence, introduce a detrimental effect.[8] The introduction of a delay in effect of several weeks strongly reduced the appropriate time window for effective interventions and also reduced the likelihood of a cost-beneficial intervention. These findings indicate that the introduction of an intervention programme with a duration of more than 4 weeks should be carefully considered. Moreover, the findings provide good reason to take steps to facilitate early RTW during the course of the structured intervention, rather that wait until some notional time point or until the person is free of symptoms.[9,38]

In conclusion, this study showed that the cost-benefits of a RTW intervention among workers on sick leave due to low back pain can usefully be modelled, and will be determined by the estimated effectiveness of the intervention, the costs of the programme, the natural course of RTW in the target population, the timing of the enrollment of persons into the RTW intervention programme, and the duration of the intervention. The latter three factors are seldom taken into consideration, whereas their impact may easily exceed the influence of the classical measures of effectiveness, such as effect size or hazard ratio. Before implementing an intervention, it should be verified whether the features of the RTW pattern in the target population as well as the nature and timing of the intervention will permit positive expectations.

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Appendix A. Mathematical description of the hazard ratio in a Weibull distribution.

The Weibull distribution is characterised by a scale parameter λ, an exponential term, and a shape parameter *k*, an acceleration term with a relative increase (*k* larger than 1) or decrease (*k* smaller than 1) over time, resulting in a survival function $S(t) = \exp-(t / \lambda)^{k}$ with a cumulative hazard $H(t) = (t / \lambda)^{k}$, whereby t = survival time. When the acceleration term is constant over time, i.e. $k = 1$, then the Weibull distribution reduces to a straightforward exponential distribution $S(t) = \exp-(t / \lambda)$ and the logarithm of the scale parameter λ will become equal to minus the regression coefficent *b* (i.e. the log of the hazard ratio) in a conventional Cox regression model with $H(t) = H_0(t) * \exp(b)$.

In the Weibull distribution the scale parameter λ is a function of different covariates, expressed by the formula $\lambda = \exp(b_0 + b_i * x_i)$, whereby b_0 is a constant and b_i is the regression coefficient of the effect of covariate x_i, for example the intervention effect. With imputation of this formula in the cumulative hazard of the Weibull function, the cumulative hazard $H(t) = (t / \exp(b_0 + b_i * x_i))^{k} = (\exp(-b_0) * t)^{k} * \exp(-b_1 * k * x_i)$. The intervention effect is expressed by the term $\exp(-b_1 * k * x_i)$, whereby x_i takes the value 1 for the intervention group and 0 for the reference group. Thus, the intervention effect in the Weibull function is expressed by $\exp(-b_i * k)$, which equals the estimated HR of the intervention. Hence, the log HR = $-b_i * k$ and with known shape parameter *k* and known HR of the intervention effect, the regression coefficient b_i can be calculated. Subsequently, this regression coefficient is used to calculate the adjusted scale parameter λ for the intervention.

Chapter 7

General discussion

7.1 Introduction

Programmes for the timely return to work of employees with musculoskeletal complaints have received much attention in the past decade. The rationale for the studies presented in this thesis is based on the frequently given advice by the occupational physician to use modified work as a return to work intervention among workers on sickness absence due to musculoskeletal complaints. In this thesis the focus is on workers on sick leave between 2-6 weeks. The three main questions of this thesis are:

1) Which measures of health are useful outcome measures in the evaluation of occupational health management options for workers on sickness absence due to musculoskeletal complaints for 2-6 weeks?
2) What is the influence of modified work on return to work among workers on sickness absence due to musculoskeletal complaints?
3) What is the effect of different timing of interventions on return to work and cost-effectiveness in workers with sickness absence due to musculoskeletal complaints?

In this chapter the main findings, core methodological issues, implications of the research, new insights, and recommendations for research and occupational health practice will be addressed.

7.2 Main findings

Which measures of health are useful outcome measures in the evaluation of occupational health management options for workers on sickness absence due to musculoskeletal complaints for 2-6 weeks?

The cross-sectional study (Chapter 2) showed that for workers on sickness absence moderate correlations were found among measures of severity of musculoskeletal pain, experienced disability, general health, and quality of life. These specific and generic health dimensions were not influenced by work-related physical and psychosocial workload. Self-perceived ability to return to work within 6 weeks explained 21-26% of the variation in the outcomes on pain and disability and was substantially less associated with the generic measures of health. In an analysis with ability to return to work as dependent variable and pain and disability as independent factors, the same associations will be found. Pain and functioning will influence the self-perceived ability to work and it has been shown that self-perceived ability is an important predictor of return to work.[1] Given the

stronger associations between the specific dimensions of pain and disability with self-perceived ability, it seems appropriate to focus more on these dimensions than on generic measures of general health and quality of life in the decisions on management of workers on sick leave (Chapter 2). This is supported by results of chapter 4 where perceived disability, expressed by functional limitations, was a strong prognostic factor for return to work, while general health and quality of life were less important predictors.

What is the influence of modified work on return to work among workers on sickness absence due to musculoskeletal complaints?

