AT WORK IN SPITE OF PAIN

Prevention and rehabilitation in two predominantly female workplaces, their effects and further development of analysis methods

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ABSTRACT

The overall aim of the thesis is to study the effects of preventive and rehabilitative interventions for employees at work despite pain at predominantly female workplaces, and further development of analysis methods.

The study had two intervention groups and two non-randomised reference groups. Hospital cleaners and home-helps were selected as intervention and reference groups for the empirical studies. In the first three studies the subjects were women with pain problems. In the last two studies only hospital cleaners were involved, but the selection was broadened to include everyone employed at the workplaces at the time.

The hospital cleaners’ intervention programme comprised occupational organisational measures, competence development, physical and psychosocial working environmental and rehabilitation measures on both an individual and a group basis. The home-help’s programme comprised a 2-week stay at an orthopaedic rehabilitation unit, training of supervisors, massage by colleagues, purchase of training equipment and stress management. The intervention lasted 12 months for the hospital cleaners and 8 months for the home-helps. A classical model for quasi-experimental design was used in the first three studies. In the last two studies, statistical control was applied as a complement.

In Study I, all four groups experienced substantial lowering in quality of life related to the three dimensions: bodily pain, general health perception and vitality. No effects of the intervention were demonstrated. In the hospital cleaners´ intervention group, the introduction of new cleaning materials and methods seemed to contribute to a reduction in workload, allowing them to take more rest breaks during working time (Study II). In the home-helps´ intervention group, a reduction both in workload and in more responsible tasks were shown, together with reduced psychosomatic stress reactions. Study III showed a very high prevalence of rotator cuff myalgia/tendinitis, myalgia/tendinitis of the dorsal neck and relatively high prevalence of myalgia/tendinitis in hip muscles. Neurogenic pain was rare. No fibromyalgia syndrome was found. Limited effects were shown on the pain outcome measures. After the intervention, more intervention than reference group subjects had an improved clinical picture. In Study IV a simple comparison did not demonstrate differences, but the intervention produced a difference in total absenteeism in the younger age group when a number of covariates were included. Those with previously high sickness absence reduced their total absence most. The interchangeability of short-term sickness absence and short-term leave was reduced. The intervention was shown to contribute to preventing an increase in sickness absence costs at the company level (Study V). The two models of analysis gave approximately the same monetary outcome. An integrated model showed that the intervention had a greater net effect on the younger group, with a number of significant interactions. The pay-back time for the younger group was just under one year, but with a very wide spread.

These particular interventions gave only moderate outcomes. The validity of the intervention effects is discussed, together with the importance of matching the intervention measures to the needs at the workplaces.

Key words: workplace, prevention, rehabilitation, women, hospital cleaners, home help personnel, health-related quality of life, working environment, musculoskeletal, pain, absenteeism, economic effect at company level, quasi-experiment.
I rörelse

Den mätta dagen, den är aldrig störst.
Den bästa dagen är en dag av törst.

Nog finns det mål och mening i vår färd -
men det är vägen, som är mödan värd.

Det bästa målet är en nattlång rast,
där elden tänds och brödet bryts i hast.

På ställen, där man sover blott en gång,
blir sömnen trygg och drömmen full av sång.

Bryt upp, bryt upp! Den nya dagen gryr.
Oändligt är vårt stora äventyr.

/Karin Boye 1927, Ur diktsamlingen ’Härdaarna’.

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ORIGINAL PAPERS

This thesis is based on the following studies, which will be referred to in the text by their Roman numerals.

I

II

III

IV

V

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DEFINITIONS OF CONCEPTS USED IN THE DISSERTATION

Disability pension and temporary disability pension
People are able to receive a disability pension if they are between 16 and 65 years of age and their working ability is permanently reduced by at least a quarter. Disability pension consists of two parts, the basic pension and the supplementary pension (see the definition of the National Supplementary Pension below). If a person’s working capacity is temporarily reduced, one can obtain sickness benefit instead of disability pension. Sickness benefit is equal to disability pension, but is time-limited (SFS 1962:381).

Frequency of pain
The pain frequency is taken into account here (Study III) in the form of answers to questions about how often the pain occurs; for example, 1) pain-free at the moment, 2) pain occurs almost every week, but can be pain-free certain weeks, 3) pain occurs almost every day, but can be pain-free certain days, 4) pain almost all the time, but can be pain-free a few hours, 5) pain all the time, but can be pain-free a few hours after treatment, and 6) pain all the time, never pain-free.

Health promotion at workplaces
The aim of this is partly to prevent people developing ill-health at the workplace, but also to encourage health for those who work there or who go back to work after a process of rehabilitation (Ekberg, 2000).

Health-related quality of life
One instrument which has been developed in order to measure health-related quality of life in questionnaire form is SF-36. The Swedish version of the SF-36 questionnaire used in Study I was developed by Sullivan and co-workers (Sullivan et al., 1994). The definition of health-related quality of life is based on the concept of health defined by the WHO in 1948 (Osmanczyk, 1990, pp. 367-368): "The term quality of life is, as is health, polyvalent and cannot be defined distinctly. Both concepts reflect different aspects of wellbeing, but quality of life has an appreciably broader content. Health-related quality of life is a pragmatic limitation and refers primarily to function and wellbeing in sickness and treatment".

Incapacity Rate
Number of paid days in the age range 16-64 years and years with sickness benefit, occupational injury sickness benefit, preventive sickness benefit, disability pension/temporary disability pension, together with sickness payment during training from 1994 onwards. Days with partial payment are counted as whole days. (Socialstyrelsen, 1998:1).

Integrated model
In Study V, a human resources costing and accounting approach (HRCA) was combined with a quantitative statistical approach in order to get an integrated model. This integrated model could make it possible to discuss how the results might vary with different assumptions, and also to specify confidence intervals for estimates.

Intensity of pain
Intensity of pain is measured here (Study III) with a visual analogue scale, VAS, for ‘worst’, ‘least’ and ‘present’ pain.
Lieu days

Long-term sickness absence
Long-term sickness absence means (in Study IV) absence from work due to illness or accident for 15 days or more.

Musculoskeletal disorders and diseases
Disorders and diseases of the musculoskeletal system (locomotor system) (WHO, 1997).

National supplementary pension scheme (called ATP in Swedish)
The general pension consists of two parts, a basic pension and a supplementary pension. The size of the basic pension depends on how many years the person has been domiciled in Sweden between 16 and 64 years of age, or the number of years that ATP points have been earned. The supplementary pension is based on the working income between 16 and 64 years of age. Everyone, regardless of citizenship, who is domiciled in Sweden, or who has been living in Sweden and has been there for at least three years earning ATP points, has the right to a basic pension (SFS 1962:381).

Occupational accidents
Accidents which occur at the workplace or at another place which the injured person visits as part of or in order to work (Arbetarskyddsstyrelsen & Statistiska Centralbyrån, 2000, p. 33).

Parental leave
Parental leave is the paid leave which one can receive in connection with the birth or adoption of a child. Parental salary is paid out for a maximum of 450 days. These days can be taken until the child has reached 8 years of age, or until the child has finished the first year at school if this is later. Parental salary can be taken for whole, three-quarter, half- or quarter-days. The time is added together to give whole salaried days (SFS 1995:584).

