Evaluation of a preventive intervention among hospital workers to reduce physical workload

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Evaluation of a preventive intervention among hospital workers to reduce physical workload

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CHAPTER 1

General introduction

The high rate of sickness absence in various sectors, including University Medical Centres (UMCs) was the rationale for entering into the 'New Style' Health and Safety Covenant. The Prevention Programme Physical Workload was introduced under the terms of the UMC Health and Safety Covenant. The objective of the programme is to reduce complaints relating to the posture and locomotor system among personnel employed in care-related departments of UMCs. This PhD thesis evaluates different aspects of the programme's implementation, including working conditions, locomotor system complaints, absence due to these complaints and behavioural aspects in relation to physically demanding working conditions.

In 2001 the UMCs signed a health and safety covenant designed to increase their workforce participation (more hands at the bedside). This covenant is an agreement between the eight Dutch UMCs[1], the trade unions[2] and the Ministry for Social Affairs and Employment (SZW). It aimed to cut back sickness absence, reduce the numbers of new work disability claimants and accelerate the reintegration of sick employees. In 2000 the average absence rate in the UMCs was 6.8%.

Two events in the late 1990s – the implementation of the revised Working Conditions Act and the publication of the findings of the first Occupational Health and Safety Report (1998) – prompted the social partners (the Association of University Hospitals/VAZ and the trade unions) and the government to jointly deploy the Health and Safety Covenant as a policy instrument. The Working Conditions Act placed the emphasis on greater employer and employee responsibility for policy on absence and occupational health and safety. Instead of detailed rules, the covenants offer social partners the opportunity to develop 'customized' health and safety policy at sector level (Tripartiete Werkgroep, 2007). The Occupational Health and Safety Report, which is published annually, reviews the current status of and developments in working conditions in the Netherlands (Houtman et al., 1998; 2007).

Sixty-nine covenants covering more than 33 sectors were signed in the Netherlands in an eight-year period (Dekker et al., 2007). This number far exceeds the aims of the Ministry for Social Affairs and Employment. More than half (3.5 million people) of the total workforce were covered by a covenant. For a number of sectors, including the UMCs, the Health and Safety Covenant was extended until mid-2007 (NFU, 2004a and b). In public administration terms, the covenant method marked a new type of policy instrument, in which decentralized development and implementation were

paramount rather than centralized legislation. Covenant objectives are concrete, quantitative and limited in time. Guidelines were also drawn up for the content of covenants; these should relate to work hazards to which a large portion of the workforce is exposed and which have considerable impact on health, such as damage to health, use of medical care, sickness absence and disability. Almost all covenants cover hazards resulting from aggressive behaviour, industrial conflicts, dangerous substances, psychological strain, RSI/CANS (complaints of arm, neck and shoulder), hazardous noise levels, physical strain, workload and reintegration.

UMC Health and Safety Covenant

The UMC Health and Safety Covenant (2001) covers the topics of harmful substances (cytostatica and anaesthetic gases), Risk Inventory and Evaluation (RI&E), psychological strain, latex allergy, integrated occupational health and safety care, RSI and physical workload. These themes were established following a baseline measurement taken in 1999 (VAZ, 1999). In 2000 the rate of new work disability beneficiaries in the UMCs came to 1.15%, while the absence rate (as already stated) stood at 6.8%. One of the aims of the UMC Health and Safety Covenant was to bring about a gross reduction of 1% in the numbers of new work disability claimants for each participating hospital in 2003. Secondly, it aimed to ensure that the sickness absence rate as a result of locomotor system complaints would not exceed 1.5% of the total absence rate in any of the hospitals. Finally, it sought to ensure that the absenteeism rate due to psychological complaints would not exceed 1.2% in any of the hospitals.
After the Health and Safety Covenant took effect, an action plan was drawn up at sector level, with national working groups created to chart work hazards on a project basis. The national working groups were set up by local project leaders responsible for developing prevention programmes in the affiliated UMCs. Approximately 50,000 people work in UMCs in the Netherlands, 19,000 of whom were affected by the Health and Safety Covenant (NFU, 2004c).

Prevention Programme Physical Workload

One of the biggest projects in the UMC Health and Safety Covenant involved the reduction of exposure to physical workload. UMC data shows that two thirds of UMC personnel are exposed to a high degree of physical strain. There

are some reports in the literature of a relationship between physical workload and the prevalence and incidence of low-back pain (Hoogendoorn et al., 2000; 2001; 2002) and of neck/shoulder pain (Ariens et al., 2001, 2002). In general, person-bound determinants like age, fitness, force of muscles, psychosocial problems and work-related determinants such as physical load and psychosocial circumstances may influence the origin of low-back pain or neck/shoulder pain. Work-related risk factors for low-back pain are frequent lifting, awkward back posture, whole-body vibration, low job satisfaction, and little social support from either supervisors or co-workers. Neck flexion, arm force, arm posture, duration of sitting, twisting or bending of the trunk, hand-arm vibration, workplace design, high quantitative job demands and low co-worker support are risk factors for developing neck/shoulder pain.
The national working group on physical workload first investigated those preventive activities that had delivered the best results, the 'best practices', in the eight participating hospitals. The Prevention Programme Physical Workload, developed and implemented in the UMC Groningen with the support of the Northern Netherlands Ergonomists Collective and the department of Human Movement Sciences Groningen, emerged as the most complete, well-founded programme. The programme uses Fishbein and Azjen's (1980) theory of reasoned action, in which the behavioural determinants of attitude, social norm and self-efficacy (ASE) play a key role. In addition to behaviour, the programme deals with technical aspects (the use of aids and adaptations to the workplace) and organizational aspects (employing an ergonomics coach). This approach was adopted by the working group because low-back and neck complaints are predominantly multicausal (Koes and Tulder, 2002).
Taking the existing prevention programme as its starting point in realizing the objectives of the Health and Safety Covenant, the working group drew up an action plan to implement the programme in the eight UMCs. The target group, objectives and operationalization of the prevention programme are explained below.

The target group for the prevention programme comprised hospital personnel from departments with a high physical workload, such as the regular nursing wards, intensive care wards, surgical wards and treatment units. Current Risk Inventory and Evaluations (RI&E) from all participating hospitals were used to establish priorities in terms of severity of physical workload. This was followed by a discussion with expert members (ergonomists and industrial

physiotherapists) of the working group.

The objectives of the Prevention Programme Physical Workload were as follows:

- increasing knowledge of physical workload guidelines
- improving attitude, social influence, self-efficacy (ASE behavioural aspects) and intention with regard to physically demanding working conditions
- reducing locomotor system complaints
- reducing absence as a result of 'locomotor system complaints'
- ensuring that the necessary conditions (ergonomic and organizational) are in place to implement 'safe moving'
- guaranteeing and consolidating the Prevention Programme Physical Workload

Ergocoach

An ergocoach was assigned to the departments, as a vital and integral component of the Prevention Programme Physical Workload, in order to achieve the first two objectives. The coach's job was to identify physically demanding work situations and to discuss them with the person in question at staff meetings or with the manager. Following on from this, the ergocoach offered targeted advice about the least physically taxing transfer technique.

Quickscan

The Quickscan was developed by the Physical Workload working group and could be implemented by both the ergocoach and the physiotrainer before the Prevention Programme Physical Workload was introduced. The quickscan is a checklist which quickly and simply paints a picture of ergonomic conditions within the department. It asks questions about departmental policy on physical workload.

Training

Using the outcomes of the quickscan as a baseline measurement, a customized training programme containing both a theoretical and a practical component was developed for each department. Its purpose was to teach employees to deal with physically demanding working conditions. The training programme utilized the principles of problem solving theory (Johnsson et al., 2002), according to which employees themselves are

responsible for managing physically demanding work by making the right choice from among the possible work adjustments available to them. These are the use of aids, asking a colleague for assistance, spreading the physical workload and effectively instructing the patient.

Physiotrainer

The above training was carried out by a physiotrainer, who was a physiotherapist attached to the department where the prevention programme was implemented. The physiotrainer was specifically trained for this programme and was familiar with the Health and Safety Covenant, the health and safety legislation and the Prevention Programme Physical Workload, as well as with norms and guidelines relating to physical workload. The principle of train-the-trainer was used in the training of UMC personnel. Engels (1998) has called into question the effectiveness of this approach because a member of one's own team has less authority and status among colleagues than an outside expert, such as a physiotherapist. Partly for this reason, the decision was taken to use physiotrainers as teachers.

Aids

Before the Prevention Programme began, all departments were given an opportunity to buy lifting and other aids, which were partly subsidized. The objective was to help reduce physical workload. As a result, the departments were well-equipped when they began the Prevention Programme.

Consolidation

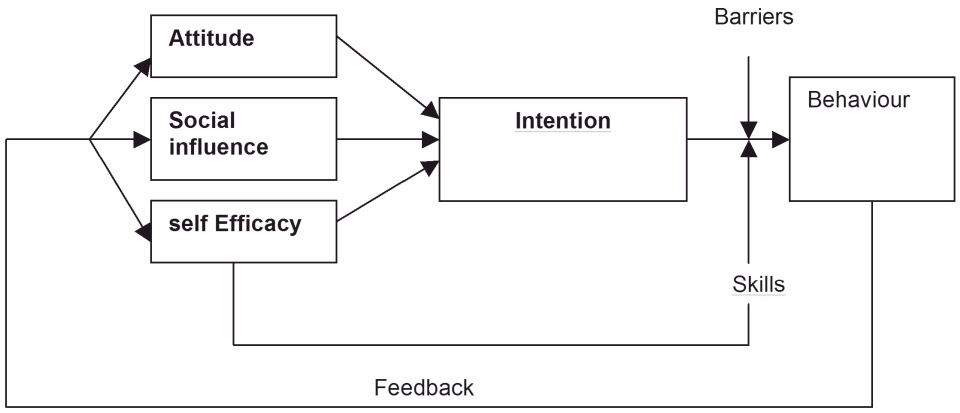
Once the Prevention Programme is underway, it is vital to maintain the knowledge and skill levels, as well as behavioural change in the target group. The ergonomics coach is the linchpin of a good assurance policy. Once the programme has been implemented in the department, the coach must ensure that this issue continues to be addressed. The subject of 'physical workload' is a regular component of departmental staff meetings, the annual review and the annual health and safety plan. In addition, work is carried out in accordance with 'physical workload' protocols. The ergocoaches also need to maintain their level of expertise by attending national ergocoaching days, regional meetings or meetings organized by the UMCs themselves.

Theoretical framework

The theoretical framework underpinning the Prevention Programme Physical Workload is Ajzen & Fishbein's (1980) theory of reasoned action (TRA) (Ajzen et al., 2007). The ASE model (figure 1) assumes that 'intention to change' and

subsequent behaviour are primarily determined by the cognitive variables of attitude, social influence and self-efficacy expectations. It also postulates that intention predicts subsequent behaviour.

Figure 1. The ASE model



The ASE model is derived from the theory of reasoned action (TRA) but incorporates a new dimension, namely Bandura's concept of self-efficacy (De Vries et al., 1988). Once the target behaviour has been learned and implemented, maintenance of or regression to the old behaviour may occur. Behaviour maintenance and regression subsequently affect people's cognitions: they receive feedback on their behaviour because they notice that the behaviour has a number of consequences, for example less back pain. If these consequences are expected, this will result in a reinforcement of the attitude towards, in this case, behaviour that avoids physical strain on the back. If, on the other hand, the consequences are not expected, this can result in a changed attitude. People will also interpret the causes of success and failure in a certain way, which then influences their self-efficacy expectations. Self-efficacy expectations are further influenced by people's skills and the barriers (vis-à-vis the target behaviour) that they encounter. Another key factor is knowledge about risky actions such as lifting, but also about ergonomics, physical workload and adjustment possibilities. People need to know how healthy or unhealthy certain behaviour is before they can consciously undertake behaviour that promotes health. The knowledge that people have about their own lifting behaviour and the ergonomic demands

of their work place determines to a large extent how they weigh up the pros and cons of their behaviour and hence their attitude. Knowledge also affects self-efficacy expectations; successfully carrying out certain behaviour produces a higher self-efficacy expectation, whereby the intention to perform behaviour is more likely to be converted into the desired behaviour. As the model shows, an integrated approach is of the utmost importance because there are a number of factors determining the effectiveness of a programme to reduce physical workload.

Research questions

The global research problem formulated in this PhD thesis is as follows: what is the outcome of introducing the Prevention Programme Physical Workload in eight UMCs as part of the Health and Safety Covenant?

The following questions have been formulated:

1. What are the results of occupational interventions for the primary prevention of musculoskeletal symptoms in health care workers? (a review)

2a. What are the prevalence rates of musculoskeletal neck/shoulder and low-back complaints and the perceived exposure to risk factors?

2b. Is any association present between physical and psychosocial work-related risk factors and musculoskeletal neck/shoulder and low-back complaints?

3. What are the results of a multifactorial intervention programme to reduce physical workload in the nursing profession?

4a. Do ASE determinants (attitude, social influence, self-efficacy) and 'intention to change' change one year after the implementation of an occupational intervention in wards with hospital workers?

4b. Do hospital workers with reduced low-back pain present higher difference scores on the ASE determinants and 'intention to change' than hospital workers with increased low-back pain or whose low-back pain remains unchanged?

5. How do nurses older and younger than 45 perceive their health, their physical and mental work effort and do they present different sickness absence rates?

Guide for the reader

Chapter two, which focuses on question 1, reports on a literature study of thirteen interventions similar to the Prevention Programme Physical Workload. The results of the interventions are compared in terms of the outcome parameters of sickness absence, health and ergonomic conditions.
Questions 2a and 2b are addressed in chapter three, which looks at the prevention of low-back and neck/shoulder complaints among four occupational groups: regular nurses, intensive care nurses, operation room nurses and radiology assistants. It also examines the principal risk factors in working conditions per occupational group, in terms of back or neck/shoulder complaints.
Chapter four, which looks at question 3, describes the results of the Prevention Programme Physical Workload for nurses at the eight UMCs. It addresses sickness absence as a result of locomotor system complaints, low-back and neck/shoulder complaints as well as occupational risk factors.
Chapter five describes the possible impact of the Prevention Programme Physical Workload on the ASE behavioural determinants and the factor of intention, thereby offering answers to questions 4a and 4b. An association is also established between the ASE behavioural determinants and the prevention of low-back and neck/shoulder complaints.
Differences in health perception between younger and older nurses are described in chapter six, which also looks at the difference in absence rates between these two groups. The chapter examines the extent to which factors such as perceived health, physical condition, fatigue and perceived work effort might explain the differences found (question 5).
Finally, chapter seven analyses more closely the key findings of the five previous chapters and places them in a wider context. The implications of the findings for day-to-day practice are discussed and suggestions are presented for follow-up research. The chapter also looks at methodological aspects of the study and at the extent to which the results can be generalized.

[1] University medical centres (UMCs):

- Leiden University Medical Center, Leids Universitair Medisch Centrum (LUMC), Leiden
- Erasmus Medical Center, Erasmus Medisch Centrum (Erasmus MC), Rotterdam
- Academical Medical Center, Academisch Medisch Centrum (AMC), Amsterdam
- VU Medical Center, VU Medisch Centrum (VUMC), Amsterdam
- University Medical Center Utrecht, Universitair Medisch Centrum Utrecht (UMCU)
- University Medical Center Groningen, Universitair Medisch Centrum Groningen (UMCG)
- UMC St Radboud (UMCN), University Medical Center St.Radbout, Nijmegen
- University Hospital Maastricht, Academisch Ziekenhuis Maastricht (AZM)

[2] The trade unions are:
Ambtenaren Centrale Overheids Personeel (ACOP)
Christelijke Centrale Overheids- en Onderwijs Personeel (CCOOP)
Ambtenaren Centrum/Algemene Federatie Zorgsector (AC/AFZ)
Centrale voor Middelbaar en Hogere Functionarissen sector Zorg (CMHF)

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CHAPTER 2

The effects of occupational interventions on reduction of musculoskeletal symptoms in the nursing profession; a review

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Ergonomics, 2006; 49, 706-723

Abstract

Objective: to present more insight into the effects of occupational interventions for primary prevention of musculoskeletal symptoms in healthcare workers.

Methods: the Cochrane Collaboration methodological guidelines for systematic reviews functioned as a starting point for the present review. Thirteen studies meeting the inclusion criteria were analysed for methodological quality and effects. Eight outcome areas were established and defined as areas whereupon an effect was determined in at least 2 studies. A method based on levels of scientific evidence is used to synthesize the information available.

Results: strong scientific evidence for the beneficial effect of occupational interventions is found for the areas physical discomfort, technical performance of transfers and the frequency of manual lifting. Insufficient evidence is found for the areas absenteeism due to musculoskeletal problems, musculoskeletal symptoms, fatigue, perceived physical load and knowledge. Training and education combined with an ergonomic intervention is found to be effective.

Introduction

Prevalence rates of musculoskeletal symptoms, low back pain in particular, are high in the European working population (Smulders et al., 1998). More than half of the working population reports having had back pain in the past 12 months, and 26 % of the working population reports back pain quite often (Hildebrandt et al., 1995). Musculoskeletal symptoms are an important reason for sickness absence and disability; more than 20 % of the employees on long-term absenteeism and about 25-30% of the employees permanently work disabled are diagnosed as having musculoskeletal symptoms (Fanello et al., 2002, Smulders et al., 1998, Statistics Netherlands, 2002).

As for musculoskeletal symptoms no branch or trade escapes the problem. In general, health care workers also have a high prevalence of musculoskeletal symptoms (Smulders et al., 1998, Statistics Netherlands 2002, Workers Insurance Company 2004). In a hospital setting, particularly for bedside work, physical risk factors for musculoskeletal disorders, like manual handling of patients and flexion and rotation of the trunk are apparent (Hoogendoorn et al., 2000). Besides, high work pressure is considered an additional psychosocial risk factor (Hoogendoorn et al., 2001; 2002).

At present, eight university hospitals in the Netherlands are developing a programme for their workers aimed at preventing musculoskeletal symptoms and sickness absence due to these symptoms. This programme is part of a

covenant for Safety and Health (University Hospitals Associaton, 1999), an agreement between the Dutch government and several branches, in this case university hospitals (50.000 employees), to improve working conditions and reduce sickness absence. The programme combines different approaches since various interrelated factors may cause musculoskeletal symptoms. One part of the programme is the training and education of employees by addressing worker behaviour. Insight into the effect of training and education, alone or in combination with other interventions, on physical load and sickness absence of health care workers in particular is useful for updating the programme. Occupational interventions can be categorised as ergonomic interventions such as redesign of a workplace, interventions to improve health by physical exercise, education and training addressing workers' behaviour and organisational interventions such as changes in work procedures (Zwerling et al., 1997).

Interventions in health care are interesting because health care has, at several levels, specific characteristics due to patient-related work processes. The most significant factor is patient handling, i.e. close contact with another human being in need of help and support. Patient handling is considered rewarding but also demanding for the nurse (Lagerstrom et al.,1998). Second, the hospital organisation is hierarchical and a nurse has to adapt to several supervisory levels, as well as to the demands of the patients (Lagerstrom et al.,1998). The third characteristic of the health care field is the working population as such. Nursing is primarily a female career, and gender differences may be explanatory in the relation between work-related physical and psychosocial risk factors on the one hand and musculoskeletal symptoms on the other (Hooftman et al., 2004).

The aim of the present review is to obtain insight into the effects of occupational interventions for primary prevention of musculoskeletal symptoms in health care workers. Such a review is not yet available and the results may be interesting for professionals and health care managers, ergonomists and other professionals in environmental health dealing with daily practice.

Methods

The guidelines of the Cochrane Collaboration Centre serve as a starting point for this literature study (van Tulder et al., 1997). The purpose of these guidelines is to offer guidance to researchers preparing high-quality reviews. The steps to be followed are a literature search, formulation of in- and

exclusion criteria, determination of methodological quality, gathering and analysis of the results, and description of the effect areas. Databases of Medline, Embase, Cinahl, and WebScience are used, as well as the Cochrane Collaboration Library and other scientific peer-reviewed articles. The search covers the period between 1985 and 2005. Because of the rather specialized issue, it was expected to find only a few references. Therefore, we searched over a twenty-year period. During the search a combination of words of 2 columns was used (see Table 1). The search was done with both MeSH and keywords.

Table 1. Sets of keywords and MeSH used in the search strategy

Physical load & factors	Musculoskeletal symptoms	Intervention	Results
lifting physical load	back low back pain musculoskeletal pain back pain injury lumbago disorders spinal disease backache	programme programme prevention evaluation management intervention ergonomic/ergonomics training implementation behaviour occupational vocational education	effect effectiveness effectively reduction behaviour sickness absence

The articles were selected by close reading titles and abstracts. Inclusion criteria were:

- the target group of the intervention are employees working in health care;
- the objective of the intervention is primary prevention of musculoskeletal symptoms;
- the intervention aims to reduce physical load by explicitly described education/training;
- an effect evaluation took place by means of an RCT, CCT or CT design;
- at least one of the following outcome variables is described: musculoskeletal symptoms, sickness absence, exposure to physical load;
- the article is written in the Dutch or English language.

Exclusion criteria were:

- the intervention consisted of physical exercise or introduction of mechanical aid only;
- the interventions focussed on employees on sickness absence only;
- the interventions focussed on individual employees.

A discussion ensued with the third author (AS) in case of doubt about in- or excluding a study (which resulted in the agreement that) when the same outcome variable was described by at least two studies, it was defined as an effect area. A method based on levels of evidence was used to synthesize the available information. The rating system was applied on each effect area and consisted of three levels of scientific evidence:

- strong: consistent findings in multiple high-quality studies;
- moderate: consistent findings in one high quality study and one or more low quality studies or more low-quality studies;
- insufficient: only one study available or inconsistent findings in multiple studies.

A study with a RCT or CCT design was labelled high quality, a study with a CT design low-quality. The findings of the studies were labelled inconsistent when less than 75% of the studies available reported the same conclusion.
Of the studies included the methodological issues were evaluated by using a criteria checklist (van Tulder et al., 1997) specifically developed for systematic reviews. The original checklist was intended for clinical examination, so five adjustments have been made mainly because the criteria involved were not applicable (see Appendix 1). The remaining categories were evaluated: sample size, study design and randomisation, follow-up period and instruments used. Because of structuring the variables, which were described at least two times, a taxonomy was used (Beaton et al., 2001).

Results

The literature search in the various databases resulted in the identification of 250 publications. Thirteen studies met the aforementioned inclusion criteria. Table 2 presents a summary of the studies with the type of intervention and the results evaluated of each intervention.
Nursing home nurses and coordinators are the two groups included in the study of Engels (et al., 1996, 1998). The study population in all thirteen cases are nurses or nursing aides/assistants, in most cases working in a hospital.