In a cross-sectional study (Chapter 3) occupational physicians and human resource managers were asked for barriers for the implementation of modified work into the regular health care for workers on sick leave. Both groups reported the lack of knowledge on the effects of modified work, the lack of (social) support from employees and colleagues, and the lack of possibilities for modification of the work tasks as main barriers. The majority of the companies reported barriers due to a mismatch between the education of the worker and the specific requirements of modified work. In the longitudinal study (Chapter 4 and 5) it was shown that all employees on sick leave showed a strong improvement in pain, disability, and general health at return to work, irrespective of the fact whether the worker had performed modified work or had returned to full duty immediately. Interestingly, workers were less likely to have performed modified work when their regular work was characterized by frequent lifting and other determinants of a high physical work load. The duration of sick leave was influenced by chronic complaints as well as the disability level. Modified work had no impact on the duration of sickness absence, but workers who performed modified work did show less recurrence of sick leave than workers returning immediately in full duty.

What is the effect of different timing of interventions on return to work and cost-effectiveness in workers with sickness absence due to musculoskeletal complaints?

A theoretical study (Chapter 6) showed that the cost-benefits of a return to work (RTW) programme among workers on sick leave will be determined by the estimated effectiveness of the intervention, the cost of the programme, the

natural course of return to work in the target population, the timing of the enrollment of persons into the RTW programme and the duration of the intervention. The results of this study suggest that with a good RTW in the first weeks, the only early interventions likely to be cost-beneficial are inexpensive work-focused enhancements to early routine care. Structured interventions are unlikely to have an additional impact when offered before the optimal time-window of approximately 8–12 weeks.

7.3 Methodological issues

General considerations

The data collection in this thesis was drawn from different sources, i.e. a literature review, a cross-sectional study, and a longitudinal study. This diversity in data collection may hamper the direct comparison between study results, but the broad scope of the studies conducted presents valuable insight into the influence of (modified) work on musculoskeletal complaints and work disability.

An important methodological issue is of course the observational nature of the studies, whereas preferably the effect of modified work should have been determined in a randomized controlled experiment. This issue will be discussed in more detail later. In order to determine the influence of modified work in the observational study, we had a relatively small study population (n=164) and, hence, the number of respondents representing the three types of modified duties (reduced working hours, adjusted tasks, or a combination of both) was small. A clear distinction between the groups could not be made. Further research in larger study populations aimed at replicating our results is warranted.

The population of the longitudinal study consisted of workers on sick leave for 2-6 weeks at time of inclusion. In the Netherlands, in the first two weeks a report of sickness absence is sent to the occupational health services, and the occupational physician is usually involved from the second week onwards. For our study two weeks therefore was the earliest time of inclusion. We did not know what happened in the weeks before inclusion and which advice was given to the worker with sickness absence.

Specific methodological issues have already been discussed in the different chapters of this thesis. Below the internal and external validity of the studies are considered.

Internal validity of the studies

Internal validity of a study refers to the extent to which the results are valid for the study subjects themselves; more specifically, the extent to which the results might be distorted by systematic errors. Several sources of systematic errors will be discussed.

Selection bias

Selection bias refers to errors in the process of identifying the study population. In the longitudinal study the population of interest was included in two ways, i.e. by the occupational health physician during his consulting hour and by selection from the absenteeism register held by occupational health services.

Considering the first, the available information did not permit a further analysis whether the occupational physician asked all workers that meet the inclusion criteria to participate in the study. However, it is expected that some occupational physicians may not have included workers who were expected to return to work within a couple of days in full duty.

Considering the latter, approximately 60% of the workers on 2-6 weeks on sickness absence responded to the request for participation in the study. It is known that most of the workers with musculoskeletal complaints will return to work within the first weeks of sickness absence.[2,3] Hence, the low response can partly be explained by the fact that subjects had already returned to work when receiving our invitation to participate in this study, or were expecting to return to work soon. Therefore, we most likely have a study population with overrepresentation of workers with longer sick leave.

We studied the effects of modified work as intervention. It is not likely that workers refused to participate in the study because they were offered modified duties, since it was not know at the start of the study whether they would perform modified work. The influence of selection bias on the results of modified work will most likely be limited.

Information bias

Information bias refers to systematic errors in the measurement of information, which results in an incorrect estimate of the association between exposure and outcome. Within the longitudinal study, information bias at baseline will not have

played an important role since the prognostic factors were determined before the outcome of interest. However, it is possible that due to a longer duration of sickness absence some workers had a higher change to have been offered modified work. In Chapter 5 it is reported that the time of onset of modified work was associated with duration of sick leave, whereby onset after 7 weeks was associated with longer sickness absence and onset between 0-2 weeks or 3-6 weeks was not associated with sick leave. Although this analysis was performed on a small study population, these results suggest that the effect of modified work on sickness absence may depend on the expired time on sick leave before starting with modified work.

The data on modified work as well as most of the outcomes were self-reported. This could bias the results if there would have been systematic differences in answering the questions. Workers with more pain could rate their work load as heavier than workers with less pain. However, in our study this will not have strongly interfered with our results, because we found no significant association between work load and duration of absence, while we did found an association between pain and duration of absence. This is in agreement with Toomingas and colleagues, who found no support for the idea of such bias in rating behaviour in studies where subjects rated both exposure and outcome variables such as modified work and pain.[4]

Confounding

In Chapter 4 it was shown that 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 in their regular job when sufficiently recovered. This suggests that the intervention not always targeted the workers who were aimed to be the recipients of the intervention. Although the factors influencing the allocation of the intervention did not predict the duration of sick leave and did not act as confounding variables, the sample size was too limited to investigate in more detail the possibility that modified work allocated as intended was beneficial whereas incorrectly allocated modified work was not beneficial.