Personnel Costs model, a kind of HRCA model (Human Resource Costing and Accounting)
In Study V we use the model which Aronsson and Malmquist (1996; 1999) developed within the framework of the costs model which goes under the name of the Personnel Costs model (Malmquist 1994; Aronsson et al. 1994). The foundation for this model was developed partly on an international level by Flamholtz (1989) and Cascio (1991), and partly on a national basis by Gröjer (1990). The models used by many other human resources economists are based mainly on salary information.

If we look at the ways in which the different models calculate sickness absence costs, in the models which are based mainly on salary information these costs are calculated as being the remaining salary during the period of sickness absence plus administrative time multiplied by the hourly rate. In the Personnel Costs model, the cost of sickness absence is shown as the net difference between the costs, in the form of the value of the loss of production and the administrative cost, and the benefits in the form of lower labour costs.

Placement policy
Placement policy is an important principle in social insurance. It involves active measures in order to give people work or to make it easier for them to gain and keep a job. These measures are to be preferred to passive payments (Prop. 1988/89:150).
Preventive measures
Measures or actions carried out with the aim of preventing and affecting the causes of work-related pain occurring. Preventive measures may also be carried out in order to prevent recurrence of sickness absence, long-term sickness absence or temporary/permanent disability pension (Hagberg, In: Kuorinka & Forcier, 1995).

Referred pain/sensation
Pain perceived as raising or occurring in a region of the body innervated by nerves or branches of nerves other than those that innervate the actual source of pain (Merskey & Bogduk, 1994).

Rehabilitation allowance
When a sickness absentee takes part in rehabilitation aimed at the working life, they may have a right to receive a rehabilitation allowance. One condition is that the rehabilitation forms part of a rehabilitation plan which is established in conjunction with the social insurance office. Situations which can give the right to rehabilitation allowance are, for example, vocational training for a period, or education for a maximum of one year (SFS 1991:1321).

Rehabilitation
Rehabilitation is a collective concept for all measures of a medical, psychological, social and work-related nature whose aim is to help the sick and injured to regain the best possible functional capacities and abilities for a normal life (Höök & Grimby, 1997).

Short-term sickness absence
By short-term sickness absence is meant (in Study IV) absence from work due to illness or accident for a maximum of 14 days.

Sick pay period
The sick pay period covers the first day on which the employee’s working ability is reduced because of illness, and the 13 following calendar days in the sickness period. After this the employee receives sickness benefit from the social insurance office (Lag 1991:1047; om sjuklön (on sick pay)). The sick pay period is paid by the insured person’s employer, i.e. from the day after the sickness notification onwards. No payment is made on the first day (qualifying day) (SFS 1991:1047).

Sickness absences
In Study IV, the number of occasions during the research period on which absence occurred due to sickness are given.

Sickness presenteeism
Where an employed person goes to work despite the feeling that, in the light of their perceived state of health, they should have taken sick leave (Aronsson et al., 2000).

Spread of pain
The location and spread of pain are indicated on self-administrated pain drawings (Study III).

Statistical model in Study V
The statistical model used in Study V is presented in Figure 1. The objective of the model is to present the main factors contributing to the main outcome of the intervention. This model is used as a basis for the statistical analysis.
Figure 1. Statistical model. The variables are age, numbers of children, single/married/partnered and cleaning experience in 1995.

**Temporary Parental Allowance**
Temporary parental allowance is a payment made when the child (or the person who looks after the child every day) is sick or infected. The temporary parental allowance is paid out for children up to 12 years. In special cases, the temporary parental allowance can be paid for children up to 16 years of age. Parents can receive the payment for a maximum of 60 days per child per year. This parental allowance can be taken for whole, three-quarter, half- or quarter-days. The time is added together to give whole salaried days (SFS 1995:584).

**Total absence**
In order to measure the outcome of preventive measures in Study IV, the total absences before and after the start of the measures was studied. This allows a detailed analysis of the total absence from a workplace. Portions of days with absences are calculated to give the equivalent number of whole days.

The following absence variables and coding form the basis of the various analyses:

1. Number of sickness absence days (total, < 15 days, 15-28 days, 29-90 days, > 90 days)
2. Number of occasions of sickness absence (total, < 15 days, 15-28 days, 29-90 days, >90 days)
3. Number of times rehabilitation allowance was paid (total)
4. Number of times holiday was taken (total, 1 day, 2-3 days, >3 days)
5. Number of times days in lieu were taken (total, 1 day, >1 day)
6. Number of occasions of parent allowance/care of sick children (total, 1 day, 2-3 days, >3 days)
7. Number of times parental leave of absence was taken (total, 1 day, 2-3 days, >3 days)

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1 Then further sub-divided into 1 day or less, 2-3 days, 4-7 days and 8-14 days.
**Vocational rehabilitation**
The support and the remedial measures which a person needs in order to regain or to maintain their ability to work. Examples of such measures are assessment of working capacity, vocational training or education. The aim of the measures is that the person will be able to go back to his or her previous work, or to get another suitable job. The efforts are directed primarily towards people who have a connection with the labour market, i.e. sickness absentees who have or who are looking for a job (Statskontoret, 1997:27, p. 24).

**Vocational training**
The sickness absentee is given the chance to try working at their own pace and/or for a limited number of hours. The vocational training often takes place at their own workplaces, but it may also be carried out at a different workplace.

**Workplace programme**
Workplace programme was a frequently-occurring concept during the time of the Working Life Fund, which was active between 1990-1995 (described in the Introduction). By ‘workplace programme’ was meant measures planned by the employer and the employees together, starting with a description of the organisation, planned changes and suggestions of measures at the individual, group and organisation levels where a comprehensive view of the working environment and rehabilitation was applied. Preventive measures were combined with adaptation and rehabilitation. The workplace programme was directed at everyone at a workplace, i.e. the healthy, those working with difficulties, recurrent sickness absentees and the long-term sickness absentee. People with temporary or permanent disability pensions also took part in certain of the programmes (Vinberg, 1997; Tekniska nomenklaturcentralen, 1995, p. 9).

**Work-related diseases**
Occupational injuries which were caused by injurious factors other than occupational accidents. Such injurious factors could, for example, be exposure to chemical substances, radiation, one-sided work movements or mentally stressful conditions at work (Arbetarskyddsstyrelsen & Statistiska Centralbyrån, 2000, p. 33).
INTRODUCTION

Working life today is characterised by increased flexibility as regards the work organisation, work forms, employment patterns and questions of competence. Demands for increased productivity and efficiency have brought about greater time pressure and increased work load. Despite extensive investments within the areas of working environment and rehabilitation, work-related ill-health causes large costs to companies and social costs, and, not least, personal suffering for those affected and their families.

In order to understand better the consequences of these increased demands, this section begins with a general picture of the recent situation regarding occupational accidents, work-related diseases, sickness absences, sickness presenteeism and costs for sick-listing, rehabilitation, occupational injuries and disability pension.

During 1999, 66 people died in occupational accidents (5 were women). The number of fatal accidents at work in 1999 was somewhat lower that in 1998, and fatal accidents as a whole fell dramatically during the last half of the last century (Arbetarskyddsstyrelsen & Statistiska Centralbyrå, 2000, pp. 3 and 7).

During the same time period, 34,830 occupational accidents were reported (64% men and 36% women), and 19,753 work-related diseases (43% men and 57% women). Both occupational accidents and work-related diseases increased for the second year in succession. Compared with 1997, work-related diseases increased by 50%. In both cases, the increases were rather greater for women. Among women both occupational accidents and work-related diseases increased with increasing age, and were most common in the 55-59 age range. The same is true for work-related diseases among men (Ibid., pp. 3-4). The fact that the frequency of diseases is somewhat lower in the oldest age group can be explained primarily because many of those who would be exposed to health risks are no longer in work by this age (Ibid., p. 20).