Table 2. Summary of studies included with population, kind of intervention, additional interventions and results

Author	Study population	Training intervention	Additional intervention	Results of intervention (region)
Hartvigsen et al., 2005	home care nurses N=345	-educated in body mechanics, patient transfer, and lifting techniques according to the Bobath-principle and use of low-tech ergonomic aids in small groups. -length of training is 2 hours meetings, 4 times during 7 months.	-	- no decrease of musculoskeletal symptoms (low back) - participants thought education was helpfull
Peterson et al., 2004	nursing assistants at state-run veterans' home N=53	-determination of risk-factors. -training package with data, minivideo's, hands-on demonstration and case studies. Length of training is unknown.	–	- no decrease of musculoskeletal symptoms or discomfort - no increase of general health - increased understanding of riskfactors, ergonomic principles and patient-handling techniques (=increased knowledge, p<0.01)
Fanello et al., 2002	hospital nurses, nursing assistants, cleaning staff N=272	- theoretical training in safe posture and patient handling. - 'on-the-job' training. - length of training is 6 days.	–	- no decrease of musculoskeletal symptoms (low back)
Johnsson et al., 2002	hospital and home care nurses N=51	- theoretical training in problem-solving (analysis model to select optimal transfer action) and practical training in patient transfer performance of 7 courses. - focus on patient perception, quality of care and risk factors.	–	- no decrease of musculoskeletal symptoms (neck/shoulder, low back) - less physical discomfort (p<0.05) - no decreased perceived physical exertion - improved technical performance of transfers (p< 0.00) - no decrease of job strain - no difference in effectiveness of learning models
Alexandre et al., 2001	nursing aides N=56	-education of ergonomic aspects in work. -train-the-trainer (physiotherapists).	physical exercise of 6 modules, 2 times a week, four months	- Decrease of musculoskeletal symptoms: cervical pain (last 2 months, p=0.01) and 7 days (p=0.00) and reduction of pain intensity last 2 months, p=0.003) lumbar pain intensity (last 7 days, p=0.01)
Yassi et al., 2000	hospital nurses, nursing assistants N=346	- 3 hours training of both experimental groups; problem based, hands-on educations of back care and handling techniques coupled with practice using equipment available on the wards.	ergonomic intervention: - safe lifting: use small manual equipment (group B) - no-strenuous-lifting group (group C) - use additional mechanical and other aid equipment	- no decrease of sickness absence - decreased musculoskeletal symptoms in B group (shoulder p=0.01, low back p=0.01) - less fatigue (p<0.00) - less physical discomfort (p<0.00) - decreased frequency of manual lifting in C group (p<0.00)
Lynch and Freund, 2000	hospital nurses N=104	- 1 hour training of nurses about risk factors for back injuries and control strategies including engineering controls and the use of proper body mechanics when handling patients, including a hands-on segment. - educate trainers (nurses).	ergonomic intervention: - use additional mechanical and other aid equipment	- lower sickness absence: low back injuries is 30% lower than average of 3 previous years. - decreased musculoskeletal symptoms (low back, p-=0.02) - decreased frequency of manual lifting (p=0.02) - increased knowledge of risk factors (p=0.01) - no increase in use of equipment or mechanical lifts

Author	Study population	Training intervention	Additional intervention	Results of intervention (region)
Engels et al., 1998	nursing home nurses N=225	- ergonomic-educational course for nurses, length course is unknown.	organisational intervention: - implementation of guidelines and protocols- imbedded programme into organisation by activities of a steering committee(appointing a trainer)	- no decrease of sickness absence - no decrease of musculoskeletal symptoms (neck, shoulder, upper back, low back, hip, knee) - no decrease of perceived physical load - no increase of knowledge - no decrease of perceived time pressure
Engels et al., 1998	nursing home nurses trainers N=24	- training reduction physical workload inherent to patient lifting and other nursing activities, length training is unknown. - coaching skills	–	- no increase of perceived exertion - improved technical performance of transfers / harmful postures p<0.01) - decrease of exposure of harmful postures and lifting (p<0.01)
Lagerstrom et al., 1998	female hospital nurses N=348	-1-day training in patient handling - course stress management and – control	physical exercise - fitness	- no decrease of musculoskeletal symptoms (neck/shoulder, elbows, hands, low back, knees, ankles/feet) increase of upper back (p<0.00) and hip symptoms (p<0.00) improved technical performance of transfers, increased motivation using learned transfers
Feldstein et al., 1993	nurses and nursing assistants N=55	-2-hour instruction session about proper body techniques, transfer techniques, use of equipment and a problem identification session on environmental hazards. - practice every two weeks, total 8 hours - problem-solving	–	- no decrease of musculoskeletal symptoms (low back) (pain and fatigue) -improved technical performance of transfers (19%, p=0.00)
Garg and Owen, 1992	nursing home nurses N=57	- determination of patient handling tasks - training nursing assistants in use of devices (2 training sessions of 2 hours) - applying techniques to patient care	ergonomic intervention - modifying toilets and shower rooms	- decrease of musculoskeletal symptoms (back injuries, 43% lower) - decrease of perceived exertion (p<0.01) - decrease of biomechanical stress (p<0.01) - decrease of exposure of patient transfers
Videman et al., 1989	N=255 nursing students	-training on patient-handling skills described by Troup and Rauhala, total 40 hours over 2.5 years.		- no decrease of musculoskeletal symptoms (back pain) - higher skill assessment than control group (p<0.001)
Wood, 1987	Nurses of a geriatric hospital N=3 x 75-bed units	-evaluation of ability to perform safely a transfer -trainer follows nursing staff individually during work for 30 minuters and gives feedback -summarizing, 1- hour classroom demonstration covering body mechanics, lift and transfer techniques and use of equipment	- personnel programme; increasing the effectiveness of the existing procedures used to process wage-loss claims.	-decrease of back injuries (in combination with additional intervention) (p<0.001)

Fanello (et al., 2002) also included cleaning staff. Johnsson et (al., 2002) and Hartvigsen (et al., 2005) included nurses working in a hospital and home care nurses, The nursing aides in the study of Alexandra (et al., 2001) reported having more than 6 months low back pain without sickness absence. In one study, the study population were students at baseline and graduated nurses at follow-up (Videman et al., 1989).

A theoretical and practical training about characteristics of physical load, risk factors, ergonomic rules and patient transfers made part of all interventions. The training-part lasted from one hour (Lynch and Freund 2000) till six days (Alexandre et al., 2001).

In the study of Johnsson (et al., 2002) the participants learned to work with a problem solving model which meant that in transfer situations the carer had to consider his or her own capability, the resources and needs of the patient and the possibilities and limitations of the environment, and accordingly choose the optimal patient handling method. Feldstein (et al., 1993) also uses a kind of problem solving session.

Education and training programmes are often used to improve the competence of employees, also in health care. The current tendency is to combine different approaches in a single programme since various interrelated factors may cause musculoskeletal problems. In the selected studies seven interventions combine training and education with an additional intervention. Yassi (et al., 2000), Lynch and Freund (2000) and Garg and Owen (1992) combine training with the introduction of mechanical equipment to assist in patient transfers. Training, physical exercise and fitness is combined by Alexandra (et al., 2001) and Lagerstrom (et al., 1997). By means of installing a steering-committee in a nursing home Engels (et al. 1998) paid attention to organisational aspects such as commitment and co-operation of the manager. The responsibilities of this committee include finding solutions to reduce the physical workload, attending meetings with coordinators and stimulating activities which contribute to the continuity of the programme. In the study of Wood (1987) a Personnel Programme was followed by a Back Programme.

Fifteen different outcome variables are described in the thirteen studies. Of these perceived physical exertion, job strain, effectiveness of the learning model, postural load, perceived time pressure, the motivation of using the transfers learned and biomechanical stress are described only once. The eight variables described at least two times are classified in a taxonomy, existing of economic, health and ergonomic outcomes. In this taxonomy

we assumed musculoskeletal health and wellbeing will influence sickness absence (economic outcome) (Hignett, 2001). Ergonomic interventions can be used tackling problems due to physical load and manual handling, which, in turn, can influence musculoskeletal health (Kemmlert, 1996). In the category economic outcomes absenteeism due to musculoskeletal problems is mentioned 4 times. The category health outcomes contains musculoskeletal symptoms (13), fatigue (2), physical discomfort (2) and perceived physical load (4). The category ergonomic contains technical performance of transfers (5) frequency of manual lifting and working in a harmful postural load (4) and knowledge of risk factors at work and ergonomic principles (3).

Methodological issues

Table 3 summarizes the methodological issues of the studies included.

Three of thirteen studies have a RCT design (Alexandre et al., 2001, Fanello et al., 2002, Yassi et al., 2000). A control group is present in eight studies in which a pre- and post-test was performed (Engels et al., 1996, Feldstein et al., 1993, Hartvigsen et al., 2005, Johnsson et al., 2002, Lynch and Freund 2000, Peterson et al., 2004, Videman et al., 2005, Wood et al., 1987). For reasons of the study design these eleven studies are rated as high quality. Two studies do neither include a control group nor a RCT design and are therefore rated as low quality studies (Garg and Owen 1992, Lagerstrom et al., 1997). The smallest sample size consists of 51 respondents (Johnsson et al., 2002) and Yassi's (et al., 2000) sample size of 348 respondents is the largest.

The follow-up period ranges from directly after the intervention (Garg and Owen, 1992, Lynch and Freud 2000) to four years (Lagerstrom et al., 1997) after the intervention. All studies use self-report instruments such as questionnaires and visual analogue scales. Johnsson (et al. 2002), Lynch and Freund (2000), Engels (et al. 1998), Feldstein (et al. 1993), Garg and Owen, (1992) and Videman (et al. 1989) make use of observational techniques for measuring outcome variables. Knowledge of risk factors in work is measured with a self constructed test (Lynch and Freund 2000, Peterson et al., 2004). Other techniques used in the studies are interviews (Garg and Owen, 1992, Lagerstrom et al., 1997), specific motorial tests (Feldstein et al., 1993), and biomechanical stress-measurement (Garg and Owen 1992). Wood (1987) counts the number of wage loss claims as a result of back incidents. At baseline the intervention and control group in the study of Engels (et al., 1998) differ in characteristics: the control group has more managerial tasks and a larger percentage is performing exercise in spare time. The intervention group

Table 3. Methodological issues of included studies

Author	Study design	Intervention group	Follow-up length	Instruments
Hartvigsen et al., 2005	CCT baseline and follow-up with control group -control group N=115	N=140	2 years after baseline	- Nordic questionnaire* supplemented with information on number of episodes of LBP and care seeking due to LBP during the past year.
Peterson et al., 2004	baseline and follow-up with 3 groups -control group N=14 -training and reinforcement by research assistant -training and reinforcement by registered nurses	nursing assistants N=17 registered nurses N=8	1 month after intervention	- questionnaires to asses top 20 risk factors and obstacles† - videotape to evaluate work environment - knowledge test
Fanello et al., 2002	RCT with matching (sex, age and function) Control group N=136	N=136	24 months	- EIFEL Scale*
Johnsson et al., 2002	CT baseline and follow-up with 2 intervention groups	N= 51, divided into 7 groups	6 months	- observation from video with 7- item checklist - Nordic scale* - Borg scale*
Alexandre et al., 2001	RCT Control group N= 29	N=27	Immedialety after intervention	- VAS scale*
Yassi et al., 2000	RCT with 3 groups A = control group N=103; B = safe lifting; C = no strenuous lifting	N=116 (B) N=127 (C)	6 months and 12 months	- interview - VAS scale*, SF 36*, DASH*, Owestry LBP Disability* - absenteeism database
Lynch and Freund, 2000	CT baseline and follow-up measuring with control group N=45	N=59	1 month and 2 months	- knowledge test† - observation in work situation with checklist† - questionnaire
Engels et al., 1998	coordinators: baseline and follow-up measuring with control group (N=12) in a laboratory setting	N=12	3 months and 15 months	- observation (OWAS)* from video - Borg scale* - Checklist†
	nurses: baseline and follow-up measuring with control group (N=126)	N=75	12 months	- knowledge examination† - Nordic-scale*
Lagerstrom et al., 1998	CT baseline and follow-up measuring	N=348	every 12 months during a 4 year period	- Nordic-scale*, physical exposures, patient handling, Borg CR-scale* - evaluation of training - interviews with management and nurses

Author	Study design	Intervention group	Follow-up length	Instruments
Feldstein et al., 1993	Baseline and follow-up measuring with control group (N=25)	N=30	1 month	- questionnaires (pain, general information) - flexibility test - proprioception test - observation
Garg and Owen, 1992	CT baseline and follow-up measuring	N=57	immedialety after intervention	- Borg RPE- scale* - observation - biomechanical model
Videman et al., 1989	CCT baseline and follow-up measuring, control group (N=113)	N=87	every 3 months during school and 1 year after graduation	- assessment of skills on video with checklist† - assessment of anthropometric aspects - questionnaires MHQ*, MPI*, LES* (cognitive, emotional and motivational aspects, health locus of control, satisfaction and strain)
Wood, 1987	CCT measuring of a 1 year period before and after the intervention with 1 control 75-bed unit.	N= 2 x 75-bed units	1 year after the intervention	- count number of wage-loss claims caused by interaction with patients

*psychometric properties satisfactory
†Instrument is not described

appears to have more symptoms of the shoulder and upper arm. Lynch and Freund (2000) and Yassi (et al., 2000) do not address the issue of the inclusion of groups with equal characteristics.
Each study explicitly specifies criteria for the selection of the target groups; the intervention and the outcome variables are described properly as well. Information about other simultaneous interventions affecting the target group is not mentioned by any of the studies, neither are the opposite effects of the intervention under study. Drop-outs within each study with the exception of the study of Yassi et al. (2000) in which information about this issue is not available, is known (0-30%) and seems acceptable.

Level of effect
The effect areas, listed in table 4, are indicated + when positive differences were found and - when no differences were found.
The aim of all thirteen studies has been to establish a decrease in (the frequency of) musculoskeletal symptoms. Four of them (Alexandre et al., 2001, Garg and Owen, 1992, Lynch and Freund, 2000, Yassi et al., 2000, Wood 1987) actually report a significant decrease, an almost fifty percent success rate.
By applying the rating system it is possible to determine the level of evidence of each effect area. As to the effects of preventive occupational interventions aimed at lowering physical load, strong evidence is available that these interventions result in less physical discomfort, improved technical performance of transfers and lowering the frequency of manual lifting. More than 75% of all results point in the same direction. In addition, the evidence that interventions result in a decrease of absenteeism due to musculoskeletal problems, a decrease in musculoskeletal symptoms, less fatigue, lower perceived physical load and increased knowledge of risk factors in work is insufficient. Findings on these areas were inconsistent in multiple studies.
With regard to the ergonomic effect-area the results obtained are more positive as compared to the health and economic effect-area. In the ergonomic area 11 out of the 12 results mentioned are positive. In the health area 50% (10 out of 21) are positive. One positive result is found among the four results described in the economic area.
One type of intervention, education and training, has been evaluated by six studies (Fanello et al., 2002, Feldstein et al., 1993, Johnsson et al., 2002, Peterson et al., 2004). Not one of them found a decrease of musculoskeletal symptoms. Six studies (Alexandre et al., 2001, Engels et al., 1996, Garg and

Table 4. Results on the economic, health and ergonomic level and eight effect areas

		Taxonomy	Economic	Health				Ergonomic		
Author	Design	Effect areas:	Lower absenteeism due to musculo skeletal symptoms	Decreased musculo skeletal symptoms	Less fatigue	Less physical discomfort	Lower perceived physical load / exertion	Improved technical performance of transfers	Lower frequency of manual lifting or harmful postures	Increased knowledge
		Additional intervention:								
Yassi et al., 2000	RCT	Ergonomic intervention	-	+	+	+			+	
Alexandre et al., 2001	RCT	Physical exercise		+						
Fanello et al., 2002	RCT	-		-						
Hartvigsen et al., 2005	CCT			-						
Peterson et al., 2004	CCT	-		-						+
Johnsson et al., 2002	CCT	-		-		+	+	+		
Lynch and Freund, 2000	CCT	Ergonomic intervention	+	+					+	+
Engels et al., 1998 -coordinators -nurses	CCT	Organizational intervention	- -	-			- -	+	+	-
Feldstein et al., 1993	CCT	-		-	-			+		
Videman et al., 1989	CCT			-				+		
Wood, 1987	CCT	Organizational intervention		+						
Lagerstrom et al., 1998	CT	Physical exercise		-				+		
Garg and Owen, 1993	CT	Ergonomic intervention		+			+		+	
(+/total effect area)			1/4	5/13	1/2	2/2	2/4	5/5	4/4	2/3
(+/total of kind of outcome)			1/4	10/21				11/12		

- = no effects are found
+ = proof for effects

Owen, 1992, Hartvigsen et al., 2005, Lagerstrom et al., 1997, Lynch and Freund 2000, Videman et al., 1989, Yassi et al., 2000) evaluated two types of interventions simultaneously, three of them (Garg and Owen, 1992, Lynch and Freund, 2000, Yassi et al., 2000) combined education with ergonomic interventions, two (Alexandre et al., 2001, Lagerstrom et al., 1997) combined education with physical exercise and two (Engels et al., 1996, Wood 1987) combined education with organisational interventions. The two studies that combined education and ergonomic interventions both found a decrease of musculoskeletal symptoms and lower exposure of manual lifting. Which part of the intervention is responsible for which part of the results remains unclear. Improved technical performance of transfers was found in five studies (Engels et al., 1996, Feldstein et al., 1993, Lagerstrom et al., 1997, Lynch and Freund, 2000, Videman et al., 1989) whereas musculoskeletal symptoms were unchanged. This information indicates that training and education alone is not sufficient for a decrease in musculoskeletal symptoms. Training and education combined with an ergonomic intervention, i.e. use of additional mechanical or other aid seems to be effective and can partly be explained by a decrease in frequency of manual lifting.

Discussion

The aim of this review is to obtain more insight in the effects of occupational interventions for primary prevention of musculoskeletal symptoms in health care workers. Knowledge of the effects is useful for decision-making about development and implementation of prevention programme. Interventions directed towards a decrease in musculoskeletal symptoms in health care workers are interesting because of the specific demands of patient-related work processes and the working population as such. Thirteen studies met the inclusion criteria and eight result areas were determined. About these effect areas, we found that ergonomic effect-areas have more positive effects than health and economic effect-areas. A possible explanation may be that the relation between the intervention and the ergonomic effect area is direct; the relation between practical training in performing patient-transfers and improved technical performance is obvious. The relation between an intervention and sickness absence is much more complicated. Many individual and organisational factors influence the decision of the employee to report sick.

The results of this review bring us to the conclusion that training and education

alone is not sufficient for a decrease in musculoskeletal symptoms. However, in combination with an ergonomic intervention i.e. the use of additional mechanical or other aid equipment, a decrease of musculoskeletal symptoms can be achieved. The use of multifactorial interventions in daily practise seems to be preferable. This conclusion is in line with the findings of Johnston (et al. 1994), who indicated in a review that training alone is insufficient.

In the present review five out of thirteen studies found a significant decrease of musculoskeletal symptoms, which is less than half of the studies. Musculoskeletal symptoms are often stable in time. It has been stated that once musculoskeletal symptoms have developed, they may not necessarily be cured, even if a new well-developed work technique has been introduced among the employees (Kemmert et al., 1993). Therefore it is questionable whether it is possible to measure a decrease in musculoskeletal symptoms after one year or earlier. Another issue is the definition of the outcome variable i.e. musculoskeletal symptoms. In this review, all studies evaluated low back pain as a complaint area. Some studies also involve symptoms of neck and shoulders and two studies involve other regions of the body. A complaint is broadly defined, the type of complaint is not circumscribed and ranges from acute traumatic injury to work-related musculoskeletal disorder. Ideally, one uses complaint rates as the outcome variable in an evaluation of interventions, since the ultimate goal of the intervention is to prevent injuries. In case a reduction of the targeted injuries is obtained, it is likely that the intervention is effective. So far however, it is not known how an intervention directed towards occupational injury is working exactly. Further research is needed to understand which type or characteristic of symptoms or injury the intervention is trying to prevent (Zwerling et al., 1997). More specific outcome variables are necessary in order to understand the underlying mechanisms.

Further explanation of the contradictory results may be that different work-related factors are relevant for new episodes and/or for the maintenance of musculoskeletal symptoms. Evidence is available that in the nursing profession low-back pain and its consequences are affected by physical and psychosocial factors (Hoogendoorn et al., 2001).

Two of the studies included (Engels et al., 1996, Johnsson et al., 2002) evaluate psychosocial factors in relation to musculoskeletal symptoms, in both studies no significant differences were established.

Most of the studies included in this review have some limitations concerning study design, definition of samples, power or outcome variables. Retrospective self-report questionnaires generate uncertainties as a result of recall bias and

may influence the registered data as to frequency as well as the start and intensity of a period of musculoskeletal symptoms.
Although beyond the scope of the present paper we realise that the quality of the training and the organisational factors are influencing the effects of intervention-programmes (Bongers et al., 1993). A variety of individual factors, such as motivation, attitude, usefulness and relevance of the newly learned knowledge or behaviour all contribute to the transfer from training to job.
One specific methodological shortcoming within this study should be mentioned. Due to the inclusion criteria, the number of articles included is relatively low. However, the aim of the present review was to obtain information about the effects of interventions including training and education; the information obtained is useful for us in order to execute additional research into prevention programmes.

Appendix 1 - Criterion checklist of methodological quality

Criterion	
Eligibility criteria are specified	
Randomisation is performed	
Treatment allocation is concealed	NA[1]
Similar groups at baseline regarding the most important prognostic indicators	
Care provider is blinded to the intervention	NA[1]
Explicitly described intervention	
Co-interventions are avoided or comparable	
Compliance in groups is acceptable	
Patient is blinded to intervention	NA[1]
Outcome assessor is blinded to the intervention	NA[1]
Adverse effects are described	
Withdrawal/drop-out rate is described and acceptable	
Short-term follow-up measurement is performed	
Long -term follow-up measurement is performed	
Timing of the outcome assessment in both group is comparable	
Sample size for each group is described	
Intention-to-treat analysis is performed	NA[1]
Variability and point measurements are described for the primary outcome measures	

[1]NA not applicable

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CHAPTER 3

Risk factors and musculoskeletal complaints in non-specialized nurses, IC nurses, operation room nurses, and X-ray technologists

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Abstract

Objectives: to gain more insight into the prevalence rates of musculoskeletal complaints of neck-shoulder and low back and to determine the relation between physical and psychosocial work-related risk factors and the complaints mentioned in non-specialized nurses, operation room nurses, Intensive Care (IC) nurses and X-ray technologists.
Methods: the study population consists of 3169 employees affiliated to eight university hospitals in the Netherlands. The study was conducted using a cross-sectional survey design. The parameters under study were having or having had (severe) low back or neck-shoulder complaints during the past year. In logistic regression analyses odds ratio's and CI 95% were estimated for all relevant risk factors for each of the four professional groups.
Results: in all groups prevalence rates of musculoskeletal complaints were high: low back 76%, neck-shoulder 60%. Operation room nurses perceived more neck-shoulder complaints (twelve months prevalence) than non-specialized nurses and IC nurses perceived less severe low back complaints than non-specialized nurses. Four physical risk factors and one psychosocial factor were associated with low back complaints in all groups.
Conclusions: the results of the present study indicate that both low back complaints and neck-shoulder complaints are major health problems in the four professional groups under study. The prevalence rate of neck-shoulder complaints in operation room nurses is higher than in non-specialized nurses and IC nurses, the latter groups having high prevalence rates already. The exposure to risk factors is perceived differently by each of the professional groups. The professional groups under study all are target for preventive interventions; these interventions need to be specified for each of the professional groups.