We did not have information on some potential confounders that could have influenced the relationship between modified work and sickness absence. Recent evidence supports the importance of factors such as catastrophizing thoughts,

coping, and self-efficacy.[5-7] It can be hypothesized that workers with for example high catastrophizing thoughts were less effective in handling modified work. Future research in this field should be directed to these factors.

External validity of the studies

The external validity of a study refers to the generalizability of the study outcomes to subjects outside the study population. The studies in this thesis have been conducted in occupational populations consisting of mainly blue collar workers with a considerable physical work load. We did not focus on musculoskeletal complaints of white collar workers. However, the respondents involved a representative study population for blue collar workers, since a wide range of companies participated with different work tasks and a sufficient contrast in physical work load was present among workers.

The study results described in this thesis may not apply to other interventions concerning modified work. We studied the influence of a single advice of the occupational health physician for modified work, i.e. a reduction in work tasks and / or a reduction in working hours. Modified work in our study was a single intervention, for which we did not found any effect on the duration of sickness absence. This is in line with results in other studies, which have also focused on modified work as solitary intervention.[8-10] Based on the studies presented in this thesis, no conclusions can be drawn on modified work as part of a broader intervention. Studies with modified work as component of a rehabilitation intervention find some positive effects on the duration of sickness absence.[11,12] However, in these interventions it remains unclear whether modified work has contributed to the effectiveness of the complete programme.

7.4 Considerations for an ineffective intervention

At onset of this study there was some evidence that the provision of modified work may influence the duration of sickness absence. Two reviews suggested a higher return to work rate as well as a reduction in sickness absence days for workers with access to any form of modified work.[13,14] Hence, performing modified work seemed a promising intervention. However, these reviews summarize a wide range of different interventions, whereas we focused on the provision of modified work as single intervention. Although the advice for modified work is part of the Dutch occupational health guidelines for low back

pain[15], there were no studies for modified work as solitary advice of the occupational physician. Our study could contribute to the knowledge of this frequently given recommendation to workers on sickness absence.
Yet, in contradiction to the reviews, we did not found any effect on the duration of sickness absence. However, our study showed a positive influence of modified work on recurrence of sickness absence. In this paragraph we will discuss limitations of the study that could have influenced the findings. Although strongly related to each other, we will distinguish methodological limitations, implementation problems, and alternative explanations.

Methodological limitations of the study

Study design

We planned a RCT to assess the effectiveness of modified work. However, many companies and some occupational health services were not willing to concur with randomization of the intervention. This was partly motivated by new legislation that was enforced during the study period. This legislation puts a strong emphasis on the provision of modified work to sick listed employees. Moreover, in several companies modified work was already the point of departure in the management of sickness absence and companies were not willing to make exceptions for workers in a control group. Randomization was not acceptable for these companies. In addition, we encountered reluctance among occupational physicians to randomize workers according to the intervention modified work.
Due to the strong selection by companies and occupational physicians who would agree with randomization, the external validity would have been compromised greatly. Modified work as advised by the occupational physician is applied in various settings. In our study we wanted to reflect the usual practice as much as possible in order to examine the effect of modified work under 'normal' conditions and not under standardized study conditions. We intended to do research over a wide range of companies and occupational physicians. Thus, an observational study with longitudinal design without randomization was considered the best alternative for the RCT.

Unequal groups

Due to the change in study design, we could not randomly select workers for an intervention or control group. As a consequence of non-randomization the

individual situation of the worker within the company could influence the assignment of modified work to the worker. We found clear indications for this in our study results.
A first suggestion of selective implementation of the intervention is given in chapter 4. Results showed that workers with less physically demanding work had a higher chance to be offered modified work. The occupational physician might have been cautious and, therefore, excluded workers who performed high physical work tasks from the provision of modified work. Alternatively, it might have been more difficult to find other tasks inside the company for workers with high physical workload. This was also suggested in Chapter 3, since companies reported that it is difficult to find appropriate modified work for workers with lower education. Although in the statistical analysis the estimation of the effect of the intervention was adjusted for physical work load, we cannot exclude the possibility that differential allocation of the intervention has influenced the results.
A second indication for selective implementation is given in Chapter 4. It was shown that with a later onset of modified work (> 6 weeks) the duration of sickness absence was longer. It seems reasonable that a larger time span of sickness absence will increase the chance to be offered modified work. This could imply that at the end more workers with a longer duration of sickness absence performed modified work in contrast with workers with a short duration of absence. However, the results from the theoretical study suggest that offering such an intervention too late in the disease process may actually be a reason for its ineffectiveness.
Both mechanisms may have biased the results and a potentially positive effect of modified work on sickness absence may have been masked by the selection of workers for intervention.

Lack of power

Another limitation of the study that could have influenced the results is the lack of power. Recruitment of companies was difficult for above mentioned reasons. Besides, the active participation of occupational physicians in the study was limited. We tried to get attention for the study by visits and telephone calls to the occupational health services as well as sending newsletters. However, as in other studies, the inclusion of respondents was a challenge in itself. This resulted in fewer workers in the study population than originally planned. It was impossible

to analyse subgroup effects, to analyse whether specific subgroups of workers were more likely to experience positive effects of modified work.