The most common occupational accidents for women are overstraining of parts of the body, which in two out of three cases is brought about by overloading during heavy lifting. Care assistants, personal assistants, nurses and nursing assistants are occupations with a high risk of overloading injuries. Such injuries lead to long sickness absences, which in 1998 averaged 43 days each (Ibid., p. 14).

Twenty-nine of the work-related diseases reported in 1999 had fatal outcomes (7 women). Overloading injuries dominated the work-related diseases, forming 64% of all cases reported in 1999. Illnesses with social or organisational causes have increased by 200% since the middle of the 1990’s, and form 20% of the women’s and 11% of the men’s reported work-related diseases in 1999. The majority of these are related to stress and high work loading, but other reasons such as bullying and harassment, reorganisation and conflicts also occur (Ibid., p. 4).

Sickness absences have greatly increased in recent years, both in number and length. From May 1997 to May 2000, long-term sickness absence (more than 30 days) has increased by nearly 80%, and more and more people have been registered as sick for more than a year. Sickness absence is increasing most among women, where the increase is twice as great. Sickness absence is highest for the over-50’s, and the increase has been greatest within the public sector (SOU 2000:78, p. 15).

Examining deaths resulting from occupational accidents, occupational injuries, work-related diseases and sickness absences gives a good, but incomplete picture of the working environment. In recent years the sickness presenteeism at workplaces has come more into focus. Aronsson et al.

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2 Men form 52% of paid workers (Arbetarskyddsstyrelsen & Statistiska Centralbyrå, 2000, p. 6).
(2000) showed in an empirical investigation of sickness presenteeism that a third of the study population (3,801 employed persons working at the time of the survey) reported that they had gone to work two or more times during the preceding year (1997) despite the feeling that, in the light of their perceived state of health, they should have taken sick leave. The highest level of presenteeism is found in the care and welfare and education sector (nursing and midwifery professionals, registered nurses, nursing assistants, compulsory school teachers and preschool/primary educationalists). All these groups work in sectors that have faced personnel cutbacks during the 1990's. The most common combination is low monthly income, high sickness absenteeism and high sickness presenteeism.

Researchers in the 'Research on rehabilitation related to the working life' (SOU 2000:78, p. 16) were given the task of analysing sickness presenteeism by asking employees whether they were thinking of changing their jobs for health reasons. This showed that just over 25% of the employed (1 million) have thoughts of this nature. In addition, 10% had already taken measures to improve their situation during the previous year. The need for change was felt most in the 35-54 age group, and the proportion thinking about a change was greatest in the public sector. One further recently reported study (Vingård & Lindberg, 2000, p. 317) shows that on average every sixth woman and every seventh man are uncertain whether they will still be doing the same jobs in two years’ time, when thinking of their own health. The proportion of those uncertain increased with increasing age.

The cost of sickness absences, rehabilitation, occupational accidents and disability pensions/temporary disability pensions were (in the social insurance system alone) around 56 billion Swedish kronor during 1998 (RFV, 1999), of which a high proportion can be assumed to be connected with factors at the workplace. Added to this will be the costs to the National Labour Market Board for rehabilitation of sickness absentees without work. In 1996 these costs amounted to 7.3 billion kronor (Statskontoret, 1997:27). It is also important to note the high costs associated with the sickness which work-related ill-health generates at the workplace in the form of costs for production shortfall, personnel replacement, and absence and rehabilitation measures (Aronsson & Malmquist, 1996). The total compensable cost for upper extremity cumulative trauma disorders in the USA in 1989 was estimated to be $563 million (Webster & Snook, 1994a). At the same time it can be estimated that the total workers’ compensation costs for low back pain cases was $11.4 billion (Webster & Snook, 1994b).

No annual statistics of sickness absence diagnoses have been produced in Sweden, but information gathered in 1993/94 within the National Social Insurance Board’s project ‘RiksLS’ showed that 37% of the sickness absences could be traced to diseases in the musculoskeletal system (RFV Redovisar, 1995:20). People obtaining disability pension and temporary disability pension amounted in 1996 to over 39,000, of which 53% were women. Of those who received disability pension or temporary disability pension, 49% of the women and 36% of the men did so because of diseases in the musculoskeletal system and connective tissues (RFV, 1997).

Known risk factors for work-related diseases in the musculoskeletal system include both physical and psychosocial conditions. Examples of a physical factors which increase the risk of diseases in the musculoskeletal system are: heavy physical work, sudden overloading, static postures, monotonous repeated work, pressure against part of the body, extreme working positions, vibration, long-term sitting and locked working positions. Examples of psychosocial factors which increase the risk are: time stress/high performance demands, lack of stimulation, limited ability to influence the work or how the work is done, unclear distribution of responsibility and poor social

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3 It is not possible to present more recent figures than those from 1996, as this type of summary is not obtainable from the National Labour Market Board. In their investigation in 1996, the Swedish Agency for Public Management produced their own summary.
support (Hagberg, 1996; Bongers et al., 1993). Previous studies show that there is a connection between psychosocial conditions at work and symptoms in the lower back and neck and other unspecified illnesses. On the other hand, this connection is weaker between these conditions and specific diseases in the lower back, neck, elbows, joints of the hand, hips and knees (Hagberg, 1996).

The quantitative importance of individual risk factors is not fully known, but it is certain that physical loading is most important in the initial stages while the psychosocial conditions affect the experiencing of problems and their progression to a greater extent in the long term - especially in the transition to chronic problems (Vingård & Kilbom, 1996).

The employers’ working environmental responsibilities

In the 1960’s, society went through structural changes. Working methods developed towards a greater degree of mechanisation and computerisation. Methods were developed for controlling work and making it more efficient. Rationalisation sifted out the low performers and companies found it more and more difficult to take responsibility for their faithful old retainers when simple work and so-called retirement places for employees with reduced capacities and failing health had been rationalised out. The public sector concerned with care expanded, as did the administration of it (SOU 1965:57). The demand for a workforce was so great that there was a certain interest in matching the tasks to the workforce. On the other side there was a fear of employing a workforce with limited resources and failing health. What was needed, therefore, was the involvement of society in the labour market measures in order to uphold the placement policy and achieve the goal; full employment (SOU 1965:57).

“… the labour market situation has for a long time been such that there have in general been great difficulties in recruiting. The involvement of a doctor in the recruitment process is thus not to ‘pluck the raisins from the cake’, but to help in forecasting the possibilities for matching between those seeking work and the intended work tasks.” (SOU 1965:57, p. 34).

Investigations pointed to a deterioration in people’s health and a reduction in working ability after 45 years of age. Structural changes and increased mechanisation within companies were further eliminating factors for the older workforce with out-of-date knowledge (SOU 1965:57; Socialmedicinsk tidskrifts skriftserie, 1965, No. 32; Socialmedicinsk tidskrifts skriftserie, 1965, No. 33).

The labour market authorities received increased resources in order to simplify the mobility and competence development of the workforce. At the same time that the older members of the workforce with reduced capacities and a lack of training were being made redundant, paradoxically more and more people were to be found in the labour market. Immigration increased, women took an increasing part in working life, and those born in the baby boom of the early 1940’s started to look for homes and work. The high employment contributed to the additional workforce of above all women and immigrants who, through their salaried work, became entitled to sickness benefit and national supplementary pension scheme (ATP). Structural changes, women with double jobs, together with the increasing age of the salaried workers meant that many people became eligible for rehabilitation and disability pension. This was indicated in a rising number of sick and an increased number of disability pensions.