Introduction

In health care, several groups of professionals can be distinguished, each with its own occupational health problems. Non-specialized nurses, Intensive Care (IC) nurses, operation room nurses and X-ray technologists do have to deal with risk factors for musculoskeletal complaints. More specifically, nurses as the largest professional group, are at high risk of work-related musculoskeletal disorders. Low back complaints are the most frequently reported musculoskeletal complaints in nurses, with a past-year prevalence of 30-60% (Trinkoff et al., 2003;Engels et al., 1996;Lagerstrom et al., 1995;). However, other studies also reported neck and shoulder complaints in 30-48% and 43-53% of the nurses (Lagerstrom et al., 1995) respectively.
Several studies associate risk factors in nursing with musculoskeletal complaints; bending, twisting, and other manual tasks are regarded as causal factors in nurses' back injuries (Lagerstrom et al., 1998; Engels et al., 1996; Engels et al.,

1994). In one study, nurses were found to be at particular risk of back injury during patient transfers, which requires sudden movements in non-neutral postures (Engkvist et al., 1998). Related to low back complaints, extreme flexion of the trunk and frequent heavy lifting are also risk factors in nursing (Trinkoff et al., 2003). Engels found that lifting, awkward posture, and stooping were associated with arm and neck complaints (Engels et al., 1996).

Other health care professionals, such as operation room nurses and X-ray technologists, also have to deal with physical and psychosocial work-related risk factors for musculoskeletal complaints. IC nursing should be considered as another high-risk specialism; because of their critical conditions patients in intensive care units require physically demanding care. Therefore, figures on musculoskeletal complaints in IC nurses may be different from nurses in general.

In the Netherlands, a survey among operation room nurses reported a past-year prevalence of low back complaints of 58%, whereas 53% reported neck complaints in the past three months (Meijsen, 2004). One study, using a direct observation method, found that operation room nurses were exposed to prolonged awkward work positions during operations (Kant et al., 1992).

According to Kumar, X-ray technologists' work was found to be biomechanically quite demanding (Kumar et al., 2003). Tasks such as repositioning patients horizontally and lifting patients from a wheelchair caused high lumbosacral compression loads.

The relationship between risk factors and musculoskeletal complaints in the work of the professional groups mentioned above is far from clarified; only limited information is available. More specific information on risk factors and musculoskeletal complaints is needed for preventive interventions in order to reduce musculoskeletal complaints. The present study examines the relation between musculoskeletal complaints and work-related risk factors in four health care professions: non-specialized nurses, IC nurses, operation room nurses and X-ray technologists.

The aim of the current study is twofold: on the one hand to gain more insight into the prevalence rates of musculoskeletal complaints of neck-shoulder and low back and the perceived exposure to risk factors, on the other hand to determine the relation between physical and psychosocial work-related risk factors and the musculoskeletal complaints mentioned.

Materials and Method

Definitions

In the literature a variety of definitions of musculoskeletal complaints as well as episodes of complaints are reported (de Vet et al., 2002). In one study, a musculoskeletal complaint is defined as having pain, problems or experiencing discomfort in the low back and neck-shoulder region (Kuorinka et al., 1987). Parameters under study were: (1) having or having had low back complaints or (2) neck-shoulder complaints during the past twelve months. These parameters are used frequently, also in more recent studies (Picavet et al., 1999; Hildebrandt 1995; Lagerstrom et al., 1995), enabling us to compare the results of the present study with reference data. Besides, we studied a subpopulation with severe low back and neck-shoulder complaints. Complaints are defined as severe when they were indicated as prolonged or occurred more than 10 times a year (de Vet et al., 2002).

Methods

The study population consisted of 3169 employees of eight university hospitals spread over the Netherlands. From January 2001 to December 2003 non-specialized nurses working on clinical wards providing low and medium care, IC nurses providing high specialized care, operation room nurses and X-ray technologists were invited to participate in a survey. The manager of each team introduced the study in a work progress meeting. In addition, the subjects received written information explaining the aim and interest of the study; at the same occasion confidentiality was guaranteed. The study was conducted using a cross-sectional survey design. In the study the Dutch Musculoskeletal Questionnaire (DMQ) (Hildebrandt et al., 2001) was administered. The DMQ is a standardized questionnaire, partly derived from the Nordic Musculoskeletal Questionnaire (Kuorinka et al., 1987), the Dutch Questionnaire on Work and Health (Winter and Grundemann, 1992) and the The Leiden Quality of Work Questionnaire (van der Doef, 2000). The DMQ includes questions on personal and demographic variables such as height, weight, function, having managerial tasks, working hours, work in the past and lifestyle. Furthermore, the questionnaire includes items on musculoskeletal complaints, musculoskeletal workload, health, tasks and psychosocial working conditions. The questions on musculoskeletal workload are categorized into five factors: force exertion, dynamic load, static load, repetitive load and ergonomic environmental conditions (Appendix 3.1). The homogeneity of the

factors used was found to be satisfactory; the Cronbach's alpha varied from .70 (ergonomic environment) to .86 (force exertion). Additionally, according to Hildebrandt, four single items are used: 'sitting, standing and walking often at work' and 'having often to deal with uncomfortable postures at work'.
The divergent validity of the indices, assessed by computing intercorrelations with an index of psychosocial working conditions, was satisfactory as well. The Cronbach's alpha of the psychosocial factors varied from .57 (job autonomy) to .76 (job demands) (Van der Doef, 2000; Winter and Grundemann, 1992). Discriminative power was good; significant associations of most sectors with musculoskeletal complaints demonstrated concurrent validity (Hildebrandt et al., 2001). Most answering categories were dichotomous (yes/no) and some were on a four-point scale.

Analyses
The questionnaires were scanned electronically and data were cleaned using logic, range, and consistency checks. Reliability figures based on the present population were checked using Cronbach's alpha, the figures varied across the constructs from .70 (ergonomic environment) to .86 (force exertion) in case of the physical factors and .56 (work organisation) to .72 (task control) for the psychosocial factors (appendix 3.1). The internal consistency of the construct 'work organisation' was moderate (.40-.60), the other constructs were satisfactory (.60-.80) or good (>.80) (Nunnally, 1967).
Cross tables, including ANOVA ($p< 0.1$), were generated to describe the prevalence of musculoskeletal complaints and risk factors in the four groups of health care professionals. For reasons of comparison the non-specialized nurses have been taken as the reference group. Health care professionals with complaints of low back or neck-shoulder in the past twelve months were included in the analyses, whereas the workers with complaints were compared with co-workers of the same professional group without complaints.
Potential physical (5 factors and 4 items) and psychosocial risk factors (5 factors) in the work situation were related to the complaints reported using univariate and multivariate logistic regression. Subsequently, univariate logistic regression was used for the selection of risk factors ($p< 0.1$). Person-bound variables such as age, body mass, length, duration of employment, working hours per week (all treated as continuous variables) gender and managerial function (treated as binary variables) were included in the analysis. Risk factors indicated and person-bound variables were subsequently entered in a model for multivariate regression (method 'enter'). Furthermore, 95% confidence

intervals (CI) and Odds Ratios (OR) were computed. This procedure was carried out for each of the four professional groups separately. A probability level of $p< 0.05$ was accepted as statistically significant. The analyses were performed using SPSS 12.0 (Huizingh, 2002).

Results

Completed questionnaires were returned by 3169 subjects (overall response rate 63%), including non-specialized nurses (65%), IC nurses (60%), operation room nurses (57%) and X-ray technologists (58%). Most respondents were female (82%) and the overall mean age was 37 years, with the highest mean age (40 years) in operation room nurses. Mean working hours were almost 30 hours a week, mean duration of employment was 10 years and almost 14% of the respondents additionally performs managerial tasks (Table 1).

Table 1. Person bound variables of four subgroups + entire group (Mean (M), Standard Deviation (SD))

		Non-specialized nurses (n=1977)	IC-nurses (n=525)	Operation room nurses (n=381)	X-ray technologists (n=286)	Total (n=3169)
Gender (% female)	M	86	72	85	75	82
	SD	35	45	36	43	38
Age (yrs)	M	37	39	40	37	38
	SD	10	8	10	9	10
Working hrs weekly	M	30	30	30	31	30
	SD	7	7	9	8	7
Non-managerial function (%)	M	84	92	88	83	86
	SD	36	27	33	38	12
Duration of employment (yrs)	M	10	12	10	11	10
	SD	9	8	9	8	9
BMI (kg/m^2)	M	24	24	24	24	24
	SD	4	3	4	9	4

Table 2 shows prevalence rates of (severe) musculoskeletal complaints in the past 12 months; the group with severe complaints is a sub sample of the first group. As to the professional group as a whole, low back complaints were the most frequently reported complaints and the proportion of prevalence

rates of severe complaints were rather similar. Among the four professional groups, the prevalence rate of low back complaints within the past year was about the same (76%). More than 12% of the participants reported severe low back complaints. Overall, severe complaints in the neck-shoulder region are apparent among 9.5% of the participants.
Among non-specialized nurses the prevalence rate of severe low back complaints was 13.5%, fewer IC nurses reported severe low back complaints ($p<.01$). Of the operation room nurses almost 70% reported neck-shoulder complaints within the past 12 months, which is more frequent compared to the non-specialized nurses ($p<.01$) and the IC nurses ($p<.01$).

Table 2. Prevalence rate (%) of musculoskeletal complaints in two categories in four professional groups

		total	Non-specialized nurses	IC-nurses	Operation room nurses	X-ray technologists
low-back	12 months	75.9	76.2	74.9	76.6	75.1
	severe	12.1	13.5	6.7*	11.5	12.9
neck-shoulder	12 months	59.8	57.9	57.7	69.4**	64.2
	severe	9.5	9.0	8.8	11.8	11.2

* $p<0.01$ vs non-specialized nurses (ANOVA)
** $p<0.01$ vs non-specialized nurses and IC-nurses (ANOVA)

To assess work related factors being predictive for low back or neck-shoulder complaints a multivariate binominal logistic regression analysis was performed, containing physical risk factors as well as psychosocial risk factors, selected through univariate analyses. The person-bound variables gender, age, body mass, height, duration of employment, working hours per week, and managerial function were inserted one by one into a univariate model for each of the complaint regions low back and neck-shoulder and for each professional group. None of the person-bound variables was identified as a relevant factor.
In general, compared with the 'no complaints' groups, the mean scores/ percentages of the low back and neck shoulder 'complaint groups' are somewhat higher on most of the risk factors. Taking the non-specialized nurses as the reference group, exposure to the physical risk factor force exertion is perceived higher in IC nurses, operation room nurses and X-ray technologists. Also dynamic load is perceived higher in IC nurses. Furthermore, operation

Table 3. Univariate analyses of low back complaints by physical and psychosocial risk factors in four professional groups

		Non-specialized nurses		IC nurses		Operation room nurses		X-ray technologists	
Risk factor	group	Mean	p	Mean	p	Mean	p	Mean	p
force exertion[1]	1[3]	3.8	**0.00**	5.4*	0.14	4.3*	**0.00**	5.0*	**0.01**
	2	4.8		5.8		5.4		6.1	
dynamic load[1]	1	4.1	**0.00**	5.0*	**0.09**	4.8*	**0.01**	4.0	**0.00**
	2	4.8		5.5*		5.6		5.6	
static load[1]	1	2.4	**0.00**	3.0	0.12	3.6*	**0.00**	2.5	0.26
	2	3.1		3.5		4.6*		2.9	
repetitive load[1]	1	2.0	**0.01**	2.3	0.48	3.5*	**0.03**	3.7*	0.76
	2	2.4		2.6		4.4*		3.8*	
Ergonomic environment[1]	1	2.4	**0.00**	3.0	**0.00**	2.8	0.31	2.2	**0.06**
	2	3.1		3.9*		3.2		2.9	
standing[2]	1	74.4	**0.07**	86.7	0.13	75.6	**0.04**	64.2	0.16
	2	78.5		91.3		85.1		73.1	
walking[2]	1	74.0	**0.02**	60.6	0.98	54.7	0.36	68.6	**0.02**
	2	79.2		60.4		60.2		82.1	
sitting[2]	1	9.0	0.28	13.8	0.54	29.1	0.25	44.3	0.40
	2	10.7		11.7		35.9		38.5	
uncomfortable position[2]	1	38.6	**0.00**	62.3	0.98	49.4	**0.01**	42.0	**0.07**
	2	51.9		62.1		69.8		60.6	
job content and autonomy[1]	1	9.5	0.87	9.5	0.93	9.3	0.51	8.4*	0.33
	2	9.5		9.5		9.2*		8.8*	
job demands[1]	1	4.7	**0.00**	4.1	**0.04**	3.8*	**0.01**	5.8*	0.88
	2	5.5		4.7		4.7*		5.8*	
work organisation[1]	1	2.1	**0.01**	1.8	0.11	1.9	**0.01**	2.4	0.92
	2	2.4		2.1		2.6		2.5	
supervisor and colleagues[1]	1	1.0	0.15	0.9	**0.10**	1.3	0.33	2.3*	0.73
	2	1.1		1.3		1.6*		2.1*	
task control[1]	1	3.5	**0.06**	3.8	0.57	6.9*	0.41	5.6*	0.61
	2	3.9		3.6		7.3*		5.8*	
N	1	436-447		120-128		80-85		64-70	
	2	1413-1436		352-381		266-277		192-204	

bold p-values are included in multivariate analyses
1 scale 0 (positive) -10 (negative)
2 percentage
31=no complaints, 2=complaints
* p<0.05 vs non-specialized nurses (ANOVA)

room nurses perceive high dynamic, static and repetitive loads and they perceive higher job demands and less task control when compared to their non-specialized counterparts. X-ray technologists perceive high repetitive load, more autonomy, less harmony as to supervisor and colleagues and less

Table 4. Univariate analyses of neck-shoulder complaints by physical and psychosocial risk factors in four professional groups

		Non-specialized nurses		IC nurses		Operation room nurses		X- ray technologists	
Risk factor	group	Mean	p	Mean	p	Mean	p	Mean	p
force exertion[1]	1[3]	4.3	**0.00**	5.6*	0.27	4.7*	**0.06**	5.4*	**0.10**
	2	4.8		5.8*		5.3		6.0*	
dynamic load[1]	1	4.4	**0.00**	5.0*	**0.02**	5.1*	0.15	5.1*	0.45
	2	4.9		5.6*		5.5		5.3	
static load[1]	1	2.7	**0.00**	3.0	**0.01**	3.9*	**0.06**	2.7	0.35
	2	3.2		3.6		4.6*		3.0	
repetitive load[1]	1	2.1	**0.01**	2.2	**0.03**	3.7*	0.17	3.6*	0.37
	2	2.5		2.8		4.3*		4.0*	
ergonomic environment[1]	1	2.6	**0.00**	3.2*	**0.00**	3.1	0.79	2.3	**0.04**
	2	3.2		4.1		3.2		3.0	
standing[2]	1	76.7	0.37	92.1	0.2	78.6	0.22	69.7	0.77
	2	78.4		88.7		83.9		71.3	
walking[2]	1	76.7	0.22	62.0	0.42	57.1	0.87	77.0	0.59
	2	79.0		58.5		58.1		79.8	
sitting[2]	1	9.6	0.38	11.5	0.35	35.7	0.74	40.4	0.96
	2	10.8		14.3		33.9		40.1	
uncomfortable position[2]	1	43.1	**0.00**	59.3	0.24	62.2	0.56	50.0	0.12
	2	52.6		64.4		65.3		50.9	
job content and autonomy[1]	1	9.6	0.59	9.5	0.57	9.4	0.15	8.6*	0.76
	2	9.5		9.5		9.1*		8.7*	
job demands[1]	1	5.0	**0.00**	4.1*	**0.00**	4.1*	**0.07**	5.6	0.25
	2	5.6		4.9*		4.7*		5.9	
work organisation[1]	1	2.1	**0.00**	1.7	**0.01**	2.4	0.66	2.2	0.21
	2	2.6		2.2*		2.5		2.6	
supervisor and colleagues[1]	1	0.9	**0.01**	1.1	0.53	1.6*	0.65	1.9*	0.29
	2	1.2		1.2		1.5		2.3*	
task control[1]	1	3.6	**0.02**	3.6	0.94	7.1*	0.79	5.9*	0.77
	2	3.9		3.6		7.2*		5.7*	
N	1	783-802		209-217		106-110		91-98	
	2	1048-1070		272-289		225-239		167-178	

Bold p-values are included in multivariate analyses
[1] scale 0 (positive) -10 (negative)
[2] percentages
[3] 1=no complaints, 2=complaints
* p<0.05 vs non-specialized nurses (ANOVA)

task control in their jobs.

In all groups, univariate analyses yielded 2 (IC nurses) to 8 (non-specialized nurses) physical predictors and 0 (X-ray technologists) to 3 (non-specialized nurses) psychosocial predictors for low back complaints. For neck-shoulder

complaints, univariate analyses yielded 2 (X-ray technologists) to 7 (non-specialized nurses) physical predictors and 0 (X-ray technologists) to 4 (non-specialized nurses) psychosocial predictors.
When these variables were entered in the model of multivariate analyses, four physical and one psychosocial risk factor reached the level of significance

Table 5. Multivariate analyses of musculoskeletal complaints by physical and psychosocial risk factors (Adjusted Odds Ratio (OR) and Confidence Interval (CI))

Professional Groups	risk factor	low back			neck-shoulder		
		OR	95% CI		OR	95% CI	
non-specialized nurses	force exertion	**1.11**	**1.04**	**1.18**	0.99	0.94	1.05
	dynamic load	0.96	0.88	1.03	1.01	0.94	1.08
	static load	**1.12**	**1.03**	**1.22**	1.01	0.95	1.08
	repetitive load	0.97	0.92	1.03	1.01	0.97	1.06
	ergonomic environment	1.02	0.96	1.08	1.05	1.00	1.10
	uncomfortable position	0.82	0.60	1.12	0.98	0.75	1.28
	standing	1.33	0.95	1.86	-	-	-
	walking	0.92	0.66	1.27	-	-	-
	job demands	**1.09**	**1.03**	**1.14**	1.01	0.97	1.06
	work organisation	0.96	0.91	1.02	1.05	0.99	1.11
	supervisor and colleagues	-	-	-	1.02	0.97	1.08
	task control	1.00	0.96	1.04	1.03	0.99	1.07
IC- nurses	dynamic load	0.99	0.88	1.12	1.01	0.90	1.15
	static load	-	-	-	0.99	0.88	1.12
	repetitive load	-	-	-	1.05	0.96	1.15
	ergonomic environment	**1.11**	**1.00**	**1.24**	0.99	0.90	1.07
	job demands	1.04	0.95	1.14	1.02	0.93	1.10
	work organisation	-	-	-	1.04	0.93	1.16
	supervisor and colleagues	1.10	0.97	1.24	-	-	-
operation room nurses	force exertion	1.11	0.97	1.28	0.97	0.89	1.06
	dynamic load	0.88	0.71	1.08	-	-	-
	static load	1.14	0.95	1.36	1.04	0.96	1.12
	repetitive load	0.96	0.84	1.09	-	-	-
	Uncomfortable position	0.63	0.29	1.37	-	-	-
	Standing	1.09	0.49	2.38	-	-	-
	job demands	1.10	0.97	1.23	1.06	0.97	1.15
	work organisation	1.07	0.93	1.22	-	-	-
X-ray technologists	force exertion	1.00	0.84	1.18	0.93	0.83	1.04
	dynamic load	**1.32**	**1.09**	**1.59**	-	-	-
	ergonomic environment	0.93	0.80	1.08	1.11	1.00	1.24
	walking	0.92	0.41	2.07	-	-	-
	uncomfortable position	0.94	0.42	2.08	-	-	-

($p<0.05$) (Table 5). None of the risk factors were associated with neck-shoulder complaints.
With regard to the non-specialized nurses, force exertion (OR 1.11, 95% CI 1.04-1.18), and static loads (OR 1.12, 95% CI 1.03-1.22), and job demands (OR 1.09, 95% CI 1.03-1.14) appear to be predictive for low back complaints. In IC nurses the ergonomic environment seems predictive for low back complaints (OR 1.11, 95% CI 1.00-1.24).In operation room nurses, no relationship emerged between risk factors and complaints. As to X-ray technologists, an association is present between low back complaints and the risk factor dynamic loads (OR 1.32, 95% CI 1.09-1.59).

Discussion

This study is conducted to gain more insight into the prevalence rates of musculoskeletal complaints of neck-shoulder and low back in non-specialized nurses, IC nurses, operation room nurses and X-ray technologists. Furthermore, the role and possible association with physical and psychosocial work-related risk factors on the complaints mentioned was determined. To this end, data were used from a cross-sectional study in which non-specialized nurses, IC nurses, operation room nurses and X-ray technologists from eight university hospitals in the Netherlands participated.
At first, some methodological shortcomings within this study should be mentioned. Of the respondents, 37% did not fill out the questionnaire. Due to a lack of data of the non-respondents, we were unable to perform a non-response analysis. For this reason, bias resulting from selective non-response cannot be excluded. However, figures on person-bound variables of the respondents in the present study are comparable with populations with the same professional background (University Hospitals Associaton, 1999).
For this study, we used data from a cross-sectional design; as a result causal inferences concerning the associations observed cannot be made. The purpose of the study was to learn about possible relations between physical and psychosocial work-related risk factors and musculoskeletal complaints. Because the questionnaires have been filled out retrospectively, the possibility of recall bias may be present. Low back or neck-shoulder complaints may influence the assessment of perceived risk factors; if respondents with complaints recall the exposure to risk factors more accurate than respondents without complaints this might have led to an overestimation of the risk factors observed.

This study showed an overall prevalence rate of low back complaints within the past 12 months of 76%. An earlier study (Picavet et al., 1999) in the Netherlands showed a prevalence rate of 44-48 % in a general working population, using the same definition of low back complaints. Other studies using the same type of questioning and focusing on health care workers found prevalence rates of 75% (Alexopoulos et al., 2003;Trinkoff et al., 2002; Lagerstrom et al., 1995). These latter results are comparable with the results of our study. This supports our findings that workers in health care more frequently report low back complaints. Our finding of the overall prevalence rate of severe low back complaints of 12% is consistent with other studies performed in health care (Lagerstrom et al., 1998; Engels et al., 1994). Picavet found a slightly higher rate of 16-18% in a Dutch working population (Picavet et al., 1999).
In our study the overall prevalence rate of neck-shoulder complaints within the past twelve months is 60%. Other studies, using slightly other definitions of neck-shoulder complaints (Picavet et al., 1999; Lagerstrom et al., 1995) found lower prevalence rates.
As already mentioned in the introduction, there is a need for specific information about risk factors in the work of health care professionals. With regard to the non-specialized nurses, force exertion and static loads and job demands appear to be predictive for low back complaints.
IC nurses perceived less prolonged neck-shoulder complaints than non-specialized nurses. With regard to the exposure of risk factors, there is an indication that the job content of non-specialized nurses and IC nurses include different occupational hazards; force exertion and dynamic loads are perceived as high. In IC nurses, low back complaints and the ergonomic environment are related.
Operation room nurses perceived more complaints (69%) in the neck-shoulder region, compared with the IC nurses and non-specialized nurses. The latter group has a high prevalence rate already (58%). As mentioned earlier, as to low back complaints the study of Meijsen (Meijsen 2004) described a past-year prevalence rate of 58% in operation room nurses of non-specialized hospitals. In the present study a prevalence rate of 77% was found. The difference in prevalence rates could be due to different assignments; in a university hospital there is less variety in the work of operation room nurses because of the education and training of surgeons. Surgeons are trained to perform some of the tasks that are usually performed by operation room nurses. In the present study, the multivariate analysis yielded no risk factors related to musculoskeletal complaints in operation room nurses. This is a

rather surprising finding since static load and repetitive load are more present in their work than in the jobs of non-specialized nurses.
The X-ray technologists as a professional group have comparable prevalence rates as the non-specialized nurses. X-ray technologists frequently wear load aprons, which is as such a risk factor for developing neck complaints (Sluiter et al., 2001). Unfortunately, we did not ask the X-ray technologists about this item.