Implementation problems

Strongly related to the methodological issues were problems with the implementation of the intervention within participating companies. A first problem is the lack of availability of modified work. Determinants such as the size of the company, the number of jobs, and the diversity of work tasks within the company could influence the availability of modified work (Chapter 3). In some companies the provision of modified work with a strong reduction of work load was difficult, since in these companies all jobs are involved with a considerable work load. Especially in small companies less possibilities exist to offer modified work. This will certainly hamper the implementation of the intervention.

Another problem concerns the active involvement of stakeholders. It is suggested that the most powerful and effective return to work interventions are interventions at the workplace, with an active involvement of stakeholders within the company.[16,17] Our study was focused on modified work as an advice of the occupational health physician in a broad range of companies. Active involvement of all stakeholders at the workplace was not guaranteed and also not acted upon by the researchers as part of the intervention. The study on barriers for implementing modified work showed a lack of knowledge of the employer about modified work (Chapter 3) and a perceived lack of support among workers. This argues for a more intensive involvement of stakeholders in the provision of modified work at the workplace.

A third implementation problem could be related to the worker on sickness absence. According to the guidelines, the occupational physician offers modified work as soon as possible to the workers on sickness absence. For some workers this could be at the first consultation with the occupational physician. Expectations of the workers could play an important role in the acceptance of modified work. Self perceived ability to return to work is a predictor of the duration of sickness absence.[1,18,19] Modified work must fit with this self perceived ability of the worker, otherwise there may be resistance by the worker, which will hamper the implementation of modified work as intervention.

Alternative explanations

Based on the results of our study, it is not possible to conclude whether or not modified work is an effective strategy to reduce days of sickness absence. However, one wonders whether the concept of the intervention is less promising than anticipated and whether the intervention 'modified work' may benefit from improvements.

An important consideration is whether we have included the most appropriate patients at the most appropriated time. Many episodes of musculoskeletal complaints resolve rapidly. Maybe we found no effect because of a favourable natural course of symptoms in both groups of workers, with or without modified work. Chapter 6 suggests that the most appropriate time for enrollment of persons into a return to work intervention is between 8 and 12 weeks, whereby the effectiveness of an intervention also depends on the natural course of RTW in the target population and the duration of the intervention. One may hypothesize that the focus should be on the subgroup of workers that do not seem to have a favourable prognosis rather than all workers with musculoskeletal disorders. However, as to date it is still very difficult to predict, with sufficient discriminatory power, which workers are most likely to return to work quickly and which workers will show a delayed RTW.

7.5 Recommendations for occupational health practice

We concluded from our study that there is no effect of modified work on the duration of absence. However, workers who performed modified work during their sick leave showed a stronger improvement in health and had a lower risk for recurrence of sickness absence than workers returning to full duty without modified work.

The results as described in this thesis give valuable new insights in the occupational health care for workers on sickness absence with musculoskeletal complaints.

1) The occupational physician is advised to ask for pain and perceived disability rather than general health and quality of life in the interview of patients with absence for 2-6 weeks due to musculoskeletal complaints.

Self-perceived pain and subsequent functional limitations determined the duration of sickness absence much more than physical general health and quality of life.

Moreover, pain and disability were strongly associated with the self-perceived ability to return to work. Therefore, pain and limitations are the most crucial subjects to discuss with the sick worker. The focus in the interview with the patient should be to stay active, despite the pain, and that pain itself does not necessarily imply that workers cannot return to work. This is in line with the evidence based guidelines for the treatment of non specific low back pain.

2) The occupational physician is advised not to interfere concerns about the physical work load of the regular tasks with the decision to offer modified work.
The provision of modified work, a recommendation in the Dutch occupational health guideline for low back pain, was primarily offered to those workers with less physically demanding jobs. This suggests that the recommended intervention was offered to those workers with the least need for this intervention.
One of the reasons for not offering modified work to workers with high physical workload (Chapter 4) could be related to the occupational physician's fear for recurrence or worsening the complaints, which has also been reported as a barrier for return to work. However, the results of our longitudinal study (Chapter 4) indicate a strong improvement in health related outcomes for employees performing modified work as well as for those returning directly to full duty. Occupational physicians should act cautiously when advising modified work for employees with a high physical load in their regular job. This caution however should address the issue whether the physical load at work can be reduced sufficiently by modified work and subsequently gradually increased and not the issue whether to provide modified work or not. This thesis shows no reasons to worry about worsening of complaints when offering modified work.

3) The occupational health physician and the company both must increase the cooperation between all stakeholders regarding implementation of modified work within the company.
According to a review of Waddell & Burton there is moderate evidence that communication, co-operation, and common agreed goals between all stakeholders are fundamental in clinical and occupational health management for improvement in return to work.[20] They defined the key stakeholders in the return-to-work process as: the worker, the occupational health team, supervisors, management, and primary health care professionals. Scheel et al showed recently

that the implementation of a modified work programme can fail due to lack of co-operation among all stakeholders.[21]
This thesis showed a discrepancy between the opinion of the occupational physician and the companies about barriers for implementing modified work (Chapter 3). Occupational physicians seem less confident about the implementation within the company. A better cooperation between all stakeholders could facilitate a more smoothly implementation of modified work within companies.