In the 1970’s a number of investigations were carried out with the aim of improving the conditions and providing secured care in all the events of life within the social insurance framework, because the labour market could not provide everyone. The Swedish state, with its large public administration and well-developed infrastructure, an aware labour market politics and strong social legislation, had to a certain extent been successful in preventing and fighting social
destitution and serious diseases. Investment in improvements for the individual, insight into public administration and the fact that increasing numbers of people got involved in influencing political matters, brought about an increased awareness of social problems. The employment legislation was improved, sick care was extended and made more accessible, study allowances were improved and parental insurance was also extended. More generous applications and higher benefits made a breakthrough in the social insurance.

During the 1970’s, the concept of worker protection was widened to working environment. This new concept included psychosocial and work organisational factors, in addition to the traditional physical environment. The pressure for change was now so great that it was no longer sufficient just to change or adapt one thing at a time. The result was that working environment questions, work organisation and rehabilitation needed to be integrated with other development factors affecting, among others, technology, competence, productivity and the development of business ideas (http://www.niwl.se/alf/fondfem.htm, 2000-02-29).

The more generous view which characterised the changes in the rules and application in the 1970’s was an expression of a striving for an increased equality in society. One step towards equality was to invest in those weak in resources. One labour market political goal was work for all. This led to the setting up of protected workshops with jobs matched to the workers and state salary support for people with obvious difficulties in getting and holding down a job in the open market (SOU 1978:14). At the same time that work was created for the handicapped, those who were social misfits and those with substance abuse problems received the right to a disability pension (SOU 1975/76:44). The pension came to be a provision for more and more people who, because of age or mental and/or physical ill-health could not live up to the demands of the labour market.

Despite active measures in the labour market and investment in sickness care and rehabilitation, the numbers of sick increased in conjunction with the worsening economy of the 1980’s. Welfare politics, which did not make people better but just freed large groups in society from providing for themselves, started to be questioned seriously. The increased redundancy from work meant that many workplaces started to look again at their rehabilitation routines. At the same time, many new rehabilitation clinics/institutes came into being, which specialised in medical rehabilitation within certain diagnosis groups such as the rehabilitation of back problems, heart diseases and respiratory problems.

During the whole of the 1990’s, the investigations aimed at managing the increased sickness absence and the increased working environment problems came one after the other. A selection of the national studies are described further on in the introduction.

A lot has certainly happened within the working environment area since Stövling’s book ‘Jobb. Rapport från 3 fabriker’ (‘Jobs. Report from 3 factories’) was published in 1971, but there is still no legislation which limits the time for which health-endangering work should be carried out, as Stövling proposed. Even Eklöf’s remarkable book ‘Rapport från en skurhink’ (‘Report from a scrubbing bucket’) (1970) focussed on the understimulating Swedish low salaried day at the cleaning bucket during the 1960’s, and which is still of relevance in the year 2001.

Employers’ rehabilitation responsibilities

The employer has a first-hand responsibility for ensuring that rehabilitation is carried out at the workplace, according to the Work Environment Act (in Swedish: Arbetsmiljölagen, AML) and the Social Insurance Act (in Swedish: Lagen om allmän försäkran, AFL). They shall organise work adaptation and rehabilitation activities in a suitable manner. The National Board of Occupational Safety and Health and the Labour Inspectorate are the overseeing authorities at the general and the local levels respectively. As such they enforce the rules and regulations (Zanderin et al., 1994).
The change in the Work Environment Act which was carried out in 1991 had the aim of clarifying the employer’s responsibility for the working environment. It became the duty of the employer to keep a continual and systematic watch on the working environment and on those injuries and diseases which it causes, by means of a system for internal control of the working environment (Prop. 1990/91:140; AFS 1992:6).

The employer has to set up a rehabilitation investigation within four weeks, and to send this in to the social insurance office within eight weeks from the first day from which the employee’s sickness absence is counted. A rehabilitation investigation can also be set in motion when the insured person’s work has been frequently interrupted by shorter periods of sickness absence or when the insured person him/herself asks for it (AFL 22:3). Thereafter the social insurance office can contact the insured and the employer. The rehabilitation investigation can include information on the rehabilitation measures carried out and those planned, or on preventative measures at the workplace. If the employer has not set up any rehabilitation measures, the social insurance office may in certain circumstances take over the investigation (AFL 22:3).

In contrast to AFL, AML is framework legislation. The law contains generally held regulations which need to be complied with in order for their intentions to be fulfilled. The government has therefore enacted working environment regulations, AMF (SFS 1977:1166).

The National Board of Occupational Safety and Health communicate the instructions and general advice in the form of notifications in its statute book, AFS, with the support of 18 § AMF. The instructions form decrees which must immediately form the basis for assessments and tests for the overseeing authority. AFS 1994:1, Work adaptation and rehabilitation, came into force on 1st July 1994.

Through the issuing of this regulation, the Labour Inspectorate has had a clearer basis for its inspection work in matters of work adaptation and rehabilitation. The inspection has to cover the working environment and rehabilitation activities as a whole, although not individual rehabilitation actions (Prop. 1990/91:140). If the employer does not fulfil his rehabilitation responsibilities, the social insurance office can call for the Labour Inspectorate, who can carry out an inspection to see whether suitably organised work adaptation and rehabilitation activities are taking place at the workplace in question.

In a study by Landstad et al. (1995), the aim of which was to determine what freedom of action the social insurance office’s rehabilitation organisers felt they had when coordinating contributions from employers among others, it emerged that the position of the labour market during the 1990’s was such that rehabilitation work and the return to a working life had been made more difficult. The rehabilitation organisers felt that the employers often had unrealistic expectations of what the social insurance office could do, and that they found it difficult to see their own role in the process. The stricter profitability thinking amongst employers meant that the simpler tasks, those which did not demand comprehensive education or training, had disappeared. The consequence was that it was difficult to organise repositioning within the same company, or the possibility for sickness absentees to train for work at their existing workplace, or at any other workplace.

The fact that many employers do not comply with the role given to them as regards rehabilitation work was shown in the study by Arneson (2000), where the employers’ rehabilitation efforts in relation to the return of women to work was studied (just over 600 women were studied). The study shows that the majority of employers did not cooperate with the women regarding the rehabilitation investigations, and that in those cases where rehabilitation measures were carried out at the workplace (46%), the employers acted very late.

A number of public studies have also shown after a closer look that there are a lot of less well-functioning employers who might be characterised by a lack of interest, knowledge, competence
and willingness to take responsibility in the rehabilitation work. One explanation for the failures is that the role of the employers and their responsibility in the rehabilitation work is unclear. Another explanation is that the economic driving force for rehabilitation has not been sufficient (CESAR-gruppen, 1994; RRV 1996:40; SOU 1998:104, p. 202; S 1999:08, pp. 122-123, 193-194; RFV 1999:2; SOU 2000:78).

In defence of the employers, it may be said that the character of the Social Insurance Act, together with lack of clarity in the text of the proposition (Prop. 1990/91:141), particularly everything to do with the responsibility for costs, have not helped to make the employers’ responsibilities clear. According to the Sickness and Work Injuries Committee (in Swedish: Sjuk- och arbetsskade-kommittén), the employer is financially responsible primarily for rehabilitation at the workplace, but also ’to a reasonable extent’ for measures which are made outside the workplace (SOU 1996:113). Factors such as the financial turnover of the workplace and its size have been regarded by the Committee as being conclusive in the calculation of what is taken as being reasonable.