Conclusion

The results of the present study indicate that both low back and neck-shoulder complaints are major health problems in the four professional groups under study. The prevalence rate of neck-shoulder complaints in operation room nursing is higher than in non-specialized nurses and IC nurses, these latter presenting high rates already. The perceived exposure to risk factors is evaluated differently across the four professional groups.
The results of the study indicate that the professional groups under study are target for preventive interventions; these interventions need to be specified for each of the professional groups.

Appendix 1

The Dutch Musculoskeletal Questionnaire (DMQ): five physical and five psychosocial factors (Hildebrandt et al., 2001)

Factor	N items	Content	Cronbach's alpha[1]	Cronbach's alpha[2]
Force exertion	13	Lifting, pushing and pulling, carrying, forceful movements with arms, high physical exertion, lifting with loads above the chest, lifting with bad grip, lifting with very heavy loads, short force exertion, exerting great force in hands	.86	.90
Dynamic load	12	Trunk movements (bending and/or twisting), movements of neck, shoulders or wrists, reaching, make sudden and/ or unexpected movements, pinching, working under, at, or, above shoulder level.	.80	.82
Static load	11	Light bent, twisted trunk posture, heavily bent, twisted trunk postures, postures of neck or wrists.	.82	.87
Repetitive load	6	Working in the same postures, making the same movements with trunk, arms, hands wrists or legs, making small movements with hands at a high pace.	.80	.85
Ergonomic environment	6	Available working space, no support, slipping and falling, trouble with reaching things with tools, not enough room above to perform work without bending.	.70	.78
Job content and autonomy	6	Monotony, skill level, challenging, new skills, learn new things, variation.	.68	.57[3]
Job demands	6	Work pressure, (problems with) speed of work, fatigue.	.70	.76[3]
Work organisation	5	Organisation degree, work progress, hinder of unexpected situations, presents of colleagues or lack in work of others.	.56	.58[3]
Task control	5	Determine workpace, - the order of tasks, make decisions in the job, leave the workplace for a while.	.72	.67[4]
Supervisor and colleagues	5	Daily leadership, irritation of others, supervisor pays attention to what I am saying, good work atmosphere, impression of supervisor of my job.	.67	.78[3]

[1]Cronbach's alpha of present study population
[2]Cronbach's alpha of Hildebrandt-study
[3] Cronbach's alpha of Winter and Grundemann study
[4] Cronbach's alpha of van der Doef study

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CHAPTER 4

Reducing musculoskeletal symptoms and sickness absence in the nursing profession: an occupational intervention

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Abstract

Objective: to determine the results of a multi-faceted intervention programme to reduce physical workload in the nursing profession. An additional aim was to evaluate the nurses' perceptions on the relationship between work and musculoskeletal symptoms.
Method: a pre-post design without a control group was used to evaluate the results in nurses of regular wards (n=466) of six University Hospitals in the Netherlands. Effect variables were perceived exposure to risk factors at work, 12 months prevalence of low back and neck/shoulder symptoms, sickness absence and perceived relationship between work and musculoskeletal symptoms.
Results: the study indicates that implementation of an intervention programme has not yielded effects on the exposure to risk factors and on reduction of musculoskeletal symptoms. However, sickness absence due to low back symptoms appeared to be lower after the intervention programme was implemented. Furthermore, after the implementation low back symptoms were perceived as more connected to work related risk factors than before.

Introduction

Musculoskeletal symptoms in general and low-back pain in particular are common health conditions in working populations. Considering the lifetime prevalence of 60–85%, non-specific low-back pain will eventually affect almost everyone during work life, also nurses as a specific working population (Burton et al., 1996). Consequence of having neck and back pain can be a diminished physical functioning in work, disability and sickness absence (Deyo, 1988). Low-back pain is a frequently indicated reason for seeking medical care, with 42% of the adult population annually consulting a health professional for their symptoms (Picavet et al., 1999, Picavet et al., 2003). In the Netherlands, around 24% of those with low-back pain are on sick leave of which 6% does not return to work within 4 weeks (Picavet et al., 2003). In order to reduce musculoskeletal
symptoms, more specifically low back pain and neck-shoulder symptoms, the target group of the present study are nurses in University Hospitals in the Netherlands. The occupational intervention made part of the Safety and Health Covenants and was implemented from 2001 – 2005 in eight University Hospitals in the Netherlands. Besides a reduction of musculoskeletal complaints, also a decrease in sickness absence was one of the aims of the intervention programme (Bos et al., 2006). The main elements of the occupational intervention programme were training and education of the hospital workers on the wards, the availability of ergo-coaches, improvement

of the equipment and labour tools like hoists.
The reason for a nationwide evaluation of the intervention programme was to obtain information about the eventual effects of the programme on health and sick leave. Another reason was to gain information on the improvement of future preventive occupational interventions.

Background

On the prevalence of musculoskeletal symptoms in the nursing profession, risk factors in work and occupational interventions in the workplace an abundance of literature is available. The following literature review presents some examples of information currently available on these topics.

Musculoskeletal symptoms
Among nurses, non-specific low-back pain is the most frequently reported musculoskeletal symptom with a past-year prevalence of 30-60% (Engels et al., 1996, Lagerstrom et al., 1995, Trinkoff et al., 2003). Other branch-specific studies have also reported neck and shoulder symptoms in 30-48% and 43-53% of the nurses respectively (Engels et al., 1996, Lagerstrom et al., 1995). Data from over 80 studies across a number of countries indicate that back injury in nurses has a worldwide point prevalence of approximately 17 percent, an annual prevalence of 40-50 percent and a lifetime prevalence of 35-80 percent (Hignett, 1996).

Determinants of musculoskeletal complaints
In general, person-bound determinants like age, fitness, force of muscles, psychosocial problems and work-related determinants, such as physical load and psychosocial circumstances may influence the origin of low-back pain (Van Wieren et al., 2006). Well documented physical risk factors related to physical load are the weight of the load and frequency of lifting, whereas awkward back postures and whole-body vibration are risk factors for the occurrence of low-back pain and consequent sickness absence (Hoogendoorn et al., 2000, Hoogendoorn et al., 2001, Hoogendoorn et al., 2002). Besides, neck flexion, arm force, arm posture, duration of sitting, twisting or bending of the trunk, hand-arm vibration, and workplace design are risk factors for the occurrence of neck pain and consequent sickness absence (Ariens et al., 2002).
Psychosocial risk factors for the origin of low-back pain are low job satisfaction,

low social support either from supervisors or co-workers. High quantitative job demands and low co-worker support are independent psychosocial risk factors for neck pain (Ariens et al., 2001). For both neck and low-back pain the nursing profession contains some of the physical risk factors described: lifting heavy loads frequently, awkward back postures, neck flexion, arm force, arm posture and twisting or bending of the trunk. Other risk factors as unfavorable ergonomic environment, low job satisfaction, low social support, high quantitative job demands and low decision authority can be attendant (Ahlberg-Hulten et al., 1995, Alexopoulos et al., 2001, Ariens et al., 2001, Bru et al., 1996, Engels et al., 1996, Josephson et al., 1997, Lagerstrom et al., 1995, Lagerstrom et al., 1998, Linton 1990, Smedley et al., 2003, Trinkoff et al., 2003). However, these latter factors are related to local circumstances of the organization and are beyond the scope of the present study.

Safety and Health Covenants

In 1999 the Dutch government initiated the so-called Safety and Health Covenants. These are agreements between employers' organizations, trade unions and the government. The covenants are aimed at improving working conditions, curbing sick leave and reducing the number of cases of occupational disability by reducing exposure to major occupational risks. Eight University hospitals as employers' organizations of 50.000 employees participated in this covenant and made appointments about, among other things, reduction of the risk factor 'high physical workload'. The main goal was reducing sickness absence with 20% during the covenant period. As part of the covenant a prevention programme, addressing the work related risk factors for musculoskeletal symptoms in nurses was introduced in eight University hospitals, in particular on wards with high physical work load. The implementation of the prevention programme started in 2001 on 104 wards and ended in 2005.

Effects of prevention programmes

Some reviews and primary studies evaluated prevention programmes resembling the present study, generating conflicting findings (Alexandre et al., 2001, Bos et al., 2006, Engels et al., 1997, Engels et al.,1998, Fanello et al., 1999, Feldstein et al., 1993, Garg et al., 1992, Hignett, 2003, Johnsson et al., 2002, Josephson et al., 1997, Lagerstrom et al., 1997, Lynch et al., 2000, Yassi et al., 2001). One of the recommendations from the studies was the use of a multi-faceted intervention, which combines ergonomic interventions such as the

use of mechanical aids, interventions to improve health by physical exercise, education and training addressing workers' behaviour as to risk factors and organizational interventions such as changes in work procedures (Bos et al., 2006, Hignett, 2003, Nelson, 2006, Zwerling et al., 1997). In a review by Bos (et al., 2006) 25% of the intervention studies (n=13) included revealed a decrease in sickness absence and in 40% a decrease in musculoskeletal symptoms. The prevention programme of the present study has a multi-faceted character: training and education, technical interventions (mechanical aids), innovative work procedures and feedback on the job make part of the intervention. The theoretical base of the multi-faceted intervention was found in the ASE-model in which it is assumed that 'intention to change' and subsequent behaviour are primarily determined by the following cognitive variables: Attitudes, Social influences, and Self-Efficacy expectations. Moreover, the model postulates that intention predicts subsequent behaviour (Ajzen and Fishbein, 1980). According the ASE-model, the factor 'attitude' consists of the advantages and disadvantages of a particular behaviour, in this study avoiding physical load. The second factor, 'social influences' consists of the outside influences the hospital worker encounters, such as the interaction with colleagues. 'Social influences' are determined by the normative beliefs of important referent persons (colleagues, supervisor) about behaviour and the individual's motivation to comply with these persons. The third factor, 'Self-Efficacy expectations', consists of beliefs of the individual about his/her abilities to perform a particular behaviour. The performance of particular behaviour can be hindered by 'barriers', which can be inside or outside the workers' possibilities. An individual learns from the consequences of his particular behaviour by feedback from the situation created. In turn, these consequences do influence the intention to perform that certain behaviour next time. Healthy behaviour and the ability to apply the problem solving strategy effectively in circumstances with high physical work load should lead to less physical risk factors and as a result, a decrease in musculoskeletal complaints.

Methods

Aim

The aim of the present study is to determine the results of a multi-faceted intervention programme to reduce physical workload in the nursing profession. The intervention programme concentrates on work-related risk factors and

the effects on musculoskeletal symptoms of the low-back and neckshoulder region and, as a result, a reduction of sickness absence. In addition, we investigated the nurses' perceptions concerning the relationship between work and musculoskeletal symptoms.

Data-collection

The project period ran from medium 2002 till medium 2005. Six University hospitals in the Netherlands (Amsterdam, Maastricht, Leiden, Nijmegen, Utrecht, and Groningen) participated in the study, representing 56 regular wards. The local project manager and the supervisor of each team introduced the study on the wards during work progress meetings. In addition, the team members received written information explaining the aim and interest of the study; at the same occasion confidentiality was guaranteed. The local project managers of the hospitals – as part of the members of the task force – were responsible for the implementation of the intervention programme in their own hospital.

Design and Participants

The population receiving the entire prevention programme consisted of 466 nurses, employed on regular wards with high physical load (intervention group). The nurses were asked to fill out an initial questionnaire (T0), one year after the start a follow-up questionnaire (T1) was administered. In the meanwhile the prevention programme was implemented at the wards according to a protocol formulated by the national task force (NFU, 2005). Nurses of one hospital (Rotterdam) and 22 wards spread out across the other hospitals completed only the initial questionnaire. One hospital was excluded from the present analyses because the follow-up data were collected after the project period.

The intervention

Within the intervention programme, three groups can be distinguished: nurses, physiotrainers (physiotherapists) and ergocoaches. The nurses were trained by well skilled physiotrainers working on the same ward with the
same patient population. The standardized training of the nurses consisted of a theoretical and a practical part – taking two hours each – provided in small groups from 5 to 12 persons. The main goal of the theoretical part was to teach the participants a problem-solving strategy. In every transfer situation the nurse has to consider his/her own capability, the resources and needs

of the patient and the possibilities and limitations of the environment, and accordingly choose the optimal patient handling method. Thus, the problem-solving strategy serves as a tool helping nurses to solve the problem of handling patients to accomplish transfers. During the practical part of the training the nurses exercised transfers based on the problem-solving strategy. Also Johnsson used the problem-solving strategy in her training to nurses (Johnsson, 2002). The nurses and the physiotrainers could enter into consultation easily, for example about approaching patients independently and about the way physical transfers should be performed. The physiotrainers were educated during a two-day course in the theoretical framework of the problem-solving strategy, the prevention programme and didactic skills. In each hospital at least five physiotrainers were appointed. All ergocoaches received a standardized training in becoming skilled in signalizing postures at risk. In total, the education of ergocoaches took eight hours spread over two days. They learned about ergonomic guidelines, body mechanics, observation techniques and how to provide feedback. At least two ergocoaches were appointed per team, each team consisting of 25-45 nurses. If needed, ergocoaches encouraged their colleagues to use the assistive devices available and provided advice on good practice to minimize efforts and physical load. The ergocoach (as a team member) paid special attention to the reduction of physical stress as a consequence of the activities on the job. In addition, among the nurses on the wards the ergocoach stimulated and monitored the use of the guidelines according the prevention programme. Prior to the training of the nurses, together the physiotrainers and the ergocoaches performed an ergonomic assessment, which listed the ergonomic circumstances and the mechanical equipment on the wards. Based on the results of the assessment, new hoists were introduced as well as chairs and low-tech ergonomic tools.

Outcome variables

In the literature a variety of definitions of musculoskeletal symptoms as well as episodes of symptoms were reported (de Vet et al., 2002). In this study, a musculoskeletal symptom is defined as having pain or experiencing discomfort in the low back and neck-shoulder region (Kuorinka et al., 1987). The parameters under study were: (1) having or having had low back symptoms or (2) neck-shoulder symptoms during the past twelve months. Also in recent studies these parameters are used frequently (Hildebrandt 1995, Lagerstrom et al., 1995, Picavet et al., 1999), enabling us to compare our results with reference data.

Sickness absence is defined as absence from work due to musculoskeletal symptoms of low back or neck-shoulder region divided into short-term absence (1-7 days), medium term absence (8 days - 1 month) and long term absence (> 1 month).

Questionnaire

In the present study the standardized Dutch Musculoskeletal Questionnaire (DMQ) (Hildebrandt et al., 2001) was used. The DMQ is partly derived from the Nordic Musculoskeletal Questionnaire (Kuorinka et al., 1987) and the Dutch Questionnaire on Work and Health (Winter et al., 1992). The DMQ includes questions on personal and demographic variables. Furthermore, the questionnaire includes items on musculoskeletal symptoms, musculoskeletal workload, general health, tasks and psychosocial working conditions. The questions on musculoskeletal workload were categorized into five factors and four single items: the factors static load, dynamic load, force exertions, repetitive load, ergonomic environmental conditions and four single items: sitting, standing, walking and working in uncomfortable postures. The homogeneity of the factors used was found to be satisfactory; the Cronbach's alpha varied from .70 (ergonomic environment) to .86 (force exertion) (Hildebrandt et al., 2001). Discriminative power was good; significant associations of most sectors with musculoskeletal symptoms demonstrated concurrent validity (Hildebrandt et al., 2001). Most answering categories were dichotomous (yes/no) and some were on a four-point scale.

Data analysis

The questionnaires were scanned electronically and data were cleaned using logic, range and consistency checks. The group completing only the initial questionnaire and the intervention group were compared on person-bound variables, musculoskeletal symptoms and sickness absence due to musculoskeletal symptoms using a chi-square tests in case of binominal data: gender and education. Student's t-tests was applied on person-bound variables such as risk factors, sickness absence and the relationship between musculoskeletal symptoms and work or leisure time. Also differences in person-bound variables and effect variables between the hospitals were checked. Paired Student's t-tests were used to assess the risk factors static load, dynamic load, force exertion, repetitive loads, and ergonomic environment. Chi square tests have been used for the other risk variables and the effect variables. The analyses were all performed using SPSS PC 12.0.

Results

Participation

From the overall study population (N=1233) including 6 University hospitals representing 56 wards 790 nurses (64%) completed the initial questionnaire (T0), of which 466 nurses (59%) filled out the follow-up questionnaire (T1) one year later. The main reason for not participating in the follow-up was finding a job elsewhere. At T0 no differences were found between the group which only completed the initial questionnaire and the intervention group with respect to person-bound variables (age, gender, working hours, working years, body mass index and self rated health) musculoskeletal symptoms and sickness absence due to musculoskeletal symptoms (data not shown).

The overall mean age of the respondents was 36.6 years, 80% were female workers, mean number of working years was 10.4 and mean working hours weekly was 30. Body mass index was 23.5 and self rated health status was 1.67 (scale 0-3). Most nurses (69%) were on a medium or high educational level.

Table 1. Person-bound variables of respondents from six University Hospitals. Means (M) and standard deviations (SD)

			Amsterdam n=25	Maastricht n=123	Leiden n=86	Nijmegen n=125	Utrecht n=80	Groningen n=27	Total n=466
Age		M	36.3	34.2	37.4	38.2	37	37.6	36.6
		SD	9	9.6	9.5	11.1	10.3	10.6	10.3
Gender (% female)		M	92.9	78.9	86.7	83.8	87.7	77.8	80
		SD	26.2	40.9	34.2	36.9	33.1	42.4	35.6
Education (%)	high	M	40.5	39.1	37.2	49.1	56,2	44.8	45.4
	medium	M	32.4	23.4	23.6	22.1	22,5	24	23.4
	low	M	27.1	37.5	39.2	28.8	21,3	31.2	31.2
Working years		M	10.1	10.3	11.4	10.2	10	9.4	10.4
		SD	8.9	8.5	9.2	9.1	8.1	7.5	8.7
Working hours		M	28.7	30.9	29.9	29.7	29	29.4	29.9
		SD	7.5	6.7	6.2	6.7	7.7	7.7	6.9
BMI		M	23.3	23.9	23.4	23.4	23.2	23.7	23.5
		SD	2.8	3.8	2.8	3.3	2.8	3.9	3.3
SRH[1]		M	0.59	0.56	0.52	0.49	0.58	0.67	0.54
		SD	1.3	1.31	1.58	1.25	1.27	1.67	1.4

[1]Self rated health (0 (good) - 10 (bad))

Effects

In the entire group no differences were found in self reported exposure to risk factors one year after the start of the implementation of the intervention programme (table 2).

Table 2. Risk factors experienced

Risk factors	Mean T0	Mean T1	p
Static loads[1]	2.9	3.0	.77
Dynamic loads[1]	4.7	4.7	.82
Force exertion[1]	4.8	5.1	.52
Repetitive loads[1]	2.2	2.1	.71
Ergonomic environment[1]	2.7	3.1	.56
Standing[2]	80.2	77	.24
Sitting[2]	9.9	10.4	.83
Walking[2]	76.9	74.7	.45
Uncomfortable postures[2]	48.8	50.0	.75

[1] On a scale from 0 (low) to 10 (high)
[2] percentage

On T0 as well as on T1 67% of the nurses perceived low back symptoms in the past twelve months (table 3). Ten percent of the nurses being free of low back symptoms at T0 did experience low back symptoms at T1. On T1 the percentage of individuals being recovered from low back symptoms was 10% as well. Sixty-two percent of the respondents perceived neck-shoulder symptoms on both T0 and T1. At follow-up the percentage of new cases with neck-shoulder symptoms in the past 12 months was 10% and the percentage individuals recovered from neck-shoulder symptoms was 11%.

Table 4 presents data on sickness absence due to musculoskeletal complaints. At T0 83 individuals (24%) were on sick leave in the previous year due to low back pain, whereas 46 cases (13.3%) were on sick leave one year later, indicating a decrease of 45%. These results can mainly be described to short-term sickness absence (1-7 days); at T0 74 respondents in this category (21.4%) were absent from work in the previous year and 23 nurses (6.9%) were absent one year later (T1). Nineteen (T0) to twenty three (T1) nurses (7.8–10%) with neck-shoulder symptoms were on sick leave; no changes were observed for sickness absence due to neck shoulder symptoms.

Among other things, at T0 risk factors at work are perceived as contributing to their low back symptoms by 29% of the nurses (table 4). One year after the start of the intervention programme nurses perceive the influence of work

Table 3. Number (%) of subjects with musculoskeletal symptoms at T^0 and T^1.

	Low back symptoms T^1		
Low back symptoms T^0	Yes	No	Total
Yes	310 (87/67) [1]	47 (13/10)	357 (77)
No	48 (45/10)	59 (55/13)	107 (23)
total T^0	358 (77)	106 (23)	464
	Neck-shoulder symptoms T^1		
Neck-shoulder symptoms T^0	Yes	No	Total
Yes	290 (85/62)	50 (15/11)	340 (73)
No	48 (38/10)	78 (62/17)	126 (27)
total T^0	338 (72)	128 (28)	466

[1]First percentage between ( ) refers to row-total; second percentage refers to overall total

related risk factors on low back symptoms almost 50% (table 5). At T1 they also perceive a reduction in the relationship between leisure activities and low back symptoms; no differences were found as to the same relation and neck shoulder symptoms.

Table 4 . Sickness absence due to musculoskeletal symptoms (%) at T^0 and T^1.

		no absence	1-7 days	8 days- 1 month	>1 month	Total
Low back	T^0	262 (76)	74 (21.4)	9 (2.6)	0	83 (24)
	T^1	289 (86.7)*	23 (6.9)*	15 (4.5)	8 (1.8)	46 (13.3)*
Neck-shoulder	T^0	225 (92.2)	8 (3.2)	5 (2)	6 (2.5)	19 (7.8)
	T^1	223 (90)	14 (5.6)	5 (2)	6 (2.5)	23 (10)

* $p<0.001$ T^0 vs T^1

This study indicates that the implementation of the intervention programme has not yielded effects on the exposure to risk factors and, as a result, a reduction of musculoskeletal symptoms. However, sickness absence due to low back symptoms appeared to be lower after the intervention programme

Table 5. Perceived relationship between musculoskeletal symptoms and work or leisure activities (%) at T_0 and T_1.

		Leisure time activities	Work
Low back	T^0	76 (16.3)	135 (29)
	T^1	63 (13.5)*	233 (49.5)*
Neck shoulder	T^0	62 (13.3)	120 (25.8)
	T_1	57 (12.2)	129 (27.7)

* $p<0.001$ T^0 vs T^1

was implemented whereas low back symptoms were perceived as more connected to work related risk factors than before. Because of the study design no causal inferences between the implementation of the intervention programme and the differences observed can be made.