4) Provide structured information about the advantages of modified work and the company policy to employees as support of the advice of the occupational physician.
Companies experience many barriers with regard to the implementation of modified work. One of the most important barrier was lack of knowledge of modified work by the employee (chapter 3). In cooperation with occupational health services, companies could give more information to their employees about the provision of modified work during sickness absence. This in addition to the advice of the occupational physician. Good examples of providing information to patients with low back pain are available from studies in New Zealand and the United Kingdom, where the use of a leaflet or a booklet had positive effects on back pain beliefs, fear avoidance beliefs and knowledge of the patient related to back pain.[22-24] In the Netherlands, there is a booklet for management of low back in general, which is distributed by the general practitioner.[25] A leaflet specified to modified work could increase the knowledge of the worker on sickness absence and their colleagues. It could support and clarify the advice of the occupational physician to the worker.

5) Temporarily work in other companies could be the answer to lack of modified work within one company.
The implementation of modified work at the workplace was hampered by a large number of barriers that demonstrate how difficult it can be to realize the intervention of modified work within companies.
As already observed in other studies, the lack of possibilities to change work tasks is a substantial barrier for realizing modified work. In companies with mainly tasks with a high physical load there may be few opportunities to reduce the

heavy work load to an acceptable level. Especially in small companies there is less diversity in work tasks. In order to counteract this potential barrier, cooperation between different companies seems to be attractive. In some parts of the Netherlands workers temporarily work for other companies were modified work is available. Until now this is only arranged for workers on sickness absence for more than 13 weeks. It is expected that when companies are more familiar with the temporarily replacement of their employees, this could also be applied in an earlier stage of the sickness absence management.

7.6 Recommendations for future research

1) Before starting a study on the effectiveness of an intervention, it is advised to examine the possibilities for implementation of return to work interventions, for example in a pilot study.

The longitudinal study in this thesis was originally designed as a randomized controlled trial to evaluate the effect of modified work. Major barriers with the implementation of modified work, as described in Chapter 3, made it necessary to change the trial into a prospective design. Other studies have shown similar barriers for the implementation of early return to work interventions.[26,27] For successfully performing a randomized controlled trial, we recommend to address behavioral components which could obstruct the implementation of return to work interventions.

2) In an occupational health care setting, where recurrence rates of 40% are very common, a follow up period for more than one year is recommended.

Chapter 5 shows a recurrence rate of 45% for musculoskeletal sick leave within 12 months after start of the initial sick leave. Several other studies have reported recurrence of musculoskeletal sick leave up to 38% per year.[28-32] These high recurrence rates suggest that an evaluation study should not limit its measure of outcome to duration to first return to work, but should also have as outcome measure the likelihood of a recurrence during follow up.

3) Classic measurements of cost-effectiveness must be reconsidered.

Chapter 6 shows that within cost-benefits studies it is important to consider the natural course of return to work in the target population, the timing of the enrolment of the persons into the RTW programme and the duration of the intervention. These factors are seldom taken into consideration, whereas their

impact may be profound. It cannot be assumed that an effect size determined in an RCT in a particular population will also be applicable to the study population of interest.

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Summary

Chapter 1: Introduction

Musculoskeletal complaints are very common and cause substantial costs to society, primarily due to the indirect costs of sickness absence and productivity loss at work. Hence, the development and evaluation of return to work interventions is important. Offering modified work is one of the options widely used by occupational physicians and companies to accelerate the return to work for workers on sickness absence due to musculoskeletal complaints. However, little is known about the requirements and effectiveness of modified work. This thesis contributes to a better understanding of the application and effects of modified work. Modified work was defined by four criteria: (i) the elective allocation of modified work by the occupational physician; (ii) where work is adjusted to the functional capacity of the worker, (iii) work activities were carried out during the sick leave period; (iv) this work was characterized by a reduction in physically strenuous activities of at least 50% due to reduction in work tasks or working hours. The first objective of this thesis addressed the measures of health which are useful as outcome measure in the evaluation of occupational health management options for workers on sickness absence due to musculoskeletal complaints for 2-6 weeks. The second objective was to study the influence of modified work on return to work among workers on sickness absence due to musculoskeletal complaints. The third objective of this thesis was to describe the effects of different timing of return to work interventions on sick leave and the costs-benefits of these interventions.

Chapter 2: Interrelationships between measurements

Chapter 2 describes the interrelationships among pain, functional disability, general health, and overall quality of life for workers on sickness absence for 2 to 6 weeks due to musculoskeletal complaints. The study also assessed the impact of work-related and individual characteristics on these different health dimensions. In a cross-sectional study, a total of 218 workers completed a questionnaire on four different health dimensions and on work-related and environmental factors. Moderate correlations among measures of pain, disability, general health, and quality of life were found. Results showed that self-perceived ability to return to work was associated with pain and disability. Physical and psychosocial workload had little influence on the different dimensions of health. The explained variance of pain and disability was much larger than the explained

variance of general health and quality of life. Therefore, within a population of workers on sickness absence for 2-6 weeks, specific dimensions of pain and disability seem to be more appropriate measures of health than generic measures of general health and health-related quality of life.

Chapter 3: Barriers for modified work

Chapter 3 investigates barriers for the allocation and implementation of the modified work intervention. A model based on health-related behavior was used, consisting of six successive stages that are necessary for changing the behaviors of patients, physicians, and companies. A questionnaire derived from this model was sent to human resource managers of different companies and their occupational health physicians. For the stages with more than one item in the questionnaire, we found that the Cronbach's alpha varied between –0.10 and 0.67, showing at best a moderate internal consistency.