The work of the social insurance office in rehabilitation and preventative measures

In January 1992, the social insurance office took over the responsibility for coordinating the rehabilitation work (AFL 22:5). In its role as coordinator, it was the job of the social insurance office to consult with those insured, to determine the needs for rehabilitation, to cooperate with other rehabilitation participants, and to make sure that these other participants fulfilled their rehabilitation responsibilities. In the background to the proposal for the legislation, the investigators write that the coordinating role of the social insurance office should also include supporting the insured in their contacts with others responsible for rehabilitation. They also stated that the social insurance office should have a responsibility for following up and evaluating how the rehabilitation work in general was functioning within the area, and take any initiative which the results of this may show to be required (Prop. 1990/91:141).

At the social insurance office, rehabilitation is connected to sickness benefit, time limited temporary disability pension and disability pension. Its aim is to act as a brake on too much expansion of payments from the social insurance system. One principal thought in social insurance is not to make the system so attractive that it replaces salaried work, which is known as the placement policy. There is also a humanitarian aspect, in that apart from providing financial support, work gives people an identity and a sense of belonging to life in society. During the whole of the period of illness the possibility for work-oriented or medical rehabilitation should be noted.

The annual report for 1998 from the National Social Insurance Board (RFV) shows that the preventive work of the social insurance office on ill-health has reduced since 1996. The reason for this is described as a transfer of working resources to the payment of sickness benefits. The rehabilitation work is still focussed on the individuals who have been made redundant or become unable to work, either wholly or partially, as a result of diseases or injury. Of the relatively limited actions which were carried out, those mentioned were in coordination with other organisations (e.g. occupational health care, the Labour Inspectorate, the employment office and health and sickness care), information provision to employers and education and training for managers. RFV stated that the social insurance offices did not show any effects of their investments, but effects were expected over the longer term (RFV Annual Report, 1998).

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4 When it comes to affecting people’s health, according to Konarski (1992), there are three aspects of life with a powerful potential for change in a positive direction: Work, the social network and the experience of meaning and context.
During 1999 a development project was carried out, with the cooperation of all the social insurance offices in Sweden, whose aims included the production of common methods for how the effects of the preventive ill-health measures should be described. The project group was agreed that the work on ill-health by the social insurance offices could be divided into three main processes: a sickness case process (medical treatment, rights to sickness benefits, investigation etc.), a rehabilitation process which covers the coordinated efforts on behalf of individuals who are in need of rehabilitation in order to be able to return to work, and also their own process which concerns work on preventing ill-health, where the efforts would be directed primarily towards those who are ‘well’ and/or those who are starting to get trouble and who belong to a risk group. The project group considered that the preventive work relating to employers should be focused on identifying companies, lines of business and occupational groups who need early intervention in order to prevent absence due to ill-health, together with efforts to ensure that those who are ‘well’ stay well and that those who find themselves in the ‘risk zone’ can be returned to the ‘well’ group (Gabrielii, 2000, p. 3).

**National investigations in the area of rehabilitation from the middle of the 1980’s and during the 1990’s**

Improving health is a highly prioritised goal which has formed the guidance for a range of different reforms within the area of working life. Among other things, as a result of new reforms and changes in the laws, employers have been given an increased responsibility for the working environment and rehabilitation.

In 1985 the government set up a committee, Rehabilitation preparation (in Swedish: Rehabiliteringsberedningen), with the task of gaining an overview of the rules on sickness insurance in connection with rehabilitation and preventive measures. In 1988 the Rehabilitation Preparation Committee presented their report on early and coordinated rehabilitation (SOU 1988:41).

The Rehabilitation Preparation Committee pointed out the need for more active rehabilitation and more effective coordination between the participants involved. The importance of early investment was stressed, as was the responsibility of the employers for rehabilitation of their own employees. One basic thought in the committee’s proposals was that rehabilitation should be carried out to the greatest possible extent at the workplace. At the same time as the social insurance office was given an increased ability to provide financial support active rehabilitation efforts, the incentive for the insured person to return to work as soon as possible was strengthened. This report became the starting point for the changes in social insurance and rehabilitation which became reality in the 1990’s. In 1992, a new Social Insurance Act came into force.

The dramatic increase in the number of occupational injuries since the new law (1976:360) on industrial injury insurance came into force on 1st July 1977, and the increasing frequency of validated occupational injuries since the mid-1980’s, together with the increases in sickness absence and disability pensions, led to the setting up by the government of the Working Environment Commission (in Swedish: Arbetsmiljökommisionen) in 1988. Its task was to survey and propose remedial measures for those working conditions which create ill-health and injury. In a number of sub-projects, significant correlations were found between the working environment

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5 The project group chose to use the concept of work on preventing ill-health instead of the concept of preventive measures which are common in many different contexts, and defined the target group as both those who are ‘well’ and those who are starting to get trouble and who belong to a risk group. This is connected with the fact that people are regarded by the social insurance office as being sick/having ill-health only when the first day of sick-leave has occurred. In certain connections, one may stumble across the concept of early rehabilitation. With the use of the above definition, early rehabilitation measures are included in the concept of work on preventing ill-health.
and health risks for a range of jobs (Arbetarskyddsstyrelsen, 1989). The Working Environment Commission considered that the reasons for the high incidence of ill-health depended to a certain extent on the conditions at the workplaces: failings in the physical working environment and the lack of rehabilitation routines. The proposal from the Commission stressed the importance of an overall view of the working environment, work organisation and rehabilitation (SOU 1990:49).

The report became very important in the discussion on how preventive measures should be designed. The Parliament decided to form a Working Life Fund during the period 1990-1995, whose task would be partly to finance the measures aimed at improving the working environment and the organisation of the work, and partly to bring about early and active rehabilitation at the workplace. The opportunity was thus opened up for a broad support to workplaces for measures partly directed towards the long-term sick individual, but also investments in order to prevent redundancy.

The Central Coordination Group for the Working Environment and Rehabilitation (CESAR) in June 1994 presented a basis for discussion between the authorities taking part (CESAR Group, 1994). The discussion document dealt with the preconditions for working environment and rehabilitation work over the next few years, and what levels of ambition might be suitable for the coordinating authorities to aim for.

The Working Life Fund and the National Board of Occupational Safety and Health’s representatives in the CESAR Group had the common experience that it had been very difficult at many workplaces to get across the overall view of working environment, work adaptation and rehabilitation questions. The primary reason for this was seen to be the difficult position of the labour market. The attitude of the social insurance office was described in the report as being far too defensive when dealing with employers and their rehabilitation responsibilities. The working methods at many social insurance offices was seen as being characterised by a narrow individual perspective on rehabilitation rather than an overall view of the working environment, preventive efforts and rehabilitation.

The group suggested that “One way to develop the method of working further is to test the consequences of broadening the ability of the offices to buy rehabilitation services and also to include preventive work with a documented connection to the cases of disease of the employees, and/or based on knowledge of the ‘risk groups’, etc. at the workplaces. The ambition should thereby be, in the build-up stage, to stimulate the companies to develop competence and routines for the preventive work which lies above the minimum demands of the Work Environment Act (AML)”. In this case, the companies should receive help with the financing of the survey, inventory, etc. (CESAR Group, 1994, p. 31).