Discussion

This study evaluates the results of an intervention programme aimed at a reduction of musculoskeletal symptoms and, as a result, sickness absence. The prevention programme was implemented in eight university hospitals in the Netherlands as part of the Safety and Health Covenants. The evaluation concerned six hospitals, we used a quasi-experimental design with a pre- and post test without a control group. The questionnaire was completed twice by 466 nurses, with an interval of one year. Sickness absence due to low back symptoms appeared to be lower after the intervention programme was implemented. No effect on the exposure to perceived risk factors related to musculoskeletal symptoms was found. The nurses perceived work as more influential on their musculoskeletal symptoms after the intervention than before. In general, the implementation of the intervention programme was successful. Even though a process evaluation of the implementation is not yet finished, the implementation was executed efficiently; a large number of meetings at all organisational levels was organized to inform all persons involved, with both a high response. The ward managers supported the programme strongly and were cooperative.
After the theoretical foundation the actual development of the programme took several years, with a number of pilot studies in which potential 'users' of the intervention programme participated. An important element of the programme was the use of multi-faceted interventions, as recommended by several authors. In the lierature is stated that training alone is not sufficient for a decrease in musculoskeletal symptoms (Nelson et al., 2006, Bos et al., 2006, Hignett 2003, Zwerling et al., 1997). In the present intervention programme several components were combined and implemented simultaneously. Hence, which component was responsible for the results obtained remains unclear. Some other methodological shortcomings within the present study are related to the fact that this study is a part of a Health and Safety covenant. Firstly, the absence of a control group and
secondly the rather short running period of the covenant. Because of the lack of a control group, it is not possible to assign the results observed to

the implementation of the intervention programme. The rather short running period and tight planning implied that the follow-up took place one year after the start of the implementation. As a consequence, it is possible that a change in the nurses' behaviour to more 'healthy behaviour' is not detected in its full scope. On the contrary, a positive trend at T1 might have been present if a long term effect indeed existed. Although no reduction of musculoskeletal symptoms could be demonstrated, sickness absence due to low back pain was reduced one year after the implementation of the intervention programme. There may be several explanations for these findings. The intervention programme may have lead to more awareness of the working position as a potential risk factor and also of physical symptoms due to certain working positions. Filling out the T1 questionnaire after the actual implementation of the intervention may have evoked an answering tendency related to more body-awareness, overshaduwing the 'real' effect. Increased bodyawareness or awareness of back symptoms may also explain the stronger association between the factor work and low back symptoms the nurses perceived after implementation of the intervention programme; nurses with increased body-awareness may associate high physical workload with low back pain more frequently (Landsman et al., 2004).

In this study none of the risk factors was perceived as more negative or positive after the implementation of the intervention programme. We expected that the influence of the risk factors would be perceived as lower after the intervention, because the nurses had learned how to act in complex physical working conditions. On the other hand, nurses may be more aware of their work situation and the relative high physical load of their job and behave accordingly. In the literature several factors influencing sickness absence are described, such as social factors, economic circumstances, the vocational sector and individual characteristics (Smulders et al., 1997). Smulders et al. identify economic and market conditions as one of the major pressures. During the present study period, the economic situation in the Netherlands deteriorated and unemployment figures rose considerably (www.cbs.nl). Under these circumstances employees are afraid of losing their jobs and are more likely to attend work in spite of reporting ill. On the other hand, in health care job-certainty is perceived as high, especially in University Hospitals where high employment protection exists. In addition figures on sickness absence among the working population in the Netherlands and especially in University Hospitals decreased from 5.3% and 6.7% in 2002 to 4.6% and 5.2% in 2004

respectively. These figures indicate a general decrease in sickness absence both on a national and vocational level. As part of the sickness absence percentage in the University Hospitals, medium term sickness absence (>3 weeks) due to musculoskeletal symptoms decreased from 1.4% to 0.8% (NFU, 2005). Summarizing the results, after the implementation of the intervention programme differences were found in sickness absence and perceived influence of work on musculoskeletal symptoms. Several explanations may account for the differences found, such as the economic situation, job (un) certainty in case of sickness absence, more body-awareness and higher perceived exposure to risk factors in case of musculoskeletal symptoms. However, it may also be possible that the intervention programme itself is responsible for the differences found. A remaining challenge will be optimizing the intervention programme itself by adding and combining elements. To evaluate the contribution of the separate elements of the intervention programme on the reduction of musculoskeletal symptoms in nurses remains a subject for further research.

Conclusion

In this study our goal was to determine the results of a multi-faceted intervention programme on the reduction of physical workload in the nursing profession and to evaluate the nurses' perception concerning the relationship between work and musculoskeletal symptoms. The intervention programme with a behaviour-cognitive base has not yielded effects on the reduction of musculoskeletal symptoms. However, sickness absence due to low back symptoms appeared to be lower after the intervention programme was implemented and low back symptoms were perceived as more connected to work related risk factors than before. Whether this change in perception made the nurses behave more carefully as to (the avoidance of) physical workload cannot be answered with the data available but remains an interesting issue in forthcoming research. Additionally, other challenges are to develop evidence-based approaches of intervention programmes in which already effective components are combined and to develop programmes for moderate risk units with patient related activities.

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CHAPTER 5

Results of an occupational intervention in hospital workers: the role of behavioural determinants

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Abstract

Purpose: evaluation of effects like the determinants attitude, social influence, self efficacy (ASE) and intention to change in relation to a change in low back pain one year after the implementation of a behavioural intervention on departments with hospital workers in the Netherlands.
Methods: baseline measurement and follow-up were compared on ASE determinants and intention (n=798). Based on changes in perceived low back pain three groups were formed of which mean difference-scores on ASE determinants and intention were calculated and tested (ANOVA).
Results: social influence, self efficacy and intention were increased one year after the intervention. Hospital workers experiencing less low back pain seem to be more susceptible to social influence, are more confident as to self efficacy and have a higher intention to change than workers who experience an increase in low back pain.
Conclusion: possibly the respondents with positive feedback (less complaints) are more sensitive to an intervention directed at practical and behavioural components. Such an intervention may be in line with their changed perception of the cause of low back pain as being dependent upon someone's physical postures and/or someone's own behaviour.

Introduction

Musculoskeletal symptoms in general and low back pain (LBP) in particular are common health conditions in working populations (Picavet, 2002). Both acute and chronic LBP have important societal consequences in terms of costs, incapacity for work and lost productivity (Houtman et al., 2006; Waddel et al., 1998). In order to reduce musculoskeletal complaints, more specifically LBP, the target group of the present study are hospital workers with patient related tasks like nurses and operation room nurses.
The occupational intervention of this study made part of the Safety and Health Covenants (NFU, 1999) and is implemented from 2001 – 2005 in eight University Hospitals in the Netherlands. Besides a reduction of musculoskeletal complaints, also a decrease of sickness absence was one of the aims of the intervention programme (NFU, 2004).
One year after the intervention, the prevalence of musculoskeletal complaints in hospital workers was still the same. Sickness absence due to low back symptoms appeared to be lower after the intervention programme was implemented. No effect on the exposure to perceived risk factors related to musculoskeletal symptoms was found (Bos et al., submitted). The present study describes whether a change in behavioural determinants could be observed after the intervention programme.

The intervention

The main elements of the multi faceted intervention programme as such were training and education of the hospital workers on the wards, the availability of educated ergo-coaches, improvement of the equipment and labor tools like hoists.

Within the intervention programme, three groups can be distinguished: nurses, physiotrainers (physiotherapists) and ergocoaches. The nurses were trained by well skilled physiotrainers working on the same ward with the same patient population. The training of the nurses consisted of a theoretical and a practical part – taking two hours each – provided in small groups from 5 to 12 persons. The main goal of the theoretical part was to teach the participants a problem-solving strategy. In every transfer situation the nurse has to consider his/her own capability, the resources and needs of the patient and the possibilities and limitations of the environment, and accordingly choose the optimal patient handling method. Thus, the problem-solving strategy serves as a tool helping nurses to solve the problem of handling patients to accomplish transfers. During the practical part of the training the nurses exercised transfers based on the problem-solving strategy. Also Johnsson used the problem-solving strategy in her training to nurses (Johnsson, 2002).

All ergocoaches received training in becoming skilled. In total, the education of ergocoaches took eight hours spread over two days. They learned about ergonomic guidelines, body mechanics, observation techniques and how to provide feedback. At least two ergocoaches were appointed per team, each team counting 25-45 nurses. If needed, ergocoaches encouraged their colleagues to use the assistive devices available and provided advice on good practice to minimize efforts and physical load. The ergocoach (as a team member) payed special attention to the reduction of physical load as a consequence of the activities on the job.

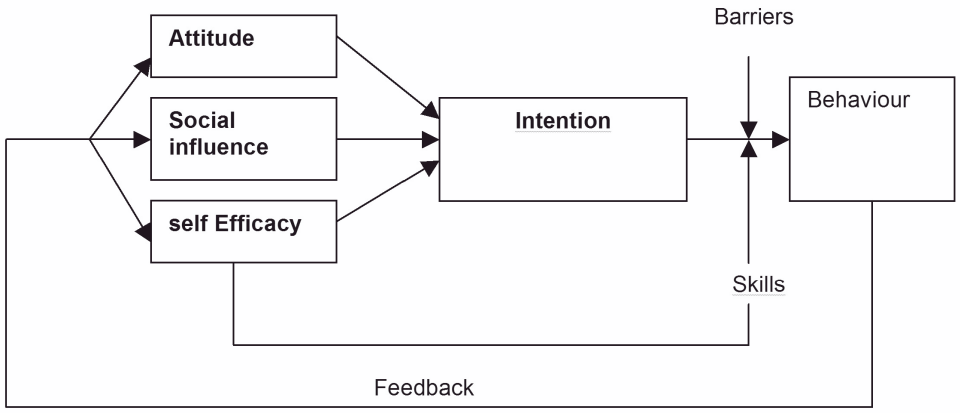
The physiotrainers were educated during a two-day course in the theoretical framework of the problem-solving strategy, the prevention programme and didactic skills by specialists of a consultancy. In each hospital at least five physiotrainers were appointed.

The nurses and the physiotrainers could enter into consultation easily, for example about approaching patients independently and about the way physical transfers should be performed.

Together the physiotrainer and the ergocoaches performed a quickscan prior to the training of the nurses, which listed the ergonomic circumstances and the mechanical equipment on the ward. Based on the results of the

quickscan, new hoists were introduced as well as chairs and low-tech ergonomic tools like jelly mats.
Apart from the technical part the intervention included a change in behaviour of the hospital workers. This part is based op the ASE-model, in which (Figure 1) it is assumed that 'intention to change' and subsequent behaviour are primarily determined by the following cognitive variables: Attitudes, Social

Figure 1. The ASE-model



*Bold items are included in the present study

influences, and self-Efficacy expectations. Moreover, the model postulates that intention predicts subsequent behaviour (Azjen et al., 1980).
The ASE-model originated from the Theory of Reasoned Action (TRA) (Fishbein, 1975). A new dimension, namely Bandura's concept of self-efficacy, has been added to the TRA concepts to form the ASE-model (de Vries et al., 1987). According the ASE model, the factor 'attitude' consists of the advantages and disadvantages of a particular behaviour, in this study formulated as 'avoiding physical load'. The second factor, 'social influence' consist of the outside influence the hospital worker encounters, such as the interaction with colleagues. 'Social influence' is determined by the normative beliefs of important referent persons (colleagues, supervisor) about behaviour and the individual's motivation to comply with these persons. The third factor, 'self-efficacy' expectations, consists of beliefs of the individual about his/her abilities to perform particular behaviour. The performance of a particular behaviour can be hindered by 'barriers', which can be inside or outside the workers possibilities. An individual learns from the consequences of his

particular behaviour by feedback from the situation created. In turn, these consequences do influence the intention to perform that certain behaviour next time. In this study, the feedback is given by the ergocoaches or the experience of low back pain after the performance of a transfer.
Two research questions have been formulated:

1. do ASE determinants as well as 'intention to change' change one year after the implementation of an occupational intervention on wards with hospital workers?
2. do hospital workers with reduced low back pain present higher difference scores on the ASE determinants and 'intention to change' than hospital workers with an increase in low back pain or when low back pain remains the same?

Literature

The ASE- model has been successfully applied in several studies to explain various aspects of health behaviour, especially in research on smoking (Ausems, 2003; Wiggers et al., 2006,) and cancer (Lopez et al., 2004). In the present study is evaluated whether the ASE determinants are associated with 'intention to change' as a result of an occupational intervention directed at the reduction of low back pain.
In the literature, we found one relevant evaluation study in which ASE-determinants were measured twice. Van Es (et al., 2001) used the ASE-model in an evaluation study aimed at enhancing compliance in adolescents with asthma. After the intervention programme no substantial effect or change in any of the behavioural determinants was observed (Van Es et al., 2001). Apart from the fact that other investigators also found that enhancing adherence is a difficult task, Van Es et al. explain the lack of improvement in self-reported adherence in ceiling effects, in adherence itself and in some variables of the ASE-model. Another explanation for the study results could be that the intervention is not effective among adolescents, despite the relatively extensive programme.
Some reviews and primary studies evaluated prevention programmes in primary results, like changes in musculoskeletal complaints and sickness absence, generating conflicting findings (Alexandre et al., 2001; Bos et al., 2006; Engels et al., 1997; Engels et al., 1998; Fanello et al., 1999; Feldstein et al., 1993; Garg et al., 1992; Hignett 2006; Johnsson et al., 2002; Josephson et al., 1997; Lagerstrom et al., 1997; Lynch et al., 2000; Yassi et al., 2001). One of the recommendations from these studies was the use of a multi-

faceted intervention which combines ergonomic interventions such as the use of mechanical aid, interventions to improve health by physical exercise, education and training addressing workers' behaviour and organizational interventions such as changes in work procedures (Bos et al., 2006; Hignett, 2006; Nelson 2006; Zwerling et al., 1997). In a review of Bos (et al., 2006) 25% of the intervention studies (n=13) included revealed a decrease in sickness absence and in 40% a decrease in musculoskeletal symptoms was found.

Methods

Six University hospitals in the Netherlands participated in the study. The project period ran from medium 2002 till medium 2005. The local project manager and the supervisor of each team introduced the study during work progress meetings. In addition, the team members received written information explaining the aim and interest of the study; at the same occasion confidentiality was guaranteed. In the present study hospital workers are individuals providing direct patient care each day i.e. regular nurses on wards or outpatient departments, intensive care nurses, operation room nurses or X-ray technologists.

The intervention group receiving the entire multi faceted prevention programme consisted of 1638 hospital workers. One month before the start of the intervention the hospital workers were asked to fill out a baseline questionnaire (T^0), one year after the start a follow-up questionnaire (T^1) was administered. In the meanwhile, the prevention programme was implemented on the wards according to a protocol formulated by the national task force. The local project managers of the hospitals – as part of the members of the task force – were responsible for the implementation of the intervention programme in their own hospital.

Each hospital was free to choose whether or not to participate in one or in both measurements. Hospital workers of one hospital (Rotterdam) completed only a baseline questionnaire. One hospital was excluded from the present analyses because the follow-up data were raised after the project period. The present analyses includes six University hospitals.

Questionnaires

Questions on demographic variables and musculoskeletal complaints were derived from the standardized and psychometrically evaluated Dutch Musculoskeletal Questionnaire (DMQ) (Hildebrandt et al., 2001). Low back

pain is evaluated with the question "Did you perceive low back pain in the past twelve months?" with answer possibilities 'no', 'yes, sometimes', 'yes, regularly' and 'yes, permanently'.
The main questionnaire included questions about 'attitude', 'social influence', 'self-efficacy expectations' and 'intention to change'. The questions were based on the results of a number of qualitative pilot studies concerning the 'attitude', 'social influence' and 'self-efficacy expectations' of hospital workers. Up till now psychometric data of this questionnaire are not available.
Attitude was based on five statements about the work situation, with answer categories on a five-point scale (Appendix 1). Based on the present study population a reliability analysis was performed revealing a Cronbach's alpha ranging from .75 to .88.
Social influence was measured by means of five questions on support of supervisors and colleagues with regard to perform healthy behaviour. Again a five-point scale was used, providing a Cronbach's alpha of .73 (Appendix 1).
Self efficacy was measured by proposing five different problem situations while asking the respondents whether they felt able to choose a solution proposed by the intervention. Answer categories on a seven-point scale revealed a Cronbach's alpha of .85 (Appendix 1).
Intention to change was measured by posing the question "Starting the working day, do you have the intention to avoid physical back load?" Answer possibilities ranged on a seven-point scale from 'absolutely yes' to 'absolutely not'.

Data analyses
Mean scores and standard deviations were calculated on the person-bound variables age, gender, educational level, working hours, years working, body mass index and low back pain. Data of the whole population on T^0 and T^1 were compared on attitude, social influence, self efficacy and intention using a paired Student's T-tests (two-tailed).
Based on the question "Did you perceive low back pain in the past twelve months?" three low back pain-groups were created by calculating difference scores (T^1 minus T^0). As a result, a group with a decrease, a group with an increase and a group with no change in low back pain one year after the start of the implementation of the intervention were formed.
For each group, two tests were performed. Firstly, the p-value of the mean difference scores on ASE-determinants and intention is determined and the

level of significance is established (p<0.001) by Student's T-tests (two tailed). Secondly, between the three groups mean differences were tested on the ASE determinants and intention (ANOVA, Bonferroni-correction). Data analyses were performed using the Statistical Package for Social Sciences (SPSS 12.0).

Results

At T^0, 2588 hospital workers received both questionnaires and 1638 respondents returned the questionnaires (response rate: 63%). At T^1, 798 out of 1638 hospital workers returned the questionnaires (response rate: 49%).

Table 1. Person-bound variables of hospital workers: mean, standard deviation (sd) N=798

Variable		Total on T^0	Sd
Age (yrs)		37.5	9.9
Gender (% female)		81	39.2
Education (%)	Low	21.6	
	Medium	25.8	
	High	52.6	
Working years		11.2	8.9
Working hours		30.2	7.2
BMI		23.6	3.7
Did you perceive low back pain in the past twelve months (%)			
no complaints		22,0	
yes sometime		42,2	
yes regular		28,9	
yes for a long time		6,9	

A non-response analysis revealed no differences in person-bound variables between responders and non-responders (results not presented).
Within de entire population 78% perceived low back pain in the past 12 months. One year after the implementation of the intervention programme mean scores on social influence, self-efficacy and intention (to change) have increased, indicating that respondents are more susceptible to their social environment (colleagues and supervisor), have stronger beliefs in their abilities to perform particular behaviour and do have stronger intentions to avoid physical load.
As a whole, the mean score on attitude remained the same. Surprisingly, in

Table 2. ASE-scores and Intention on T^0 and T^1: mean, standard deviation (SD) and p-value

Determinant	Aspect (min-max)	T	Mean	Sd	p-value
Attitude (A)	Bring in colleague(-12, +12)	T^0	8.50	3.22	0.42
		T^1	8.41	3.36	
	Bring in mechanical aid (-12, +12)	T^0	5.51	4.64	0.10
		T^1	5.72	4.53	
	Workspace (-12 ,+12)	T^0	9.63	2.65	<0.01
		T^1	9.11	3.17	
	Stimulation patient(-12, +12)	T^0	8.87	3.46	0.78
		T^1	8.73	3.69	
	Own body (-12, +12)	T^0	9.31	3.08	0.13
		T^1	9.08	3.28	
	Total (-64, +64)	T^0	41.88	11.86	0.23
		T^1	41.14	13.60	
Social influence (S)	(-6,+14)	T^0	6.23	5.78	<0.01
		T^1	7.26	5.32	
Self efficacy (E)	(0-30)	T^0	15.73	4.20	<0.01
		T^1	17.03	3.86	
Intention	(0-6)	T^0	4.05	1.66	<0.01
		T^1	4.35	1.51	

the attitude towards the creation of more workspace a decrease is observed (Table 2).

Within the entire group of respondents 431 (54%) perceived no change in low back pain during the past twelve months. One-hundred-sixty-eight respondents (21%) indicated an increase in low back pain, whereas 199 hospital workers (25%) indicated a decrease. The group with an increase in low back pain consists of less female workers (73%) and more workers have a low educational profile (32.9%) (results not presented).

Considering the groups separately, in one year the group with a decrease in low back pain and the group with no changes in low back pain both presented higher scores on 'social influence' (95% CI -2.59 to -.64 and -1.74 to -.50) , 'self- efficacy' (95% CI -2.23 to -1.11 and -1.67 to -.94) and 'intention' (95% CI -.73 to -.18 and -.57 to -.22) (table 3).

The group with a decrease and the group with no changes in low back pain seem to be both more sensitive to social influences, are more confident on their ability to perform certain behaviour and do present stronger intentions

Table 3. Mean (M) difference scores ASE-determinants and Intention, Confidence Interval 95% (CI)

	low back pain change					
	decrease		increase		no change	
	M	CI	M	CI	M	CI
Attitude (A)	0.22	-2.08 to 1.64	-1.75	-0.36 to 3.98	-0.53	-0.83 to 1.90
Social influence (S)	**1.61**	-2.59 to -0.64	-0.13	-0.75 to 1.07	**1.12**	-1.74 to -0.50
self-Efficacy (E)	**1.72**	-2.32 to -1.11	0.54	-1.19 to 0.16	**1.31**	-1.67 to -0.94
Intention	**0.45**	-0.73 to -0.18	-0.06	-0.18 to -0.33	**0.39**	-0.57 to -0.22
N	199		168		431	

Bold values: p <0.01 (T^1 minus T^0)

Table 4 Mean (M) difference scores ASE-determinants and Intention, Confidence Interval 95% (CI) between three low back pain groups

	low back pain change				
	decrease	Increase		no change	
	M	M	CI	M	CI
Attitude (A)	0.22	-1.75	-1.44 to 5.55	-0.53	-1.73 to 4.27
Social influence (S)	1.61	**-0.13**	0.13 to 3.24	1.12	-0.17 to 2.73
self-Efficacy (E)	1.72	**0.54**	0.18 to 2.23	1.31	-0.10 to 1.69
Intention	0.45	**-0.06**	0.06 to 0.99	**0.39**	0.06 to 0.88
N	199	168		431	

Bold values p <0.05 decrease vs. increase and no change (between groups)

to change (p < .001). Compared with the group 'decrease in low back pain' the group with an increase in low back pain has less favorable scores on social influence (95% CI: .13 to 3.24) and self-efficacy (95% CI: .18 to 2.23). The same holds for the scores on 'intention to change' compared to both other groups (95% CI: .06 to .99 and .06 to .88) (Table 4).

Discussion and conclusion

Discussion

This study evaluates the change in the ASE determinants and 'intention to change' one year after the implementation of an occupational intervention directed at the reduction of low back pain. The target group of the intervention

are hospital workers of University hospitals in the Netherlands. These outcomes are secondary results. In another study primary results are evaluated (Bos et al., submitted)

In the ASE-model it is assumed that intention to change and subsequent behaviour are determined by determinants as Attitude, Social influence and self-Efficacy. In this study, two determinants 'social influence' and 'self efficacy' were increased one year after the implementation of the intervention (research question 1). Increased 'social influence' indicates that hospital workers respond to the feedback of the ergo-coaches, their colleagues and supervisor about dealing adequately with physical load in the work situation. Consequently, a culture is developed in which appointments and protocols are formulated as to how to handle highly dependent patients from bed to chair.

Increased 'self efficacy' indicates that hospital workers are more confident in their own capacities when dealing with complex physical work circumstances, e.g. handling a patient with pain on an intensive care ward.

The determinant 'attitude' remained unchanged after the implementation of the intervention, possibly because at baseline the mean score on this variable was high already, referring to a ceiling-effect. Although no change occurred in 'attitude', 'intention to change' actually increased. Higher intention to change indicates that the hospital workers are more motivated to avoid physical back load and work safely.

Although the mean scores on social influence, self efficacy and intention improved significantly, it is questionable if the effect size is relevant. The large sample size may be this is the reason for the significant changes. On the other hand, attitude excepted, all determinants and the intention to change are improved.

According to the ASE-model, intention to change is a predictor for the subsequent behaviour. Whether the actual behaviour itself is really visible in professional tasks is not known. We think is an interesting topic in further observation research.