A large number of barriers were reported in different stages. Barriers were found due to lack of knowledge on the effects of modified work and due to negative attitudes of the employees. Both companies and physicians reported barriers in the possibilities to adjust the work tasks or the organization of the work activities to the worker's capabilities. The majority of companies reported barriers due to a mismatch between the educational level of the worker on sickness absence and the specific requirements of modified work. In conclusion, the allocation and implementation of the intervention modified work is hampered by a large number of barriers. For a successful modified work intervention a maximum effort from all parties involved is required.

Chapter 4: Duration of sickness absence

In Chapter 4 the influence of modified work on the duration of sickness absence is described. Although originally designed as a randomized controlled trial to evaluate the effectiveness of modified work, major problems with the randomization of respondents made it necessary to change the trial into an observational study with prospective design. A questionnaire, with questions related to health, work and individual factors, was filled out by the worker at the beginning of the sickness absence period and when return to work in full duty was accomplished. Information on the total duration of sickness absence was

received from occupational health services. A total of 164 workers participated in the study.
In a logistic regression analysis it was found that workers on sickness absence for musculoskeletal complaints in jobs characterized by a high physical work load were less often assigned modified work by the occupation physician. Workers were more likely to be allocated modified work when they had a better mental health, prolonged periods of standing in their regular job, and less skill discretion.
The Cox Proportional Hazards regression analysis showed that disability and chronic complaints had the strongest associations with duration of sickness absence. Modified work, on advice of the occupational health physician, did not influence the total duration of sickness absence or the improvement in health, since both workers performing modified work as well as those returning to work immediately in full duty showed a similar improvement in health-related outcomes.

Chapter 5: Recurrence of sickness absence
The primary aim of Chapter 5 was to describe the likelihood of recurrence of sickness absence and to evaluate the impact of modified work and individual and work-related risk factors on this recurrence. We used the same population as in Chapter 4. A third questionnaire was sent to respondents 12 months after the first day of sickness absence, with questions on the reccurrence of a period of absence due to the original diagnosis as well as other musculoskeletal complaints, after the date of initial return to work. Data of 137 workers were used for the analysis.
The mean follow-up period after return to work in full duty was approximately 9 months. Within this period about 45% of the participants reported a recurrence of sickness absence. Prolonged standing and musculoskeletal sickness absence in the 12 months before the initial sick leave increased the probability of recurrence. Workers who performed modified work during their initial sickness absence, reported less recurrence of absence in the follow up period. This latest finding suggests a beneficial long-term effect of modified work, possibly explained by an increased awareness of workers that it is possible to continue working although experiencing musculoskeletal complaints.

Chapter 6: Timing of interventions

Chapter 6 examines the theoretical effects of different timing of interventions for workers on sickleave due to low back pain on return to work and describes the consequences of this timing for cost-benefits of return to work interventions.

Return to work curves were selected in order to demonstrate the influence of differences in RTW rates on the effectiveness of interventions. The selected RTW curves were fitted to a mathematical model that best described the RTW rate over time. The mathematical model was based on a Weibull distribution. Studies on structured interventions were reviewed for their effects on RTW rate, as expressed by the Hazard Ratio or Relative Risk. These measures of effect were used in the mathematical model to calculate the theoretical effects of different timing on RTW rates.

Results showed that the cost-benefits of a RTW programme will be determined by the effectiveness of the intervention, the natural speed of RTW in the target population, the timing of the enrollment of persons into the RTW programme, and the duration and the costs of this programme. The most appropriate time-window of the intervention was approximately between 8 and 12 weeks.

Chapter 7: General discussion

Chapter 7 integrates and discusses the results of the studies in this thesis. The main findings are summarized. Due to a higher explained variance, specific dimensions of pain and disability seem to be more appropriate measures of health in a population of workers on sickness absence for 2-6 weeks than generic measures of health and quality of life. In a prospective study among 164 workers the strongest associations with longer duration of sickness absence were found for a higher level of disability and chronic complaints. For modified work, on advice of the occupational health physician, we found no association with the total duration of sickness absence. However, workers who performed modified work reported less recurrence of absence in the follow up period. We found that a time window between 8-12 weeks was the most appropriate time to offer a structured intervention aimed at return to work.

In the general discussion, methodological issues of the research conducted were discussed, as well as the consequences of the non randomization in the study for the evaluation of the effects of modified work on return to work. Furthermore,

recommendations are presented for occupational health care as well as future research in this area.

SAMENVATTING

Hoofdstuk 1: Introductie

Klachten aan het bewegingsapparaat zijn veel voorkomend en veroorzaken substantiële onkosten voor de maatschappij, met name vanwege de indirecte kosten voor verzuim en productieverlies op het werk. Interventies die gericht zijn het laten terugkeren van verzuimende werknemers, de zogenaamde Return-To-Work (RTW) interventies, zijn daarom volop in ontwikkeling. Het aanbieden van aangepast werk is een van de opties die veel gebruikt wordt door bedrijfsartsen en bedrijven om de terugkeer naar het werk te bespoedigen. Er is echter weinig bekend over de voorwaarden en effectiviteit van aangepast werk. Dit proefschrift draagt bij aan een beter begrip over toepassing en effecten van aangepast werk. Aangepast werk als onderwerp van studie wordt hierbij gedefinieerd door vier criteria: (i) het voorschrijven van aangepast werk door de bedrijfsarts; (ii) waarbij het werk wordt aangepast aan de functionele mogelijkheden van de werknemer, (iii) dit aangepast werk wordt uitgevoerd tijdens de verzuimperiode; (iii) en dit werk wordt gekarakteriseerd door vermindering in fysiek belastende activiteiten van minimaal 50% door reductie in werktaken en/of werkuren. De eerste vraagstelling van dit proefschrift is gericht op het vaststellen van de gezondheidsaspecten die van belang zijn voor bedrijfsartsen bij het bepalen van interventies voor werknemers die 2-6 weken verzuimen vanwege klachten aan het bewegingsapparaat. Daarnaast wilde we graag de invloed onderzoeken van aangepast werk op de terugkeer in het oorspronkelijke werk van deze werknemers. De derde doelstelling van dit proefschrift is gericht op het bepalen van de meest geschikte tijd voor het aanbieden van gestructureerde interventies aan werknemers met bewegingsapparaatklachten, zowel wat betreft verzuimduur als kosten effectiviteit.