The basis for the discussion led in June 1995 to a common action plan with common proposals for changes. In September 1995 the proposal was delivered to the government.

The proposal contained, among other things, the following suggestion:

“The proportion of workplaces with systematically planned and executed routines for working environmental work, adaptation and rehabilitation activities must be increased. The efforts must be connected to the responsibility of the employers for preventive work and rehabilitation as described in AML, AFL and ASS. The ability of the social insurance office to buy rehabilitation services and to provide financial support for work aids is being reinforced. The ability of the social insurance office to initiate discussions with the employer in order to prevent repeat cases of diseases is clarified in AFL. The

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6 The CESAR group comprised representatives from the National Social Insurance Board (RFV), the National Swedish Board of Health and Welfare, the Swedish Labour Market Board (AMS), the National Board of Occupational Safety and Health (ASS) and the Working Life Found (ALF).
government should ensure as soon as possible that all employers are covered by a good quality of occupational health care” (GD Group, 1995).

In the final report of the Sickness and Occupational Injury Committee (SOU 1996:113) (in Swedish: Sjuk- och arbetsskadekommittén), attention was called to the need for the coordinating authorities to develop more efficient methodology, to carry out investigative work and to give companies knowledge of the value of integrating the working environment, work adaptation and rehabilitation in their business development. It proposed that opportunities should be created to broaden the perspective to look at all individuals at a workplace which is in need of investment and to amalgamate these into a working environment and rehabilitation programme. The Committee stated that the social insurance office should be able to provide partial finance for the carrying out of the remedial programme, especially in small companies. It was also proposed that the social insurance office should be able to part-finance remedial measures for people with documented problems with a risk of recurring sickness absence (SOU 1995:149; SOU 1996:113).

In 1996 the Swedish National Audit Office (RRV) carried out an investigation of the effectiveness of the cooperation between the social insurance office and the Labour Inspectorate in the supervision of the employers. RRV found that the cooperation between the two authorities did not work effectively, and that the level of goal fulfilment was low. The ability of the national authorities to obtain information on how and to what extent the blame for this lay was not taken into account. According to RRV, this type of information would be of value in the discussion of the employers’ incentive to take further measures towards work adaptation and rehabilitation. A number of reasons were pointed out in the report for the lack of effectiveness in supervision: secrecy and register laws, questions of control, data processing support, together with various aspects of the procedural patterns of the social insurance office and the Labour Inspectorate. RRV recommended various measures in order to create better conditions for information exchange, and thereby an improvement in cooperation (RRV 1996:40).

An investigation with the aim of further clarifying the employers’ responsibilities for remedial measures and costs where preventive efforts and rehabilitation are concerned was submitted during the autumn of 1998 (SOU 1998:104). The proposal contained suggestions that the social insurance office should in the future be able to part-finance different rehabilitation measures at the workplace, and that the social insurance office would have an increased responsibility for investigation as regards rehabilitation relating to the working life. It was also suggested in the proposal that the employer should be responsible for ensuring that the measures relating to the working life were carried out as necessary in order that the employee could return to work. It was proposed that, in order to fulfil their responsibility for the working environment in accordance with the AML and for workplace-directed rehabilitation according to AFL, the employers themselves should obtain the support of a occupational health care service or other similar expert resource.

In a report from the National Health Committee (in Swedish: Nationella folkhälsokommittén), it was proposed that successful health-promoting measures should start from the workplaces where measures against unsuitable working environments could be integrated with measures against other stressful factors. The use of such measures would increase the possibility both of improving health in general, and of reducing the inequalities in health. The Committee suggested a further development of the workplace as an arena for a broad health effort which would include both health risks related to the working environment and the living conditions and habits of the employees as a whole (SOU 1998:43, p. 269).

In one of the latest of an array of national investigations (SOU 2000:78), a completely new rehabilitation reform is proposed. The new reform is motivated by the fact that the 1992 reforms went a long way towards achieving their goal of, among other things, reducing sickness absence
and exclusion from the working life. It is necessary for the coordination of an individual’s rehabilitation to be made central to a much greater extent than previously. The investigation suggested a new role for the participants involved in rehabilitation. Their task would be to lead the work of change with individuals who, during the rehabilitation process, would to a great extent work out their own goals and develop strategies in order to achieve these goals (based on a paper by Ekberg & Svedin, 1998). Changes in the labour market, demographic changes and an increased and somewhat different need for rehabilitation mean that a stronger rehabilitation directed towards the working life is necessary in order to meet the needs of the future. It is proposed that occupational health care should have a broadened and expanded role with the aim of supporting the workplaces in their preventive work. The future need for a workforce is also given as a reason for needing stronger rehabilitation measures.

At present, comprehensive political demands are made for a more effective use of the collective resources in society in order to satisfy people’s individual need of different support measures better. One consequence of these demands is that coordination and patterns of cooperation within, for example, the rehabilitation area, are still in need of development at several levels and in several areas. More investigations and political signals, which have been presented during the last years, have dealt with and made suggestions on the necessity of increased cooperation of the authorities at both central, regional and local levels (SOU 1996:113; SOU 1996:34; Prop. 1996/97:63).

In summary, all the investigations and reports mentioned point out that increased investment is necessary in the areas of prevention and rehabilitation, more developed forms of cooperation are needed, and that new methods need to be tried for work directed towards the workplace. The year 2001 will be a year for reflection and summarising of the investigations carried out in the area of rehabilitation in recent years. Facts from a wide range of investigations should together give a comprehensive view of the situation. At the end of the year, new proposals for direction and prioritisation, based on summarised assessments and analyses, will be laid before the government for decisions.

The objectives and work of the Working Life Fund over five years

In 1989 the Swedish Parliament made a law (SFS 1989:484) on a special environmental payment. For 16 months, all employers paid in 1.5% of their wages bill. The Working Life Fund (ALF) was set up in 1990 using this money. The aim was to carry out a very comprehensive public investment between 1990 and 1995 in order to create a better working environment, rehabilitate employees and increase productivity in companies and authorities (Prop. 1989/90:62). Apart from initiating development work in the working life, a very important task was to spread the knowledge of successful investments. According to the goals set out by the government and parliament, the Working Life Fund was to create better working environments, which in turn should result in fewer occupational accidents, reduced sickness absence, fewer disability pensioners and more effective rehabilitation. These in their turn should lead to increased access to workforce and reduced costs for the social insurance system. The starting point for the Working Life Fund was that responsibility for the working environment, as well as the responsibility for business ideas and productivity, should lie with the employer (SFS 1990:130).

During the five working years of the Fund, support was given to nearly 25,000 projects for change in the form of workplace programmes and nearly 13,000 training and start-up cheques were issued as part of the spreading of knowledge and experience. Of just over 11 billion Swedish kronor in the Working Life Fund, 75% went to the private sector and 25% to the public sector. Approximately one fifth (23%) of the funds were used for measures to improve the physical environment, i.e. the more traditional working environment investments; somewhat under a fifth (17%) was used for vocational rehabilitation and just over half (51%) went to changes in work
organisation, of which the majority went into competence development of personnel for broadened work tasks. Support for the workplace programme constituted on average one third of the total cost, which means that the investment in the Working Life Fund resulted in a total investment of just over 30 billion Swedish kronor (http://www.niwl.se/alf/fondfem.htm). The workplace programmes are calculated to have involved a total of 3 million employees (Brulin & Nilsson, 1994).