Whether a reduction in low back pain is associated with higher difference scores on the ASE-determinants and 'intention to change' compared with an increase in low back or when low back pain remained the same (research question 2) is evaluated through the creation of three groups. Whether the differences observed are causally related to the intervention cannot be confirmed by the present data set but at least the study confirms an association between a change in perceived low back pain and a change

in behavioural determinants and intention. Two theoretical explanations may confirm this association. The first explanation follows the biomedical model (van Dijk, 1990): perceived low back pain motivates workers to perform safe and healthy behaviour as to physical load, as educated by the intervention. In turn, this behaviour leads to reduced physical work load and a decrease in perceived low back pain. In this case physical load, such as lifting, is associated with the prediction of low back pain. However, this explanation is not consistent with the results of a co-study with almost the same population in which no decrease in the perceived risk factors was found (Bos et al., submitted).

The second explanation can be found in the bio-psychosocial model (Gatchell, 2006). Following the bio-psychosocial model, a wide range of biomedical and psychological, including pain-related fear and social experiences have shown to predict pain (Linton et al., 2002). Pain-related fear refers to fearful beliefs about the cause of pain and generally appears as fear of pain, fear of physical activities or fear of injury (i.e. fearful beliefs that movements might induce further pain or injury) (Waddell and Main, 1998). A decline in pain is caused by less pain related fear and increased knowledge, more self efficacy in coping with complex physical work situations and higher intention to move safely. Henrotin (et al., 2006) concludes in a systematic review on the effect of written or audiovisual information on low back pain that information (booklets) as an intervention, based on a bio-psychosocial model is recommended in primary care to shift patient beliefs on low back pain.

Though up till now the precise working mechanisms are not yet known, an intervention like the one in this study may increase knowledge on low back pain. As a result a shift in beliefs on (the cause of) low back pain may occur with an inclined perception of pain intensity and disability (Gheldof et al., 2006).

At present, consistent evidence that the intervention is efficient in the prevention of low back pain (re)occurrence is lacking, but it might be that workers with reduced low back pain (intensity) are more sensitive to the intervention because higher improvements in self efficacy, social influence and intention to change are observed. So far the best explanation for the results obtained is a shift in beliefs about (the origin of) low back pain.

Whether it is allowed to assign the improvements in behavioural determinants observed to the implementation of the intervention programme is questionable, as a matter of fact no control group was included in the study.

On the other hand baseline data were obtained which made it possible to compare follow-up data within the intervention group.
A major point in the present study is the lack of a control group. We did not have the opportunity to add a control group because the intervention made part of a covenant in which appointments with stakeholders were made.
Another limitation is the relative low response rate on T^1 (49%). Due to a lack of data of the non-responders, we were unable to perform a firm non-response analysis. For this reason, bias resulting from selective non-response cannot be excluded. However, figures on person-bound variables of the respondents in the present study are comparable with populations with the same professional background (NFU, 1999).

Conclusion
Social influence, self efficacy and intention to change are increased one year after the occupational intervention. Moreover, hospital workers who experience a decrease in low back pain one year after the intervention present higher scores on 'social influence', 'self efficacy' and 'intention' than workers who experience an increase in low back pain. Finally, the attitude of the hospital worker towards the work situation has not changed after the occupational intervention. Possibly these respondents are more sensitive to an intervention directed at practical, behavioural components. Such an intervention may be in line with their perception of the cause of low back pain as being dependent upon someone's physical postures and/or someone's own behaviour.

Practice Implications
The present study population is known as being at risk for (the development of) low back pain. The results obtained may be regarded as additional step in the prevention of low back pain; nurses with a decrease of low back pain seem to be more sensitive to a behavioural approach. One year after the start of the intervention the behaviour determinants were slightly improved. A third measurement should give insight into the continuing of the improved behaviour. In the mean time embedding of the intervention into the organization is important. Embedding means there is systematic attention to physical load, a regular organization of training and instruction and the object prevention of physical load is included in the annual policy report.
Further research should focus on long term changes in behaviour in relation to perceived low back pain. A follow-up study with a control group is an

indicated design in which the visible professional tasks and the adoption of new habits should be observed.
It is interesting to expand the research to other professions in health care like medical surgeons but also to employees in facility service departments in hospitals. Both groups do have jobs with a high physical load.

Appendix 1. Determinant, subject, answer categories and Cronbach's a

Determinant	Subject	Answers	Scale	a
Attitude (A)	Bring in a colleague in order to avoid physical back load is:	very pleasant- very unpleasant	5-point	.75
		very wise - very unwise		
		very handy - very clumsy		
		very important - very unimportant		
		very necessary - very unnecessary		
	Bring in mechanical aid in order to avoid physical back load is:	very pleasant - very unpleasant	5-point	.86
		very wise - very unwise		
		very handy - very clumsy		
		very important - very unimportant		
		very necessary - very unnecessary		
	Create workspace in order to avoid physical back load is:	very pleasant - very unpleasant	5-point	.83
		very wise - very unwise		
		very handy - very clumsy		
		very important - very unimportant		
		very necessary - very unnecessary		
	Stimulation of the patient to cooperate in order to avoid physical back load is:	very pleasant - very unpleasant	5-point	.87
		very wise - very unwise		
		very handy - very clumsy		
		very important - very unimportant		
		very necessary - very unnecessary		

	The use of guidelines for performing a transfer in order to avoid physical back load is:	very pleasant - very unpleasant	5-point	.88
		very wise - very unwise		
		very handy - very clumsy		
		very important - very unimportant		
		very necessary - very unnecessary		
Social influence (S)	My supervisor finds that I should avoid physical back load consciously	very much agree - very much disagree	5-point	.73
	My colleagues find that I should avoid physical back load consciously	very much agree - very much disagree		
	The majority of my colleagues obviously avoid physical back load obviously	very much agree - very much disagree		
	Do you take your supervisor's opinion about avoiding physical back load seriously	very much - very little		
	Do you take your colleagues' opinions about avoiding physical back load seriously	very much - very little		
self Efficacy (E)	Are you capable …			
	…of using the right transfer-technique…	absolutely yes - absolutely no	7-point	.85
	…of using available mechanical aid…	absolutely yes - absolutely no		
	…of instructing the patient correctly…	absolutely yes - absolutely no		
	…of adjusting and creating workspace…	absolutely yes - absolutely no		
	…in order to avoid physical back load?			
	Do you think it is possible to avoid physical load in all circumstances?	absolutely yes - absolutely no		

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CHAPTER 6

Perceived health, work effort and sickness absence as to age in the nursing profession

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Abstract

Objective: work related health is changing when employees grow older. The present study evaluates health-related factors in relation to aging in the nursing profession. Research questions are:

- how do nurses older and younger than 45 years perceive their health, physical and mental work effort?
- is the prevalence of musculoskeletal complaints among nurses older and younger than 45 years?
- do nurses older and younger than 45 years present different sickness absence rates and are eventual differences associated with perceived health, perceived musculoskeletal complaints or perceived physical and mental work effort?

Method: we used cross-sectional data of 1993 nurses in eight university hospitals in the Netherlands. The Dutch Musculoskeletal Questionnaire (DMQ) was used to assess the health components. Data on work effort and sickness absence (2002-2005) were derived from a self-report and from the database of the hospitals involved. Mean scores and confidence intervals were calculated. Student's T-tests were used to compare self rated health, physical condition and fatigue at the end of a working day. Chi^2-tests have been used for the remaining risk variables: musculoskeletal complaints, sickness absence and effort of the job.

Results: nurses over 45 years indicate lower self rated health, lower physical condition, more musculoskeletal complaints and more physical fatigue after a day working compared to their younger colleagues, additionally they perceive lower mental effort. Sickness absence longer than one week due to low back pain is higher among older nurses.

Conclusion: the results of the study indicate that occupational interventions may be worthwhile for nurses of 45 years and older. Tailor made, age-related interventions for older employees should be developed, evaluated and implemented in the organisation. When this process is accompanied by careful monitoring and research, older nurses may be kept more years in their valuable positions at the wards.

Introduction

The nursing profession with its high physical and psychosocial load can be regarded as a heavy job (Lagerstrom et al.,1998; Trinkhoff et al., 2002). In the nearby future the high demanding nature of this profession may even increase (van Wieren et al., 2006). Due to demographic changes in the labour force (Naegele, 1999), e.g. among nurses working in all kinds of healthcare facilities mean age is growing. At the same time the patient population in hospitals is in need of more specialized and physically demanding care, which is to be provided by nurses with a higher mean age than a few decennia ago. From an occupational health and human resource perspective, physical and mental health is more frequently threatened when mean age of the working

population increases.
The present study evaluates subjective health, perceived effort and sickness absence in relation to work among nurses younger and older than 45 years in the Netherlands.
The definition of an aging worker is generally based on the period when major changes occur in relevant work related functions during the course of work life, i.e. between 45 and 50 years (Ilmarinen et al., 1991). Generally, ageing is accompanied by physical and mental changes. Changes in physical work capacity are often concentrated on the cardiovascular and musculoskeletal systems, body structure, and some important sensory systems (Ilmarinen et al., 1991). The maximal oxygen consumption in absolute and relative terms shows a clear and linear decline with age among both men and women (Ilmarinen et al., 1991). As a result, physical condition is deteriorating, fatigue occurs more rapidly and more time is needed for recovery after physically demanding tasks. The nursing profession, the target group in this study, is a job with profound physically demanding tasks, e.g. lifting, which requires a good condition (Bos et al., 2007; Schaie, 1994).
Mental functional capacity is often defined as the ability to perform different tasks that require intellectual effort. Perception, memory, learning, thinking, and the use of language are some examples of cognitive functions (Ilmarinen et al., 1991). From the point of view of work life the most important changes in mental functions are related to the weakening of precision and the speed of perception[7]. In most work tasks speed and precision can be substituted by the high motivation of aging workers and the experience and wisdom they have assembled throughout their work life. Even though the speed of learning may slow down with age, the actual learning process is not dependent on a person's age. Strong motivation to learn can also compensate for the slower learning speed. According to the literature, some mental characteristics can also strengthen with age (Baltes & Smith, 1990; Ilmarinen, 2006). Simultaneously, mental capacity is increasing and the analytic and problem solving power is increasing (Ilmarinen, 2006).
A survey in the EU countries in the year 2000 pointed out that around 40% of men and women over 45 years of age reported that work affected their musculoskeletal and psychosocial symptoms (Ilmarinen, 2006; de Zwart et al., 1997) and 40% reported also work-induced stress symptoms. De Zwart (de Zwart et al., 1997ab) found increased musculoskeletal complaints among workers in physically demanding occupations with age for both sexes. For several complaints substantially higher rates were reported for women

than for men, with a relatively high number of musculoskeletal complaints observed among older female workers. Among nurses, non-specific low-back pain is the most frequently reported musculoskeletal symptom with a past-year prevalence of 30-60% (Lagerstrom et al., 1998; Trinkhoff et al., 2002, Engels et al., 1996). Other branch-specific studies have also reported neck and shoulder symptoms in 30-48% and 43-53% of the nurses respectively (Lagerstrom et al., 1998; Engels et al., 1996).
Based on a review of Dekker (et al., 2007) only weak evidence was found for older age and history of sickness absence as factors associated with long-term sick leave in sick-listed employees. Another study (Lotters & Burdorf, 2006) demonstrated age as a main factor, next to gender, perceived physical workload and poor general health (as to neck, shoulder and upper extremity disorders) being associated with longer periods of sickness absence.
The nursing profession is characterized by work related risks (Bos et al., 2007). The work related risks include high physical load, high psychosocial load and the work has to be performed according to rather strict work schedules. When taken into account the increasing need for more specialized and physically demanding care for reasons of the more severe patient population in hospitals, together with higher levels of musculoskeletal complaints in female workers, the nursing profession with its high percentage of female workers may form a risk on its own for the older female worker. For this reason perceived health, prevalence of musculoskeletal complaints, perceived physical and mental work effort in older and younger nurses and the association between sickness absence is investigated. Based on the results, evidence can be obtained for the urge for work-related interventions aiming at improving workability in nurses over 45 years.

To obtain more insight in the physically demanding nature of the nursing profession of the older versus the younger nurses, the following research questions have been formulated:

- how do nurses older and younger than 45 years perceive their health, physical and mental work effort?
- what is the prevalence of musculoskeletal complaints among nurses older and younger than 45 years?
- do nurses older and younger than 45 years present different sickness absence rates and are eventual differences associated with perceived health, perceived musculoskeletal complaints or perceived physical and mental work effort?

Methods

Sample and design

The data used in the present study were collected as part of the Health and Safety covenant of university hospitals, which ran from medium 2002 till medium 2005. All nurses (n=3267) appointed by seven university hospitals in the Netherlands were asked to participate in the study. Two age-groups were formed: nurses younger than 45 years (< 45 yrs) and nurses of 45 years and older (≥45 yrs). The study was conducted using a cross-sectional design.

Instruments

In the study the Dutch Musculoskeletal Questionnaire (DMQ)(Hildebrandt et al., 2001) was administered. The DMQ is a standardized questionnaire, partly derived from the Nordic Musculoskeletal Questionnaire (Kuorinka et al., 1987) and the Dutch Questionnaire on Work and Health (de Winter & Grundemann, 1992). The DMQ includes questions on personal and demographic variables such as height, weight, function, having managerial tasks, working hours, work in the past and lifestyle. Furthermore, the questionnaire includes items on musculoskeletal complaints, musculoskeletal workload, health, tasks and psychosocial working conditions.

In this study health components are: self rated health ('In general, how is your health?' 4 point scale), physical condition ('How is your physical condition in de past few months?', 4 point scale), mental fatigue ('How is your mental status at the end of a working day?', 4 point scale), physical fatigue ('How is your physical status at the end of a working day?', 4 point scale) and musculoskeletal complaints (self rated complaints as to pain, uncomfortableness, stiffness of the regions neck, shoulder, arms, low back, legs in the past 12 months). Physical work effort was asked by: 'I do have strenuous work (2 point scale) and mental work effort was asked by 'I do have punctual work' (2 point scale). Prevalence of low back pain and neck shoulder pain was asked by: 'How many times in the past 12 months did you perceive low back complaints' (5 point scale) and 'How many times did you perceive neck shoulder complaints' (5 point scale). 'Sickness absence was evaluated by 'How many times in the past 12 months were you listed sick due to low back pain?' and 'How many times in the past 12 months were you listed sick due to neck/shoulder pain?' (6 point scale).

Data analyses

The questionnaires were scanned electronically and data were cleaned using logic, range, and consistency checks. Mean scores and confidence intervals were calculated. Student's T-tests were used to assess self rated health; self rated physical condition and perceived physical and mental fatigue at the end of a working day. Chi^2-tests have been used for the other risk variables and musculoskeletal complaints, sickness absence and work effort. Subsequently, perceived health, physical condition, physical and mental fatigue at the end of the working day, physical and mental work effort and complaints were entered in a multivariate regression model (method 'enter') in order to find an explanation for sickness absence. Additionally, 95% confidence intervals (CI) and Odds Ratios (OR) were computed. This procedure was repeated in the two age groups for sickness absence due to low back pain and for sickness absence due to neck/shoulder pain. Data analyses were performed using the Statistical Package for the Social Sciences (SPSS 12.0).

Results

Completed questionnaires were returned by 1993 subjects (response rate 61%). A non-response analysis revealed no differences in person-bound variables between responders and non-responders (results not presented). 1445 nurses (73%) were younger than 45 years, whereas 548 (27%) of the nurses were 45 years or older.

As expected, most of the respondents were female: 87% in the younger and 82% in the older age group. Mean age of the nurses in the younger category was 32 years; in the older category mean age was 50 years. Mean weekly

Table 1. Person bound variables of nurses in two age categories: mean (M) and standard deviation (sd)

		<45 N=1445		≥45 n= 548	
		M	sd	M	sd
Age (yrs)		32.2	7	50.3	3.9
Gender (% female)		87.2	33.4	80.1	39.7
Education (%)	Low	27.2		47.0	
	Medium	23.5		26.4	
	High	49.4		26.6	
Working years		7.2	6.3	16.7	10.3
Working hours		30.1	6.9	28.8	6.8
Body Mass Index		23.6	3.8	24.6	3.5

working hours was 30 in the younger group and almost 29 hours in the older group. Of the younger nurses 73% is medium or high educated, in the older nurses this percentage is 53.

Table 2. Perceived health, complaints and work effort in nurses across two age categories: mean (M) and CI 95%

		<45	≥45		
	scale	M	M	CI 95%	
Health					
Self rated health*	0-10	.54	**1.00**	-.60	-.31
Physical condition*	0-10	1.89	**2.11**	-.44	-.003
Physical fatigue**	1-4	2.31	**2.40**	-.16	-.02
Mental fatigue**	1-4	2.21	2.18	-.04	.11
Complaints of					
Elbow	%	6.6	**17.8**		
Pols/hand	%	19.5	**29.2**		
Hip	%	16.5	**26.7**		
Knee	%	26.8	**35.4**		
Ankle	%	17.9	**23.6**		
Low back	%	78.6	**70.7**		
Neck	%	47.1	**52.2**		
Shoulder	%	34.7	**42.2**		
Work effort					
Physical	%	64.8	61.3		
Mental	%	71.7	**63.3**		

*scale 0 (positive) –10 (negative)
**scale 1 (positive) – 4 (negative)
Bold = p<0.05 vs younger nurses

When compared with younger nurses older nurses perceive their health as lower (CI 95% -.60 to -.31) and indicate a lower physical condition (-0.44 to -.00). They also indicate more physical fatigue at the end of a working day (-.16 to -.02). The 12 months prevalence of musculoskeletal complaints is higher in older nurses, including complaints in all bodily regions, except the low back region. Perceived mental effort is higher in younger nurses, possibly indicating older nurses have more mental capacity.

In both categories 23.1% of the nurses with low back pain indicated a period of sick leave. Sickness absence longer than one week due to low back pain is higher in older nurses (4.3%). Almost 9% of the younger nurses with neck/ shoulder pain were on sick leave due to neck/shoulder pain in the past 12 months against 12.8% of the older group.

Table 3. Sickness absence in nurses during the past 12 months due to low back pain or neck/shoulder pain

		<45	≥45
Nurses with low back pain (at least one time)	n	966	313
Sickness absence due to low back pain (% of nurses with low back pain)	n	223 (24)	78 (25)
1-7 days	%	20,3	18,8
≥ 8 days	%	**2,8**	**4,3**
Total	%	23,1	23,1
Nurses with neck/shoulder pain (at least one time)	n	565	251
Sickness absence due to neck/shoulder pain (% of nurses with neck / shoulder pain)	n	20 (8.8)	32 (12.7)
1-7 days	%	5.3	5.2
≥8 days	%	3.2	7.6
Total	%	8.5	12.8

Bold: p<.05 <45 vs ≥45

The multivariate analyses model revealed only one factor in the low back pain group as well as in the neck/shoulder group as contributing to sickness absence. In the low back pain group physical condition was associated with sickness absence (OR 1.21, CI 95%, 1.05-1.39) in nurses over 45 years. In the neck/shoulder group self rated health was associated with sickness absence (OR 1.36, CI 95%, 1.12-1.64) in nurses younger than 45 years.

Table 4. Multivariate analyses of sickness absence due to low back pain or neck/shoulder pain in younger and older nurses (Odds Ratio (OR) and Confidence Interval (CI))

	Sickness absence due to							
	Low back pain				Neck/shoulder pain			
	< 45		≥ 45		< 45		≥45	
	OR	CI	OR	CI	OR	CI	OR	CI
Self rated health	1	.92-1.17	1	.85-1.20	**1.36**	**1.12-1.64**	1.2	.97-1.54
Physical condition	1	.95-1.12	**1.21**	**1.05-1.39**	1	.86-1.18	0.97	.79-1.18
Physical fatigue	.83	.61-1.11	1.03	.64-1.67	.63	.37-1.1	1.39	.71-2.71
Mental fatigue	.89	.67-1.18	1.25	.76-1.97	.66	.39-1.12	.87	.47-1.62
Physical work effort	.81	.55-1.19	.63	.33-1.18	.66	.33-1.31	1.13	.45-2.85
Mental work effort	.81	.55-1.21	.94	.50-1.78	1.35	.64-2.90	.87	.36-2.09

Bold: p<.05

Discussion and conclusion

Discussion

In this study perceived health, perceived work effort, prevalence of musculoskeletal complaints and sickness absence in younger (<45 years) and older (≥45 years) nurses in eight university hospitals in the Netherlands is addressed. The results of this study indicate lower perceived health among older nurses as compared to their younger counterparts. In performing work-related tasks mental effort is lower in older nurses. Sickness absence due to musculoskeletal complaints is higher in nurses of the older age group. In nurses of the older age group sickness absence due to low back pain is partly explained by physical condition, whereas in nurses of the younger age group sickness absence due to neck/shoulder pain is partly explained by self rated health.

The results obtained in this study are confirmed by the literature as to perceived health, perceived work effort and sickness absence (Sluiter et al., 2003, 2006). Prevalence of musculoskeletal complaints is higher in the older group, except low back pain. The relevance of the differences found in the two age groups is not very high since prevalence is high in both age groups (Trinkhoff et al., 2002). For this reason preventive interventions should be directed not only on nurses over 45 years of age. Additionally, organizations' HRM policies as well as their occupational health policies should include tailor made interventions for different age groups.

One finding is more or less contrary to our expectations, namely that low back pain is less frequently indicated by nurses over 45 years. It may be that the healthy worker effect is responsible for this finding. According to Pearce (et al., 2007) one component of the healthy worker effect is called the healthy worker survivor effect, i.e. the selection of unhealthy people out of the workforce. In case this type of healthy worker effect applies to our study, nurses over 45 years of age already stopped working for reasons of – among other things – low back complaints. As a result, in the remaining nurses less low back pain complaints were found. Perceived physical work effort in all nurses and mental work effort in the younger group is high, indicating the high demanding nature of the nursing profession (Sluiter et al., 2006). Perceived mental work effort is lower in older nurses, possibly explained by the increased mental capacity in older workers as mentioned before.

Because of demographic changes in the labour force – i.e. increasing age of health care providers – together with an increase in the need for

physically demanding care, insight in health related factors susceptible for preventive interventions may prevent sickness absence or early retirement. As a specific target group we focused on nurses older than 45 years since these professionals may be at risk as to sickness absence or work disability (NFU, 2004). The development, evaluation and implementation of age-related interventions in the organisation may contribute to the prevention of (temporary) work disability or early retirement and keep professionals motivated to continue working. Ilmarinen (et al., 1991) already mentioned some interventions on the individual and the organisational level. On the individual level promotion of physical, mental and social recourses, improving health, developing competence, coping with changes and participating are some examples. On the organisational level interventions like age management, age ergonomics, work-rest schedules, flexible working hours, part time work and tailored competence training are mentioned. Not only interventions on the individual and organisational level are needed, also the government has to support these kinds of interventions by redirecting policy (Wynne & Grundemann, 1999). Regarding the results of our study both interventions on the level of the employee as well as on the organisational level may be considered. The interventions on the individual level should be tailor made because differences in self rated health among older nurses are high (de Zwart et al., 1997ab). These differences may be due to a chronic disease, lifestyle, the general attitude towards work and changes in the work situation. Interventions on an individual level can be advised and initiated by the Human Resource department and the occupational physician. In that case, both are in need of information as to the content of the job, the needs of the employee, his or her health conditions and the workability of the employee. Interventions on the organisational level should include a solid policy of age management with three dimensions: job content, job demands and physical performance of the nurses. The job content should include sufficient possibilities for decisions on the level of the job: participation in the work-schedules, moment and length of pauses, interventions related to lifestyle (moving, nutrition, relaxing) are also possibilities. Regarding job content, older workers in jobs with no or little decision latitude and with high job demands are at risk for developing health complaints (de Zwart, 1997a). Moreover, physical job demands should be lower for older workers.