Hoofdstuk 2: Samenhang tussen gezondheidsmaten

Hoofdstuk 2 beschrijft de samenhang tussen pijn, functionele beperkingen, algemene gezondheid en kwaliteit van leven voor werknemers die 2-6 weken verzuimden vanwege klachten aan het bewegingsapparaat. Daarbij werd nagegaan welke persoonlijke en werkgerelateerde kenmerken van invloed zijn op deze verschillende dimensies van gezondheid. In een cross-sectionele studie vulden 218 werknemers een vragenlijst in met vragen over vier verschillende dimensies van gezondheid, werkgerelateerde factoren en omgevingsfactoren. Matige correlaties waren aanwezig tussen pijn, beperkingen, algemene

gezondheid en kwaliteit van leven. De eigen inschatting van werknemers over terugkeer naar het werk was een belangrijke factor voor het verklaren van de variantie in pijn en beperkingen. De verschillende dimensies van gezondheid werden niet beïnvloed door werkgerelateerde fysieke en psychosociale factoren. De verklaarde variantie van pijn en beperkingen was groter dan bij de dimensies algemene gezondheid en kwaliteit van leven. Hierdoor lijken meetinstrumenten over pijn en functionele beperkingen beter geschikt voor het vaststellen van gezondheid bij werknemers die tussen de 2-6 weken verzuimen door klachten aan het bewegingsapparaat dan meetinstrument die gericht zijn op algemene gezondheid en kwaliteit van leven.

Hoofdstuk 3: Knelpunten bij de implementatie van aangepast werk

Hoofdstuk 3 beschrijft de belemmeringen voor de implementatie van aangepast werk. Een model over gezondheidsvoorlichting, bestaande uit zes opeenvolgende stadia voor gedragsverandering, werd hiervoor gebruikt. Op basis van dit model werd een vragenlijst ontwikkeld, die is opgestuurd naar medewerkers van personeelzaken van diverse bedrijven en hun bedrijfsartsen. Voor de stadia met meer dan 1 item werd de interne consistentie van de diverse stadia in de vragenlijst bepaald. Deze interne consistentie was op zijn hoogst 'gemiddeld' en varieerde tussen – 0,10 en 0,67.

Een groot aantal barrières voor implementatie van aangepast werk werd gemeld. Knelpunten waren gerelateerd aan de beperkte kennis over de effecten van aangepast werk en de negatieve attitude bij werknemers. Zowel de bedrijven als de bedrijfsartsen rapporteerden beperkte mogelijkheden om de werktaken te veranderen of de organisatie van het werk aan te passen aan de functionele mogelijkheden van de verzuimende werknemer. De meerderheid van de bedrijven gaven aan dat het scholingsniveau van de werknemer en de specifieke vaardigheden nodig voor het aangepaste werk, lang niet altijd overeen kwamen. Concluderend kan gesteld worden dat de invoering van aangepast werk gepaard gaat met een groot aantal knelpunten. Voor een succesvolle implementatie van aangepast werk is de maximale inzet van alle betrokken partijen noodzakelijk.

Hoofdstuk 4: Duur van ziekteverzuim

In hoofdstuk 4 wordt de invloed van aangepast werk op de duur van het ziekteverzuim beschreven. Oorspronkelijk was hiervoor een gerandomiseerd gecontroleerd experiment gepland. Grote knelpunten rond de randomisatie van werknemers maakten het echter noodzakelijk de studie te veranderen in een observationele studie met prospectief design. Een vragenlijst over gezondheid, werk en individuele factoren werd door de werknemers ingevuld aan het begin van het ziekteverzuim en wanneer men volledig was teruggekeerd in het reguliere werk. Gegevens over de verzuimduur werden verkregen via arbodiensten. In totaal namen 164 verzuimende werknemers deel aan de studie.

Een regressie analyse toonde aan dat verzuimende werknemers waarbij het reguliere werk werd gekenmerkt als fysiek zwaar, minder snel aangepast werk kregen aangeboden door de bedrijfsarts. Werknemers hadden een grotere kans op aangepast werk wanneer zij een betere mentale gezondheid hadden, in hun reguliere werk sprake was van langdurig staan, en in hun reguliere werk weinig mogelijkheden tot afwisseling in taken waren.

Een Cox Proportional Hazard regressie analyse gaf aan dat functionele beperkingen en chronische klachten de sterkste associatie hadden met de duur van verzuim. Het verrichten van aangepast werk, op advies van de bedrijfsarts, had geen invloed op de duur van het verzuim en de verbetering in gezondheid.