Because the activities of the Working Life Fund were characterised as a large social reform programme, the investment was the object of numerous evaluation studies (some were initiated by the ALF, but a considerable number were initiated by external researchers with interests in certain limited areas).

Working environment and rehabilitation in coordination (the AMoRE project)

The AMoRE project in the county of Jämtland was a cooperation between the social insurance office, the County Labour Board, the Labour Inspectorate and the Working Life Fund (before it was wound up) between 1994-1997. The overall aim was that the community, in cooperation with companies and employees, should create healthy companies which did not make people sick, and that the employers should be made more aware of their responsibility for working environment and rehabilitation matters. The aim of the project was to make rehabilitation work effective by applying a holistic view to working environment and rehabilitation. Preventive efforts were therefore combined with adaptation and rehabilitation. The working environment and rehabilitation programmes were directed to everyone at the workplace, i.e. those who were well, those working with problems, repeated sickness absentees and long-term sickness absentees. The basic thinking behind the AMoRE project was that the insurance office should take on board and benefit from the experience, methods and skills built up within the Working Life Fund (Vinberg, 1997).

The relative risk of long-term sickness absence of two work groups

In the report of the survey group to the Working Environment Commission (in Swedish: Arbetsmiljökommissionen) (Arbetarskyddsstyrelsen, 1989) on work involving special health risks, it was found that female cleaners has an increased risk of cardiac infarctions and skin diseases. This working group showed an increased risk of sickness absence and death at an earlier age, and they also found increased risk of giving birth to underweight babies. Female home care assistants had a greater risk of developing lung diseases, cardiac infarctions, stress and serious accidents. An increased risk of effects on the foetus was also shown in this group.

In a study on work and long-term sickness absence in Jämtland and Västernorrland counties, the occupational groups of cleaners and home help personnel are identified as two of the 20 occupations where the relative risks of long-term sickness absence are very high (Goine et al., 1994:21, Tables 10 and 11). Diseases of the musculoskeletal system were the commonest reason for sickness absence in all 20 of the high-risk jobs (49% among men, 59% among women). The causes of sickness absence could be attributed to problems in the musculoskeletal system for 66% of female cleaners and for 59% of the female home help personnel (Ibid., p. 27 and Appendix 4:52).

In a continuation study the researchers turned their attention to a number of people in those occupations which had previously been identified as high-risk, using a questionnaire in order to determine their experience of working environment and health. In the group of female caretakers and cleaners, it emerged that 48% worked full time. About 35% of the group stated that working
along with colleagues did not form part of their work and 55% replied that there was no chance to change job or any work rotation. An increased proportion had problems with the thoracic spine, hand/tendons, and foot/tendons (Knutsson & Nilsson, 1995, pp. 122-123).

In the group of care assistants and home help personnel, only 28% worked full time. Together with warehouse and stores workers, this group suffered the greatest degree of bodily strain of all the female occupations studied. 47% of the group stated that the work involved or required that they carried out heavy lifting for at least a quarter of the time. Only 8% thought that they were able to learn new things in their work. An increased proportion had problems in the middle and lower back. Problems in the upper part of the back, on the other hand, were not more common. An unusually large proportion (about 20%) stated that some in their working area smoked (Knutsson & Nilsson, 1995, p. 110).

In the SCB survey in 1999 of the 16 work groups of women who had the most occupational accidents per 1000 employees, we find both the nurses/care assistants and the group of cleaners etc.

The work of Härenstam et al. (Härenstam, 2000), in what is known as the MOA project, had the aim of developing a model which could be used to look for groups in the population who had jobs and life situations which were correlated with health or ill-health respectively. Instead of looking for risk factors, as before, work and life situations were identified. The analysis model looks at where they were in the labour market, what type of workplace they had and what characterised those individuals who had these work and life situations. Eight typical situations were identified, called: ‘unlimited’, ‘locked’, ‘exposed’, ‘heavy and monotonous’, ‘changed’, ‘reasonable’, ‘mobile’ and ‘hindered’. The comparisons of these eight types of situation showed that they congregated into certain lines of businesses and/or into male- or female-dominated workplaces respectively. In some of the types of situation certain types of occupations were grouped, but others instead differed in work situation or in free time situation. Relatively clear differences could be seen between state of health and salary levels in the different clusters.

![Figure 2](image_url)

**Figure 2.** Occupations with the highest relative frequencies regarding occupational accidents reported in 1999. Women. Employees and own businesses. (Arbetarskyddsstyrelsen & Statistiska Centralbyrån, 2000, p. 13)
The type of situation which was connected with the greatest problems of ill-health for women had ‘heavy and monotonous’ work. This only included monotonous work tasks, particularly within cleaning, certain areas of industry and large kitchens where the measurement results increased and staff numbers went down. It was common for the physical loading in the work to exceed the physical abilities, and the women often also had the main responsibility for home and family. Free time was often both physically and socially passive, and many stated that they did not have the strength to carry out any activity over and above the paid and the unpaid work. In addition, the salary level in this group was the lowest for women in general. Smoking, overweight and poor condition were common among both men and women (Ibid., p. 57).

LITERATURE REVIEW

The literature review presented here is based on a structure of research and development work within the following areas:
• Health promotion work (general health)
• Prevention work (reduction of risk factors for ill-health)
• Early rehabilitation (early symptoms of ill-health)
• Rehabilitation (medical, psychological, social, working life oriented)
• Vocational rehabilitation (back to earlier work or other relevant work)
• Rehabilitation connected with the workplace (measures in the working environment/at the workplace)

These concepts are defined in more detail in ‘Definitions of concepts used in the dissertation’.

Within the above framework, emphasis has been put on reviewing the effects of preventive and rehabilitative interventions at the workplace. The literature review is divided into two parts; one general part which deals with experiences and effects of different types of intervention programmes, and a specific part which is concerned directly with research and development projects within the work groups of cleaners and home help personnel. These two workgroups have been the subject of the empirical investigations which form the basis of the work for this dissertation. One large part of the literature reviewed deals with problems of the musculoskeletal system (locomotor system).

I have purposely omitted from this literature review the large body of pioneer work which describes ergonomic measures with a rehabilitative aim. Although this work is very important for the design of individual workplaces, it falls partly outside the framework of my dissertation work. In this context is should therefore be sufficient just to give some of the central references which overlap into this area (e.g. Zotterman et al., 1948; Lundervold, 1951; Murrell, 1965; Akerblom, 1948; Astrand & Rodahl, 1970). A historical overview by Ivergård & Landstad (2000) shows that much of this pioneer work had its origin in the Scandinavian countries. Even when considering more recent research in the area of working life and rehabilitation in general, the Scandinavian countries have played a prominent role. ”The Scandinavian countries have recognized the links between and among worker participation, work organization, and workplace health and safety for many years” (Rest, 1996).

Experiences and effects of different types of intervention programme

It has been pointed out in many studies that there must be a clear relationship between the mechanisms for ill health/sickness absence and the measures which are taken with the aim of
prevention or rehabilitation (Ekberg, 1997; Ferraz-Nunes, 1996; Landstad et al., Study I, II, III). Limited resources also make demands for an effective rehabilitation process in relation to the desired effect. It is therefore necessary first to understand the mechanisms by which ill health and sickness absence arise.