One of the limitations of this study is the lack of data of the non-responders, except on the person-bound variables we were unable to perform a firm non-response analysis. For this reason, bias resulting from selective non-response

cannot be excluded. However, the figures on person-bound variables of the respondents in the present study are comparable with populations with the same professional background (NFU, 2004). Another limitation can be found in the cross sectional nature of the study design, because of such a design causal inferences cannot be made.

Conclusion

In the hospitals the proportion of health care providers over 45 years is growing. On the one hand perceived health is lower among older nurses as compared to their younger counterparts. In addition, the proportion of nurses on sickness absence due to musculoskeletal complaints is higher in nurses over 45 years of age. At the same time, physically demanding care is increasing among patients admitted to the hospitals. On the other hand, mental effort in performing their work is perceived lower in older nurses when compared to their younger colleagues.

The results of the study indicate that tailor made occupational interventions may be worthwhile for nurses of all age groups, especially for older nurses. When the process of development, evaluation and implementation is accompanied by careful monitoring and research, older nurses may be kept more years in their valuable positions at the wards.

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CHAPTER 7

Discussion

Main findings

The Prevention Programme Physical Workload was implemented between 1999 and 2004 as part of the Health and Safety Covenant for University Medical Centres. Overall, sickness absence in the Netherlands fell from 5.4% to 4.6% in the period covered by the covenants (Veerman & Molenaar-Cox, 2006). In that same period, far-reaching changes were made to the rules and regulations. At sector level, employers were given greater responsibility for tackling sickness absence and employees were given shared responsibility for their own reintegration. This was also a time in which the economy was stagnating. Both of these changes may have had an impact on the sickness absence rate. Studies show that a stagnating economy is linked to a lower absence rate. During uncertain economic times, employees become unsure about whether they will keep their jobs and are less inclined to call in sick (Meineken, 2003). However, the economic downturn was more apparent in sectors where employees were covered by a health and safety covenant. In those sectors, which included central government, teaching hospitals and general hospitals, the police force, home care, the hotel and catering sector and the building industry, the average sickness absence rate fell from over 7% to 5.5%. Added together for the years 1999-2004, the reduction in sickness absence came to 22% in the covenant sectors and 9% in the non-covenant sectors (Veerman & Molenaar-Cox, 2006). This means that the percentage drop was 2.5 times greater than in sectors where employees did not work in accordance with a covenant. Almost 90% of covenant agreements on sickness absence and reintegration were fully or largely achieved. A cost-benefit calculation puts the saving as a result of reducing the sickness absence rate at between 12.6 and 22.6 million euros (Tripartite Working Group, 2007).

The UMC Health and Safety Covenant produced a drop in absence rates of 20% in the participating hospitals (NFU, 2004abc). Approximately 6330 employees – more than 10% of all those employed in the UMCs – took part in the Prevention Programme Physical Workload, as part of the Health and Safety Covenant. During the covenant period, 400 ergocoaches were trained in the eight UMCs. Products were developed to support the programme, such as practical physical workload guidelines, a course book for ergonomics, an ergonomics coach profile and information leaflets.

The high incidence of locomotor system complaints has also been

demonstrated among the four occupational groups in this study: regular nurses, intensive care (IC) nurses, surgical assistants and radiology assistants. The prevalence of these complaints among regular nurses has been the subject of research for decades, but less is known about IC nurses, surgical assistants and radiology assistants as separate groups. Furthermore, studies usually involved incidence rates for low-back complaints, whereas neck/shoulder complaints are also a serious problem. We also know more about the risk factors that the different occupational groups associate with locomotor system complaints. For nurses, these risk factors are high physical exertion, static load and high job demands. For IC nurses, they are a poor ergonomic working environment, and for radiology assistants dynamic load. No risk factors were found for surgical assistants as an outcome of the multivariate analysis. All in all, exposure to physical and psychosocial risk factors is perceived differently across the four professional groups. This finding indicates the need for a tailor-made component in the intervention programme at the level of risk factors. The instruction component about physical techniques should focus on coping with static postures at the operating table for surgical assistants and on the work environment for IC nurses. We know with regard to neck/shoulder complaints that psychosocial factors, in addition to physical factors, may also play a role in causing and maintaining complaints (Ariens et al., 2001;2002). Psychosocial factors may include, for example, social support from the manager and other team members. More attention could also be paid to these factors in a prevention programme. Aspecific locomotor system complaints (about 90% of all complaints) often have not one, but several causes and are therefore multifactorial. In part, the complaints relate to the individual, and in part to work. For this reason, an intervention programme was chosen that aimed both at behavioural change and at the use of aids, modifications to the workplace and organizational measures such as deploying ergocoaches. This approach is supported by the findings of the literature review. It is not enough to provide a training course; integrated programmes that include an ergonomic component offer the greatest prospect of positive results.

Implementing a prevention programme is all about implementing innovation. The Prevention Programme Physical Workload is based on behavioural change. In implementation processes, the type of communication with the client and the target group is critical. We might expect the intervention programme that emphasized terms like low-back complaints and sickness absence to initially have shown an increase in complaints, thereby disguising

a possible decrease as a result of the intervention. Filling out the questionnaire once the programme had been implemented may have elicited a response tendency towards greater body awareness, overshadowing the 'real' effect. Increased body awareness or awareness of back symptoms may also explain the stronger association between the factor of work and the low-back symptoms that nurses perceived after the intervention programme; nurses with increased body awareness may more frequently associate high physical workload with low-back pain (Landsman et al., 2004). The further development of the intervention programme should tie in with a health management system which emphasizes a more positive approach such as health and vitality and which gives employees themselves more opportunities to regulate and to shape their work. Once the intervention programme was implemented, we found that sickness absence due to low-back symptoms appeared to be lower. We found no effect on the exposure to perceived risk factors relating to musculoskeletal symptoms. The nurses perceived work as having a greater impact on their musculoskeletal symptoms than before.

The ASE model assumes that intention to change and subsequent behaviour are determined by attitude, social influence and self-efficacy (Ajzen & Fishbein,1980; Ajzen et al., 2007). In this study, two determinants – social influence and self efficacy – had increased one year after the intervention. Increased social influence means that hospital workers respond to feedback from their colleagues, ergocoaches and supervisor about dealing adequately with physical load in the work situation and develop a culture in which they make agreements and protocols about how to transfer a highly dependent patient from bed to chair. These results could indicate behavioural change among the nurses. A second measurement point can show the extent to which the new behaviour is maintained long-term. It would also be interesting to examine why behavioural change is greatest among the group with reduced complaints. One possibility is that the perception of fewer back complaints is a direct effect of behavioural change.

With the gradual ageing of the European population, many countries will lose around 13% of their workforce to retirement in the next 10 years. The substantial proportion of workers in the 55 years and older age group (more than 15%) presents a significant ongoing policy challenge, particularly for the Netherlands and for Scandinavian countries (Parent-Tirion et al., 2007). The same applies to the physically and emotionally taxing tasks that are part of nursing and care occupations. Older nurses have more difficulty meeting the physical demands of their work than younger nurses, although they tend

to have less difficulty with the emotional workload. Chapter 6 ends with the conclusion that older nurses perceive their health as being less good than their younger colleagues. This can only partly be compensated for by the internal adaptation mechanisms of individuals (De Zwart et al., 1997). Especially in 'high demand jobs' (Sluiter, 2006), where physical workload cannot be fully controlled using ergonomic measures, a subjective perception of poor health will become a stumbling block. Workforce participation for employees older than 50 declines if health is perceived as poor. For employees to continue working after their 61st year, they must perceive their health to be good (Burdorf and Mackenbach, 2006).

Effectiveness of intervention on work capability and participation

A great deal of attention within occupational health care is focused on the effectiveness of interventions on work capability and participation. A literature survey has been conducted into effective interventions in the area of lifestyle factors (Proper et al., 2005). Lifestyle factors relate to the following: movement, smoking, alcohol consumption, nutrition and relaxation. With regard to encouraging movement, Proper concludes that interventions that encourage movement have a positive effect on a number of health-related variables such as the degree of physical activity, aerobic stamina and the percentage of body fat. Programmes that also target the locomotor system generally lead to a reduction in locomotor system complaints. Partly due to a lack of well-designed studies, there is no evidence for the effect on work-related variables such as sickness absence. Factors that cannot be influenced are age and the associated changes in health. For this reason, organizations should ensure that their intervention programmes tie in with other factors that increase employability, such as lifestyle factors, job content/composition and interventions aimed at good ergonomic working conditions (Nauta et al., 2005). An all-round job, which calls for different competencies or ensures regular task variety, will make an older employee more employable, whereas a specialist job entails a more limited employability. Finally, Burdorf and Mackenbach (2006) argue for more interventions geared towards health, lifestyle and working conditions because these promote work participation and work capability among older people. Health management should tie in directly with hospital policy, with working conditions and with work content. Zwetsloot claims in this respect that an organization's health policy is part of its strategic goals because investments in employee health have an impact

on business yields such as functioning and productivity (Zwetsloot and Van Scheppingen, 2007).

Methodological considerations

Fishbein & Azjen's (1980) theoretical model, which underpins the prevention programme, has been used for many years in various fields of research, such as therapy compliance, cancer and smoking. The model has a broad application and is suitable for all types of behaviour. However, its broad application is also a disadvantage in that the model is not specific. Supplementary research aimed at making it more precise, as well as the inclusion of health themes and health perceptions, would fine-tune the model, thereby increasing its predictive value. Another theme with potential added value for the model is the influence of the cultural, social and physical environment as environment can elicit certain behaviour or impede desired behaviour.

The principal measurement tools used in this study are the locomotor system questionnaire (LSQ; or VBA in Dutch) and the ASE (attitude, social norm and self-efficacy) questionnaire (Hildebrandt et al., 2001). The LSQ is a psychometrically evaluated questionnaire that includes components about psychosocial work factors. It is this aspect in particular that needs modification. Since then, other questionnaires have become available, such as the Assessment and Perception of Work Questionnaire (VBBA in Dutch) and the Utrecht Eagerness Questionnaire (UBOS). The ASE questionnaire included questions about attitude, social influence, self-efficacy expectations and intention to change. The questions were based on the results of a number of qualitative pilot studies concerning the attitude, social influence and self-efficacy expectations of hospital workers. As yet, psychometric data from this questionnaire are not available.

The results described in this study are based on data obtained through questionnaires. In their answers, respondents were sometimes asked to go back as much as 12 months in time, which may have affected the reliability of the data (recall bias).

Another methodological shortcoming involves the literature review (chapter 2). Due to the inclusion criteria, the number of articles reviewed is relatively small. However, the aim of the review was to obtain information about the effects of interventions, including training and education; the information obtained has proved useful for carrying out additional research into prevention programmes.

Other shortcomings are the absence of a control group and the covenant's rather short running time (12 months). Because of the lack of a control group, the results observed cannot be attributed to the implementation of the intervention programme. The brief running time and the tight planning meant that the follow-up took place one year after the start of the implementation. As a consequence, it is possible that a change to more 'healthy behaviour' was not fully detected. Quite the reverse – a positive trend at T1 might have been present if there was indeed a long-term effect.
Due to a lack of data about non-respondents we were unable to perform a firm non-response analysis. For this reason we cannot rule out bias resulting from selective non-response. However, figures on person-bound variables of the respondents in the present study are comparable to populations from the same professional background (VAZ, 1999).
Finally, the roles of researcher and project leader in the UMCG were fulfilled by a single person in this study, which is rather at odds with the requirement for 'research independence'.

Trends in the nursing profession: workload and lifestyle

Despite the deployment of aids, the proper management of physically demanding workplace conditions and the deployment of ergocoaches, the work of nurses will always involve a high physical load. The patient's bedside, with a patient in need of help, is the nurse's principal workplace.
As is the case with the Dutch population as a whole, the average age and Body Mass Index (BMI) of patients will gradually increase in the decades ahead, with implications for the physical workload of nurses. But it is also likely that nurses too will become overweight. Obesity leads to reduced physical capacity. In addition, employees who are seriously obese have a higher rate of sickness absence and are sick for longer periods than employees who are not overweight (CBS, 2007). This trend has major implications for public health, both for the individual and from a macro-economic perspective. These chronic health problems will also have repercussions on the 'workability' of Dutch employees and hence on the work capability of nurses.
In general, a higher average age goes hand in hand with poorer health and a more complex set of symptoms, thereby increasing the demand for care. Delivering care to patients with a high BMI index requires more physical strength and makes care routines more difficult. For example, patients' beds will have to be wider (and longer) in order to ensure patient comfort, which

will require nurses to lean further forward in order to do their work. A wider bed also means less working space around the bed, which will entail more manoeuvring of the bed and/or hoist.
IT is also making inroads into the field of care. Increasingly, patients will have access to internet and email (Zwetsloot, 2007). Communication between nurse and patient will occur more often via internet (chat, email). Recording critical parameters such as heart rate and blood pressure are examples of care routines in which computers have become indispensable. Other examples are electronic patient files and the digitizing of X-rays. For nursing work, this means working longer and more frequently with computers, as a result of which the physical load will also acquire a static and repetitive character.

Implications for practice

The practical implications of this study can be broken down into three levels: macro (government), meso (organization) and micro (individual).

Government
According to the government, employers and employees find the Working Conditions Act excessive and far too detailed. The Cabinet therefore wants to abolish superfluous rules and regulations and give companies more room to customize. Because employees and employers are being given the opportunity to interpret health and safety policy in their own way, the support base for the health and safety policy will increase. This in turn will improve safety and health on the work floor. The switch to less detailed regulations and more customization is consistent with the policy of prevention, absence through illness and reintegration pursued by the Ministry for Social Affairs and Employment. It means that employers and employees will together bear more responsibility for safety, health and reintegration into the workforce. The Labour Inspectorate checks whether companies are complying with the statutory regulations. As soon as a tested Health & Safety catalogue has been drawn up, it is used as a frame of reference for the inspection. A Health & Safety catalogue describes the various ways employers can comply with the target regulations drawn up by the government. For example, a Health & Safety catalogue can contain measures that have contributed in the past to a safe and healthy working climate, norms resulting from research, best practices (practical solutions that have proven their worth), NEN norms,

sector guidelines, agreements, handbooks or current health and safety policy regulations. The responsibility for compiling and publishing the Health & Safety catalogues is borne by the employers and employees (or associations of employers and employees, for example, in a particular sector or industry). Health & Safety catalogues are tested marginally. This means that checks are made to see whether the catalogue has been compiled properly and is satisfactory (SZW, 2008).

Organization

Behavioural change among large groups of employees by definition entails an organizational change, in this case for the hospital, the executive departments and management. For a behavioural change to become permanent, it is critical that the changed behaviour be maintained with utmost care. This means that the policy has to be anchored in the organization; the topic of 'healthy working' must stay on the agenda by means of a systematic focus on the desired behaviour. The Health & Safety catalogue developed for each sector can make a significant contribution by devoting a section to the description (in the form of a protocol or guideline) of successful guarantees. Structural coordination and cooperation between Health and Safety departments and Human Resources about embedding the topics in their human resources and staff policy is a point of special interest, especially since this linkage is needed for all topics that are part of the prevention programme, such as age management, (age-related) ergonomics, work-rest schedules, flexible working hours, part-time work, career policy and tailored competence training.

Because in most hospitals the project leaders are employed by the internal health and safety departments, managers – those responsible for implementing health and safety policy – sometimes felt insufficiently involved in the implementation of the Prevention Programme Physical Workload. Project leaders have an advisory role vis-à-vis management and will always have to engender sufficient commitment among departmental managers before they can begin their work. This dilemma is removed if management is more involved in programme implementation and assurance. The way to achieve this is to make them aware of intervention outcomes. Feedback to management can take the form of regular monitoring of business outcomes such as functioning and productivity on the one hand and of health outcomes such as self-rated health and employee work capability on the other. Health is therefore not viewed from a medical or a health protection perspective,

but is seen as a factor which helps to determine the functioning of people (human and social capital) and which may contribute to the value of an organization – in other words, as a production factor to be developed and promoted (Zwetsloot & Van Scheppingen, 2007). The role of the organization consists of facilitating a healthy working style on the part of its employees, by creating a pleasant work environment and healthy working conditions and by calling employees to account for unhealthy behaviour.

Individual
Nurses as individual employees will increasingly have to take on greater responsibility when it comes to their vitality and a healthy working style and lifestyle. Employees can help to ensure that they remain broadly employable by not carrying out the same one-sided, heavy work with no variation. Other measures include eating healthy, getting sufficient exercise and using the right aids. The manager/employer can help by facilitating healthy living and working, by offering health-promoting interventions and by discussing career planning and work variety with employees.
At the level of the workplace and work processes, attention should be paid to the introduction of IT applications, whose implications need to be charted, with the design of the workplace and work processes modified accordingly. A concrete example is the IC department. The introduction of a PDMS (patient data management system) means that data entry and data access occur directly at the bedside and no longer at an observation desk. The arrangement of equipment around the bed will look fundamentally different.
Increasing numbers of overweight patients will mean adapting aids such as beds and hoists. A hoist must be able to transfer more than 180 kilos, and operating tables will also have to cope. In such a situation, the role and responsibility of the individual nurse will consist of the timely use of a hoist for overweight patients.

Follow-up research

This study has yielded insights into the effects and outcomes of the Prevention Programme Physical Workload, as part of the Health and Safety Covenant for University Medical Centres, but some matters have not been fully addressed. As already stated, further research into expanding the theoretical model is recommended. This might increase the predictive value of the model. Also,

in such a study it is important to monitor staff over a longer period (more than a single measurement moment) in order to answer the question of whether the recorded changes are a result of the intervention. Finally, the prevention programme offers points of departure for further development.

- Relationship between theoretical model and preventive interventions
  The theoretical framework of the intervention programme (the ASE model) can be further developed into a health management model, which establishes a relationship between health, behaviour and functioning in work (participation). This extension of the theoretical framework could be linked to the development of research tools to validly and reliably show behaviours at the three levels (government, organization and individual).
- Follow-up and monitoring
  Repeating the measurement will provide information about the permanence of the behaviour change among the UMC staff on the one hand, and about the actual anchoring of the prevention programme within the organization on the other. In addition, monitoring health parameters among groups of employees seems to be a useful way to monitor sickness, sickness absence and recovery behaviour and in so doing to collect information to develop health policy.
- The prevention programme
  Some reviews in this thesis have made differentiations according to occupation, age, low-back complaints in relation to behavioural determinants. In addition to the occupational groups that took part in this study, there are other groups in the health care sector that are exposed to a high physical workload. These include doctors (surgeons) and support service staff. The content of the Prevention Programme Physical Workload can be further enhanced by the inclusion of work-related psychosocial factors and their relationship to psychological and locomotor system complaints. A further addition could be programme components aimed at increasing fitness and encouraging employee movement.

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Summary

The high rate of sickness absence in various sectors, including University Medical Centres (UMCs) was the rationale for entering into the 'New Style' Health and Safety Covenant. The Prevention Programme Physical Workload was introduced under the terms of the UMC Health and Safety Covenant. The objective of the programme is to reduce complaints relating to the posture and locomotor system among personnel employed in care-related departments of UMCs. This PhD thesis evaluates different aspects of the programme's implementation, including working conditions, locomotor system complaints, absence due to these complaints and behavioural aspects in relation to physically demanding working conditions.

In 2001 the UMCs signed a health and safety covenant designed to increase their workforce participation (more hands at the bedside). This covenant is an agreement between the eight Dutch UMCs, the trade unions and the Ministry for Social Affairs and Employment (SZW). It aimed to cut back sickness absence, reduce the numbers of new work disability claimants and accelerate the reintegration of sick employees. In 2000 the average absence rate in the UMCs was 6.8%.

The UMC Health and Safety Covenant (2001) covers the topics of harmful substances (cytostatica and anaesthetic gases), Risk Inventory and Evaluation (RI&E), psychological strain, latex allergy, integrated occupational health and safety care, RSI and physical workload. These themes were established following a baseline measurement taken in 1999 (VAZ, 1999). In 2000 the rate of new work disability beneficiaries in the UMCs came to 1.15%, while the absence rate (as already stated) stood at 6.8%. One of the aims of the UMC Health and Safety Covenant was to bring about a gross reduction of 1% in the numbers of new work disability claimants for each participating hospital in 2003. Secondly, it aimed to ensure that the sickness absence rate as a result of locomotor system complaints would not exceed 1.5% of the total absence rate in any of the hospitals. Finally, it sought to ensure that the absenteeism rate due to psychological complaints would not exceed 1.2% in any of the hospitals.

Prevention Programme Physical Workload

One of the biggest projects in the UMC Health and Safety Covenant involved the reduction of exposure to physical workload. UMC data shows that two thirds of UMC personnel are exposed to a high degree of physical strain. There are some reports in the literature of a relationship between physical workload and the prevalence and incidence of low-back pain

The national working group on physical workload first investigated those preventive activities that had delivered the best results, the 'best practices', in the eight participating hospitals. The Prevention Programme Physical Workload, developed and implemented in the UMC Groningen with the support of the Northern Netherlands Ergonomists Collective and the department of Human Movement Sciences Groningen, emerged as the most complete, well-founded programme. The programme uses Fishbein and Azjen's (1980) theory of reasoned action, in which the behavioural determinants of attitude, social norm and self-efficacy (ASE) play a key role. In addition to behaviour, the programme deals with technical aspects (the use of aids and adaptations to the workplace) and organizational aspects (employing an ergonomics coach). This approach was adopted by the working group because low-back and neck complaints are predominantly multicausal (Koes and Tulder, 2002).
The target group for the prevention programme comprised hospital personnel from departments with a high physical workload, such as the regular nursing wards, intensive care wards, surgical wards and treatment units.

The objectives of the Prevention Programme Physical Workload were as follows:

- increasing knowledge of physical workload guidelines
- improving attitude, social norm, self-efficacy (ASE behavioural aspects) and intention with regard to physically demanding working conditions
- reducing locomotor system complaints
- reducing absence as a result of 'locomotor system complaints'
- ensuring that the necessary conditions (ergonomic and organizational) are in place to implement 'safe moving'
- guaranteeing and consolidating the Prevention Programme Physical Workload

The global research problem formulated in this PhD thesis is as follows: what is the outcome of introducing the Prevention Programme Physical Workload in eight UMCs as part of the Health and Safety Covenant?

The following questions have been formulated

1. what are the results of occupational interventions for primary prevention of musculoskeletal symptoms in health care workers?;

2a. what are the prevalence rates of musculoskeletal complaints of neck-

shoulder and low back and the perceived exposure to risk factors?;

2b. is any association present between physical and psychosocial work-related risk factors and musculoskeletal complaints of neck-shoulder and low back?;

3. what are the results of a multifactorial intervention programme to reduce physical workload in the nursing profession?;

4a. do ASE determinants (Attitude, Social influence, self Efficacy) as well as 'intention to change' change one year after the implementation of an occupational intervention on wards with hospital workers?;

4b. do hospital workers with reduced low back pain present higher difference scores on the ASE determinants and 'intention to change' than hospital workers with an increase in low back pain or when low back pain remains the same?;

5. how do nurses older and younger than 45 years perceive their health, their physical and mental work effort and do they present different sickness absence rates?