Hoofdstuk 5: Terugkeer naar werk na verzuim

De belangrijkste doelstelling van hoofdstuk 5 is het beschrijven van de kans op terugkeer van ziekteverzuim en het evalueren in hoeverre deze kans wordt beïnvloed door het verrichten van aangepast werk, individuele factoren en werkgebonden risicofactoren. Het betrof dezelfde populatie werknemers als beschreven in hoofdstuk 4. Er werd 12 maanden na de eerste dag van verzuim een derde vragenlijst verzonden naar de respondenten, met vragen over het ontstaan van een nieuwe verzuimperiode, gerelateerd aan de oorspronkelijke diagnose of aan een andere klacht aan het bewegingsapparaat. De gegevens van 137 werknemers waren bruikbaar in de analyse.

De gemiddelde followup periode na terugkeer in het reguliere werk was 9 maanden. In deze periode rapporteerden 45% van de werknemers een nieuwe periode van verzuim vanwege klachten aan het bewegingsapparaat. Langdurig staan in het reguliere werk en eerder verzuim voorafgaand aan de

oorspronkelijke verzuimperiode verhoogden de kans op een herhaling van verzuim. Werknemers die aangepast werk hadden verricht in de oorspronkelijke verzuimperiode, hadden een geringere kans op herhaling van verzuim tijdens de followup. Deze bevinding suggereert een positief effect op langere termijn van aangepast werk, wellicht te verklaren door een verbeterd bewustzijn van werknemers om door te werken ondanks ervaren klachten aan het bewegingsapparaat.

Hoofdstuk 6: Timing van interventies

In hoofdstuk 6 wordt het theoretische effect onderzocht van timing van gestructureerde interventies voor werknemers die verzuimen vanwege lage rugpijn. Bovendien beschrijft dit hoofdstuk de consequenties van die timing op de kosten-baten verhouding van interventies gericht op terugkeer naar het werk.
Twee return to work (RTW) curves werden geselecteerd om de invloed van verschillende RTW snelheden op de effectiviteit van interventies te demonstreren. De geselecteerde RTW curves zijn gefit in een wiskundig model dat het natuurlijke RTW beloop over de tijd beschrijft. Het wiskundig model was gebaseerd op een Weibull verdeling. Een review van interventiestudies vond plaats naar de effecten op return to work, uitgedrukt in een Hazard Ratio of een Relatief Riscio. Deze maten van effect zijn gebruikt in het wiskundig model om te berekenen wat het theoretisch effect is van verschillen in timing van interventies.
De resultaten laten zien dat de kosten-baten verhouding van RTW interventies wordt bepaald door de effectiviteit van de interventies, het natuurlijk beloop van RTW in de specifieke doelgroep, de timing rond instroom in het RTW programma en de duur en kosten van het programma. Het meest geschikte moment van starten van een gestructureerde interventie is gelegen tussen de 8 en 12 weken.

Hoofdstuk 7: Algemene discussie

Hoofdstuk 7 integreert en bediscussieert de resultaten zoals beschreven in dit proefschrift. De belangrijkste bevindingen worden samengevat. Vanwege een hogere verklaarde variantie lijken specifieke dimensies rond pijn en beperkingen meer geschikt voor het vaststellen van de gezondheid in een populatie met werknemers die 2-6 weken verzuimen dan generieke instrumenten rond kwaliteit van leven. In een prospectieve studie onder 164 werknemers vormden functionele beperkingen en chronische klachten de sterkste associatie met een

langer durend verzuim. Voor het verrichten van aangepast werk, zoals geadviseerd door de bedrijfsarts, vonden wij geen verband met de duur van het ziekteverzuim. Wel rapporteerden werknemers die aangepast werk hadden verricht minder verzuim in de followup periode. Resultaten laten zien dat een tijdsperiode van 8-12 weken het meest geschikt lijkt om een RTW interventie in te zetten.

In de algemene discussie komen methodologische tekortkomingen van het onderzoek aan de orde en worden de consequenties beschreven van het niet randomiseren binnen de studie naar effecitiviteit. Bovendien worden in de algemene discussie aanbevelingen gedaan voor arbodiensten en bedrijven en voor toekomstig onderzoek op dit gebied.

Over de auteur

Miranda van Duijn werd op 7 juni 1974 geboren in Schalkwijk. Ze behaalde in 1991 haar HAVO diploma aan het St Gregorius College in Utrecht. Vervolgens startte zij haar opleiding tot ergotherapeut, die succesvol werd afgerond in juni 1995. Naast haar werk als ergotherapeut, in eerste instantie in psychiatrisch centrum Bloemendaal en later op de afdeling ergotherapie van het VU medisch centrum, studeerde Miranda Bewegingswetenschappen aan de VU in Amsterdam. In 2000 behaalde Miranda haar doctoraal examen. In december 2000 begon zij als junior onderzoeker op de afdeling Maatschappelijke Gezondheidszorg van het Erasmus Medisch Centrum Rotterdam. Hier verrichtte zij het onderzoek beschreven in dit proefschrift. Sinds januari 2003 is Miranda als projectcoördinator betrokken bij diverse zorginnovaties op het gebied van revalidatie en integrative medicine in de regio Amsterdam West. De laatste jaren werkt zij met veel plezier in het Slotervaartziekenhuis in Amsterdam.

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