Chapter 2

In this chapter thirteen studies have been evaluated. The objective was to obtain more insight into the effects of occupational interventions for primary prevention of musculoskeletal symptoms in healthcare workers. The Cochrane Collaboration methodological guidelines for systematic reviews functioned as a starting point for the review. The studies meeting the inclusion criteria were evaluated on methodological quality and effects. Eight outcome areas were established and defined as areas whereupon an effect was determined in at least two studies. A method based on levels of scientific evidence is used to synthesize the information available. We found strong scientific evidence for the beneficial effect of occupational interventions for the areas physical discomfort, technical performance of transfers and the frequency of manual lifting. Insufficient evidence was found for the areas absenteeism due to musculoskeletal problems, musculoskeletal symptoms, fatigue, perceived physical load and knowledge. Training and education combined with an ergonomic intervention was found to be effective.

Chapter 3

The aim of this part of the study was to gain more insight into the prevalence rates of musculoskeletal complaints of neck-shoulder and low back and to determine the relation between physical and psychosocial work-related risk

factors and musculoskeletal complaints in non-specialized nurses, operation room nurses, Intensive Care (IC) nurses and X-ray technologists. The study population consists of 3169 employees affiliated to eight university hospitals in the Netherlands. In all groups of nurses we found high prevalence rates of musculoskeletal complaints: low back 76%, neck-shoulder 60%. Operation room nurses perceived more neck-shoulder complaints (twelve months prevalence) than non-specialized nurses and IC nurses perceived less severe low back complaints than non-specialized nurses. Four physical risk factors and one psychosocial factor were associated with low back complaints in all groups. The results indicate that both low back complaints and neck-shoulder complaints are major health problems in the four professional groups under study. The exposure to risk factors is perceived differently by each of the professional groups.

Chapter 4

In this chapter the results of the Prevention Programme 'Physical Load' are described. The aim of the intervention is to heighten the awareness of work-related risk factors, reduce musculoskeletal symptoms of the low-back and neck-shoulder region and sickness absence. In addition, we were interested in the nurses' perceptions on the relationship between work and musculoskeletal symptoms. Nurses of regular wards (n=466) of six University Hospitals in the Netherlands were asked to fill out a questionnaire twice, with one year in between. Just after the first questionnaire was administered the intervention programme was implemented according the protocol. Effect variables were perceived exposure to risk factors at work, 12 months prevalence of low back and neck/shoulder symptoms, sickness absence and the perceived relationship between work and musculoskeletal symptoms. The results of the study indicate that implementation of an intervention programme did not yield effects on the exposure to risk factors and on the reduction of musculoskeletal symptoms. However, sickness absence due to low back symptoms appeared to be lower after the intervention programme was implemented and low back symptoms were perceived as more connected to work related risk factors than before.

Chapter 5

In this chapter the cognitive behavioural determinants of the Prevention Programme 'Physical Load' are evaluated. More specifically, we evaluated the ASE determinants and intention to change in relation to low back pain

one year after the implementation of the intervention on departments with hospital workers. Two questionnaires were administered twice among 798 university hospital workers in the Netherlands. After the implementation of the intervention respondents' baseline measurement and follow-up were compared on Attitude, Social influence, self Efficacy (ASE) and intention to change. Based on changes in perceived low back pain three groups were formed of which mean difference-scores on ASE determinants and intention were calculated and tested. We found social influence, self efficacy and intention were increased one year after the implementation of the intervention. Hospital workers experiencing less low back pain seem to be more susceptible to social influence, are more confident as to self efficacy and have higher intentions to change than workers who experience an increase in low back pain. Hospital workers with a decrease in low back pain also indicate an improvement in self-efficacy, social influence and intention to change. It might be that these respondents are more sensitive to an intervention directed at practical, behavioural components. Such an intervention may be in line with their perception of the cause of low back pain as being dependent upon someone's physical postures and/or someone's own behaviour.

Chapter 6

Work, health and aging in the nursing profession is the focus of chapter 6. Work related health is changing when employees grow older. The study described in chapter 6 evaluates health-related factors in relation to aging in the nursing profession. Research questions are:

- how do nurses older and younger than 45 years perceive their health, physical and mental work effort?
- what is the prevalence of musculoskeletal complaints among nurses older and younger than 45 years?
- do nurses older and younger than 45 years present different sickness absence rates and are eventual differences associated with perceived health, perceived musculoskeletal complaints or perceived physical and mental work effort?

We used cross-sectional data of 1993 nurses in eight university hospitals in the Netherlands. The Dutch Musculoskeletal Questionnaire (DMQ) was used to assess the health components. Data on work effort and sickness absence (2002-2005) were derived from a self-report and from the database of the hospitals involved. According to the results nurses over 45 years indicate lower

self rated health, lower physical condition, more musculoskeletal complaints and more physical fatigue after a day working compared to their younger colleagues, additionally they perceive lower mental effort. Sickness absence longer than one week due to low back pain is higher among older nurses. The results of the study indicate that occupational interventions may be worthwhile for nurses of 45 years and older. Tailor made, age-related interventions for older employees should be developed, evaluated and implemented in the organisation. When this process is accompanied by careful monitoring and research, older nurses may be kept more years in their valuable positions at the wards.

Chapter 7

In the general discussion the main findings, the methodological considerations, practical implications and future research are addressed.

Approximately 6330 employees – more than 10% of all those employed in the UMCs – took part in the Prevention Programme Physical Workload, as part of the Health and Safety Covenant. During the covenant period, 400 ergocoaches were trained in the eight UMCs. Products were developed to support the programme, such as practical physical workload guidelines, a course book for ergonomics, an ergonomics coach profile and information leaflets

The finding of this study indicates the need for a tailor-made component in the intervention programme at the level of risk factors, the target group and age-differences within the target group. Besides, an intervention programme that aimed both at behavioural change and at the use of aids, modifications to the workplace and organizational measures such as deploying ergocoaches give better results.

The further development of the intervention programme should tie in with a health management system which emphasizes a more positive approach such as health and vitality and which gives employees themselves more opportunities to regulate and to shape their work.

Main shortcomings in this study are the absence of a control group, the crossectional design and data collection with questionnaires only (recall bias).

Structural coordination and cooperation between Health and Safety departments and Human Resources about embedding the topics in their human resources and staff policy is a point of special interest. Behavioural change among large groups of employees by definition entails an

organizational change. It is critical that the policy has to be anchored in the organization; the topic of 'healthy working' must stay on the agenda by means of a systematic focus on the desired behaviour.

Nurses as individual employees will increasingly have to take on greater responsibility when it comes to their vitality and a healthy working style and lifestyle. The manager/employer can help by facilitating healthy living and working, by offering health-promoting interventions and by discussing career planning and work variety with employees.

Further research expanding the theoretical model and the Prevention Programme Physical Load is recommended. This might increase the predictive value of the model. Also, in such a study it is important to monitor staff over a longer period (more than a single measurement moment) in order to answer the question of whether the recorded changes are a result of the intervention. Finally, the prevention programme offers points of departure for further development.

Samenvatting

Onder de paraplu van het Arboconvenant UMC is het Preventieprogramma Fysieke Belasting ingevoerd. Aanleiding voor het afsluiten van het Arboconvenant betrof het hoge ziekteverzuim in diverse branches, waaronder de branche Universitair Medische Centra (UMC). Het Preventieprogramma Fysieke Belasting – als onderdeel van het Arboconvenant – heeft als doel klachten aan het houding- en bewegingsapparaat (HB-apparaat) van medewerkers werkzaam op zorggerelateerde afdelingen in Universitair Medische Centra te verminderen. In dit proefschrift worden verschillende aspecten van de invoering van het preventieprogramma fysieke belasting geëvalueerd, waaronder de werkomstandigheden, klachten van het HB-apparaat, verzuim als gevolg van klachten van het HB-apparaat en gedragsaspecten ten aanzien van fysiek belastende werkomstandigheden.
In 2001 hebben de Universitair Medische Centra het Arboconvenant getekend om de arbeidscapaciteit te vergroten. Dit convenant is een overeenkomst tussen de acht Nederlandse Universitair Medische Centra, de vakcentrales (werknemersvertegenwoordiging) en het Ministerie van Sociale Zaken en Werkgelegenheid (SZW). Het Arboconvenant UMC (2001) omvat diverse thema's waaronder Risico Inventarisatie en –Evaluatie (RIE), gevaarlijke stoffen, psychische en fysieke belasting. Het gemiddelde verzuimpercentage in 2000 in de UMC's bedroeg 6,8% en de WAO instroom 1,15%. Doelstellingen van het Arboconvenant UMC betroffen onder andere een bruto afname van de WAO-instroom in 2003 van 1% per betrokken ziekenhuis; daarnaast werd nagestreefd dat het verzuimpercentage wegens klachten aan het HB-apparaat in geen van de ziekenhuizen hoger zou zijn dan 1,5% van het totale verzuimpercentage. Tot slot stelde men zich tot doel dat het verzuimpercentage wegens psychische klachten in geen van de ziekenhuizen hoger zou uitvallen dan 1,2%.

Preventieprogramma Fysieke Belasting
Eén van de omvangrijkste projecten van het Arboconvenant UMC betrof het terugdringen van blootstelling aan fysieke werkbelasting. Uit informatie afkomstig van de UMC's is blijkt dat twee derde van de medewerkers van een UMC bloot stond aan een hoge vorm van fysieke belasting. In de literatuur is meer dan eens melding gemaakt van de relatie tussen fysieke en psychische werkbelasting en de prevalentie en incidentie van lage rugklachten.
De landelijke werkgroep Fysieke Belasting inventariseerde als eerste onder de acht betrokken ziekenhuizen díe preventieve activiteiten die het meeste succes had gesorteerd, de zogenaamde 'best-practices'. Het Preventieprogramma

Fysieke Belasting bleek het meest complete en onderbouwde programma. Het programma maakte gebruik van the Theory of Reasoned Action van Fishbein en Azjen (1980) waarin de gedragsdeterminanten Attitude, Sociale influence en self Efficacy (ASE) een belangrijke rol spelen. Volgens het ASE-model worden de 'intentie te veranderen' het het bijgehorende gedrag bepaald door de cognitieve variabelen Attitude, Sociale Invloed en self-Efficacy. Naast de gedragsmatige aanpak besteedt het preventieprogramma aandacht aan technische (inzet hulpmiddelen en aanpassing van de werkplek) en organisatorische elementen (inzet van ergocoach). Deze benadering is door de werkgroep overgenomen, omdat klachten van de lage rug en nek overwegend multicausaal zijn (Koes en Tulder, 2002).
De doelgroep van het Preventieprogramma Fysieke Belasting betroffen ziekenhuismedewerkers van afdelingen met een hoge fysieke belasting, zoals de reguliere verpleegafdelingen, afdelingen intensive care, operatieafdelingen en behandelunits.

De doelstellingen van het Preventieprogramma Fysieke Belasting luiden als volgt:

- verhoging van het kennisniveau omtrent richtlijnen voor fysieke belasting;
- verbeteren van Attitude, Sociale invloed en self Efficacy (ASE gedragsdeterminanten) en intentie te veranderen ten opzichte van fysiek belastende werkomstandigheden;
- afname van klachten van het bewegingsapparaat;
- verzuimreductie vanwege 'klachten bewegingsapparaat';
- aanwezigheid van de noodzakelijke randvoorwaarden (ergonomisch en organisatorisch) om 'verantwoorde bewegingen' uit te voeren;
- borging en consolidatie van het Preventieprogramma Fysieke Belasting.

Gebaseerd op deze probleemstelling zijn de volgende vraagstellingen geformuleerd:

1. welke resultaten leveren interventieprogramma's op voor de primaire preventie van klachten aan het houdings- en bewegingsapparaat onder ziekenhuis medewerkers;

2a. wat is het het voorkomen van lage rugklachten en klachten van nek en schouder en de ervaren blootstelling aan risicofactoren;

2b. welke associaties bestaan er tussen fysieke en psychosociale werkgerelateerde factoren en klachten van nek en schouder en de lage rug;

3. wat zijn de resultaten van een multifactorieel interventieprogramma gericht op het reduceren van fysieke belasting in de verpleging;
4a. zijn de ASE determinanten (Attitude, Sociale invloed en zelf Efficatie) en intentie verandert 1 jaar na de invoering van het preventieprogramma fysieke belasting op verpleegafdelingen en andere patiënt gerelateerde afdelingen;
4b. hebben ziekenhuis medewerkers met minder pijnklachten hogere verschilscores op ASE determinanten en intentie dan ziekenhuis medewerkers met een toename in lage rug klachten of gelijk blijvende klachten;
5. ervaren verpleegkundigen ouder dan 45 jaar en verpleegkundigen jonger dan 45 jaar een andere gezondheid, fysieke en mentale inspanning en zijn de verzuim scores verschillend

Hoofstuk 2

In dit hoofdstuk zijn 13 studies geëvalueerd. Het doel was meer inzicht te krijgen in de effecten van werkgerelateerde interventies voor primaire preventie van klachten aan het bewegingsapparaat onder ziekenhuis medewerkers. De richtlijnen van de Cochrane Collaboration waren richtinggevend voor de review. De studies die voldeden aan de inclusiecriteria zijn geëvalueerd op methodologische kwaliteit en effecten. Acht uikomstgebieden zijn er vastgesteld en gedefinieerd als een gebied met een effect van tenminste 2 studies. Voor elke studie is een niveau van wetenschappelijk bewijs aangegeven. We vonden sterk bewijs voor effecten van interventies op de gebieden van fysiek discomfort, technische uitvoering van transfers en de frequentie van handmatig tillen. Onvoldoende bewijs is gevonden voor de resultaatgebieden verzuim als gevolg van klachten van het hb-apparaat, klachten van het hb-apparaat, vermoeidheid, ervaren fysieke belasting en kennis. Training en educatie gecombineerd met ergonomische factoren is effectief.

Hoofdstuk 3

Het doel van dit hoofdstuk was inzicht verzamelen in de prevalenties van klachten aan het hb-apparaat van nek schouder en lage rugklachten en de relatie bepalen tussen fysieke en psychosociale risicofactoren in het werk en klachten aan het hb-apparaat onder verpleegkundigen, Ic verpleegkundigen operatieassistenten en röntgen laboranten. De studie populatie bestond uit 3169 werknemers werkzaam in de UMC's in Nederland.

In alle beroepsgroepen zijn hoge prevalenties gevonden van klachten aan het hb-apparaat: lage rugklachten 76% en nek schouderklachten 60%. Operatieassistenten ervaren meer nek schouderklachten (12 maand prevalentie) dan reguliere verpleegkundigen. Ic verpleegkundigen ervaren minder ernstige lage rugklachten dan reguliere verpleegkundigen. Vier fysieke en 1 psychosociale risicofactor is geassocieerd met lage rug klachten in alle groepen samen. De resultaten suggereren dat lage rug klachten en nek schouderklachten grote gezondheidsproblemen zijn voor de 4 onderzochte beroepsgroepen. De blootstelling aan risicofactoren is verschillend ervaren door de 4 beroepsgroepen.

Hoofdstuk 4

In dit hoofdstuk worden de resultaten beschreven van het preventie programmema fysieke belasting. Het doel van de interventie betreft het verhogen van het bewustzijn van werkgerelateerde risicofactoren, reductie van klachten hb-apparaat (lage rugklachten en nek schouderklachten) en ziekteverzuim. Daarnaast waren we geïnteresseerd in de perceptie van de verpleegkundigen van de relatie tussen werk en klachten hb apparaat. Verpleegkundigen (n=466) van zes UMC's vulden 2 keer een vragenlijst in met een tijdsinterval van 1 jaar. Na het invullen van de eerste vragenlijst is het preventieprogrammema geïmplementeerd volgens een vastgesteld protocol. Effect variabelen waren ervaren blootstelling aan risicofactoren, 12 maands-prevalentie van lage rugklachten en nek schouderklachten, ziekteverzuim en de ervaren relatie tussen werk en klachten hb-apparaat. De resultaten suggereren dat implementatie van de interventie geen invloed heeft op de ervaren klachten. Het verzuim als gevolg van lage rug klachten was lager na invoering en lage rugklachten worden meer gezien als werkgerelateerd dan voor de implementatie.

Hoofdstuk 5

In dit hoofdstuk zijn de cognitieve gedragscomponenten van het preventieprogrammema fysieke belasting geëvalueerd. De ASE determinanten en intentie in relatie tot lage rug klachten 1 na implementatie van de interventie op patiënt gerelateerde afdelingen. Twee vragenlijsten zijn afgenomen onder 789 ziekenhuismedewerkers. Voor en nameting is met elkaar vergeleken op Attitude, Sociale Invloed, zelf Efficacy (ASE) en intentie. Van die groepen ziekenhuiswerkers met verschillende veranderingen in lage rugklachten zijn de gemiddelde verschilscores berekend op ASE

determinanten en intentie. Sociale invloed, zelf efficacy en intentie waren toegenomen na de implementatie. De groep die minder lage rugklachten ervaart na implementatie lijkt ook beter te scoren op zelf efficacy en intentie van de andere 2 groepen. Blijkbaar wordt de afname van klachten gezien als de beloning voor rugbelasting vermijdend gedrag.

Hoofdstuk 6

Werk gezondheid en leeftijd als thema's van de verpleegkundige beroepsgroep is de focus van hoofdstuk 6. Werkgerelateerde gezondheid verandert met het ouder worden van werknemers. De studie evalueert gezondheidsgerelateerde factoren in relatie tot veroudering in de verpleegkundige beroepsgroep. Onderzoeksvragen zijn:
Hoe ervaren oudere (>45) en jongere verpleegkundigen hun gezondheid, fysieke en mentale werk inspanning;
Wat is de prevalentie van klachten hb apparaat onder oudere (>45) en jongere verpleegkundigen;
Wat is het verschil in zelfgerapporteerd verzuim cijfers tussen oudere (>45) en jongere verpleegkundigen en worden deze verschillen verklaard door ervaren gezondheid, klachten hb apparaat of ervaren fysieke en mentale werk inspanning.
Crossectionale data van 1993 verpleegkundigen van 8 ziekenhuizen zijn hiervoor gebruikt. De Vragenlijst Bewegingsapparaat is gebruikt om de genoemde onderwerpen vast te stellen. Oudere verpleegkundigen ervaren een lagere gezondheid, lagere fysieke conditie, meer klachten aan het hb apparaat en meer fysieke vermoeidheid aan het einde van de werkdag in vergelijking met jongere verpleegkundigen. Oudere verpleegkundigen ervaren een lagere mentale inspanning. Ziekteverzuim langer dan 1 week als gevolg van lage rug klachten is hoger onder oudere verpleegkundigen.

Hoofdstuk 7

In de eind discussie worden de belangrijkste bevindingen, de methodologische overwegingen en praktische implicaties beschouwd. Ook worden suggesties gedaan voor vervolgonderzoek. Aan de uitvoering van het Preventieprogramma Fysieke Belasting, als onderdeel van het Arboconvenant, hebben ongeveer 6330 medewerkers meegedaan: ruim 10% van alle werknemers in de UMC's. Er zijn tijdens de convenantperiode 400 ergocoaches opgeleid in de 8 UMC's. Ter ondersteuning van de implementatie van het Preventieprogramma Fysieke Belasting zijn producten

ontwikkeld zoals praktijkrichtlijnen Fysieke Belasting, een cursusboek voor ergocoaches, het ergocoachprofiel en voorlichtingsfolders.
De uitkomsten van de studie ondersteunen de gedachte dat een preventieve interventie niet alleen afgestemd moet zijn op de doelgroep en het werk wat de doelgroep verricht, maar ook op de leeftijdsverschillen binnen die doelgroep. Daarnaast heeft een multifactorieel preventieprogramma, waarin aandacht is voor gedragsmatige, organisatorische en technische aspecten een duidelijke meerwaarde.
Verdere ontwikkeling van het interventieprogramma zou moeten aansluiten bij een gezondheidsmanagement systeem, waarbij de nadruk gelegd wordt op een meer positieve invalshoek zoals gezondheid, vitaliteit en waarbij werknemers zelf meer mogelijkheden in handen krijgen om hun werk te regelen en vorm te geven.
De belangrijkste methodologische beperkingen van dit onderzoek zijn het ontbreken van een controlegroep, het cross sectionele design (oorzaak-gevolg) en dataverzameling met behulp van vragenlijsten (recall bias).
Belangrijke implicaties van dit onderzoek hebben ook betrekking op de onderlinge communicatie tussen stafdiensten (arbodiensten en Human Resource (HR) afdelingen) en de betrokkenheid van managers bij de invoering van een preventieprogramma zoals het Preventieprogramma Fysieke Belasting. Goede communicatie en afstemming ondersteunen niet alleen de implementatie, maar ook de consolidatie en borging van het programma.
Niet alleen managers, maar ook medewerkers hebben een duidelijke verantwoordelijkheid voor gezondheid en gezondheidsgedrag op de werkplek. Regelmatige communicatie hierover - bijvoorbeeld in het bilateraal overleg en het jaargesprek – kan bijdragen aan het actueel houden van dit thema. De organisatie of werkgever heeft hierin eveneens een taak door het faciliteren van een gezonde werkstijl van de medewerkers, het creëren van een prettige werkomgeving, het bevorderen van gezonde arbeidsomstandigheden en de medewerkers aan te spreken op ongezond gedrag.
Het is aan te bevelen om toekomstig onderzoek te richten op uitbreiding van het gebruikte theoretisch model en op de verdere ontwikkeling van het Preventieprogramma Fysieke Belasting. Daarnaast is van belang om medewerkers over langere tijd te volgen, omdat hiermee antwoord kan worden gegeven op de vraag of de geregistreerde veranderingen een gevolg zijn van de interventie.

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Kees, lief, ik vind je geweldig, om de ruimte en de rust die je me geeft. Tot heel gauw!

Levensloop

Ellen, geboren Evelien Henriette, Bos (1969) brengt haar jeugd door in Haren en doorloopt de HAVO aan het Augustinuscollege te Groningen. Op 17 jarige leeftijd verhuist ze naar Emmen om in het Scheperziekenhuis de inservice opleiding voor A verpleegkunde te doen. Aansluitend, op 21-jarige leeftijd start ze met de propedeuse Pedagogiek die in die tijd toegang geeft tot de doctoraal studie Bewegingswetenschappen. Als diffentiatie volgt Ellen de richting Arbeid en Gezondheid. Gedurende de studie werkt Ellen als verpleegkundige in het Academisch Ziekenhuis te Groningen. Tijdens haar afstuderen ontwikkelt ze een instrument voor het uitvoeren van een Risico-Inventarisatie en Evaluatie op verpleegafdelingen. In 1994 studeert ze af en vindt een baan als projectmedewerker en later als stafmedewerker bij de interne arbodienst van het UMCG. Ze ontwikkelt zich als adviseur met inhoudelijk vakgebied Ergonomie. Sinds 2001 staat ze ingeschreven als Europees Ergonoom. Behalve aan projecten in het ziekenhuis neemt ze ook deel aan regionale en landelijke projecten. In deze periode volgt Ellen de studie psychologie aan de RUG. Rond 2000 oriënteert Ellen zich op de mogelijkheden om onderzoek te verrichten en in 2002 start ze met het promotieonderzoek dat leidt tot de uitgave van dit boek. Vanuit haar werk bij de arbodienst is ze een ruim een jaar gedetacheerd bij Toegepast Gezondheidsonderzoek (TGO), onderdeel van disciplinegroep Gezondheidswetenschappen en Graduate School SHARE. Sinds mei 2008 werkt Ellen bij TNO Kwaliteit van Leven in Hoofddorp als onderzoeker/adviseur Veilig & Gezond Ondernemen en Gezondheidsmanagement.

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