Kaiser (1997) points out three main approaches taken in research which attempt in different ways to explain the mechanisms behind absence: individual, social psychological and economic. Included in the individual explanatory models are work motivation, job satisfaction, personality and ability to work (health status). The social psychological explanatory models include, for example, the absence culture (group cohesiveness), working environmental conditions (ability to influence them) and aspects of fairness. The economic models include, among other things, the ‘right’ to go absent as a compensation for poor wages (the value of free time), and the acceptance of absence by the company (which in turn is dependent on the company’s production technology and its need of special skills). Kaiser states that the different variables and explanatory models are part of a complex set of interactions, and that it is impossible to separate them from each other. In other words, the costs of sickness absence cannot sensibly be classified from, for example, just a social psychological perspective.

Kristensen (1991) presents a similar line of reasoning in his literature review, “...it is asserted that sickness absence cannot be understood if it is viewed as a simple function of ill health or other individual factors, such as job satisfaction. Absence should rather be regarded as a coping behaviour that reflects an individual’s perception of his/her health (illness) and is a function of a number of factors at different levels, primarily the combination of job demands and coping possibilities at the job (job strain)”. Problems in back and neck often have multiple explanations – both organisational factors such as monotonous and repetitive tasks and psychological factors such as stress and lack of social support (Ekberg, 1997). Rehabilitation is a process of change where one tries to change not only the picture of symptoms, but also how the symptoms are handled and how important they are for the life situation.

My assessment of the above is that the literature within the area can be divided into:
- Multi-component programmes
- Programmes directed towards individual problems
- Participative interventions

**Multi-component programmes**

An important collection of methods for prevention in the working life was produced by Dul, Hildebrandt & Vink (1996, p. 12). “Based on epidemiological and biomechanical evidence, potential individual and work-related risk factors are identified. Prevention strategies are aimed at these risk factors, in particular at the mechanical work load. Basically, the objective of the intervention can be to reduce the work load during heavy physical work, or to vary monotonous work with constrained postures or repetitive movements. Three types of interventions are possible: 1. task and work-place (re)design (technical and organizational changes of the work); 2. health promotion (education and training) for workers and others to change behaviour (e.g. postures, movements, work methods, fitness); 3. medical screening of workers (pre-employment selection, early detection of beginning disorders, return to work of disabled workers).” A similar review in the USA was carried out by Snook (1998). In this review he presents descriptions of measures such as job design, job selection, education and training in relation to different work situations. These descriptions are based on the comprehensive research and experience to be found within the Liberty Mutual rehabilitation institute (for a detailed discussion of these measures, see Liberty Mutual Group, Presentation of POWER – Rehabilitation at work, 1997).
The literature review carried out by Heaney and Goetzel (1997) of 47 evaluation studies covering 35 multi-component work-site health promotion programmes with goals such as reduced sickness absence, increased productivity and a better quality of life, showed that a number of the programmes included remedial regimes which combined information, education, skill building and remedial measures both in the organisation and in the general physical working environment. These programmes were certainly successful, but even more successful were those programmes of actions where the specially treated participants were offered advice and support in individual risk management with the aim of reducing health risks. The duration of the remedial programmes was also shown to be important for good results. The most successful programmes were those which lasted at least one year.

In a review of seven studies of multidisciplinary rehabilitation programmes for chronic back pain, Feuerstein et al. (1994) showed that 67% of the patients were working at the 12-month follow-up time in contrast to an average of 44% in the control groups. Variables predictive of return to work included: younger age, male, no legal claims, not in the top workers’ compensation bracket, less time off work and availability of former job. Medical history predictors included fewer back surgeries, absence of total disability and shorter duration of disorders. Physical predictors were flexibility and strength, lower pain problems, and lower reported impairment due to pain. Psychological predictors comprised lower level of depression, hypochondriasis, distrust, premorbid pessimism, and higher levels of cooperativeness and satisfaction with treatment.

In Johanson’s (1995) evaluation of rehabilitation programmes with financial support from the Working Life Fund, he shows a significant reduction in long-term sickness absence after compared with before the workplace programme. Some of the conclusions were that the reduction in long-term sickness absence which was due to the workplace programme had been even greater; more people at the workplace were affected, a larger proportion of women who were the target for measures, longer programmes, greater proportion of non-material investments, and more long-term sickness absence before the programmes. Reduction of short-term sickness absence which was due to the workplace programme was greater the larger the proportion of men who took part in the programme. The study therefore showed a significant reduction of long-term sickness absenteeism after compared with before the workplace programme the longer the programme of remedial measures lasted.

Hetzler et al. (1995) carried out case studies of 40 companies and administrations distributed over five counties which received support from the Working Life Fund in order to carry out holistically-directed workplace programmes. The majority of the 40 workplaces had decentralisation, sharing of responsibilities and job rotation as active features in the preventive work. The authors stated that one precondition for the success of a rehabilitation programme was that there was a balance between the preventive and rehabilitative measures. Another precondition is considered to be the fact that there is a high level of competence in communication in the organisation (internal and external), together with how deeply rehabilitation thinking is rooted in the organisation. According to Hetzler et al., what determines the degree to which a rehabilitation programme achieves success is whether a holistic view of the working environment, sickness absence and rehabilitation has become prevalent in the organisation, and in particular among its management or wherever the responsibility for these questions lies, and also the extent to which the company has introduced structures in order to monitor that the holistic view is also manifested in active work contributions.

Shi (1993) showed in a study that the comprehensiveness of the intervention programme plays a large part in the reduction of the costs of sickness absence, contact with the health services and consumption of medicines. The workers in a public utility company were divided into four groups. One of the four groups received very little attention, and they acted as a reference group for the other three groups. The other three groups received health support programmes of low, medium
and high intensity. The health promotion interventions consisted of (1) health risk assessment (HRA) at the beginning and the end of the study (all four groups), (2) a bimonthly health newsletter (all four groups), (3) a health resource centre (groups 2, 3, and 4), (4) a self-care book (groups 2, 3, and 4), (5) behaviour change workshops/classes (groups 3 and 4), (6) division health wise team (groups 3 and 4), (7) case management (group 4 only), and (8) an environmental policy (group 4 only). The results showed a positive correlation between the extent of the intervention programme (intensity) and reduction of the costs as mentioned above. The high-intensity group in the support programme reduced costs most, but at the same time the measures taken in the group cost the most. The group with the medium intensity programme was the one which showed the best return on investment.

A review by Ekberg and Linton (1994) of evaluation studies of previous rehabilitation in the neck, shoulders and spine showed that long-term sickness absence can be affected to a higher degree than short-term sickness absence by means of various types of interventions.

Bendix et al. (1995) showed in a study, where patients (chronic disabling low back pain) were randomised to one of three different active programs (“…group 1 - a full-time, intensive 3-week multidisciplinary program, including active physical and ergonomic training and psychological pain management, followed by 1 day weekly for the subsequent 3 weeks; group 2 - active physical training twice a week for 6 weeks, for a total of 24h; group 3 - psychological pain management combined with active physical training twice a week for 6 weeks, also for a total of 24h.”), that the intensive multidisciplinary programme is superior to the less intensive programmes in terms of return-to-work rate, health-care contacts, pain and disability scores, and staying physically active.

A comparison between the cost effectiveness of a multidisciplinary rehabilitation programme with conventional treatment within the primary care of patients with long-term musculoskeletal problems showed that the multidisciplinary programmes was much more demanding on resources, but even so was the most cost-effective with regard to improving the health-related quality of life for the patients (Grahn et al., 2000).

A comprehensive rehabilitation programme within the paper pulp industry showed that successful work-oriented rehabilitation required a carefully planned collaboration between the company’s internal resources and those available in the community (Goine, 1998). The programme included collaboration by the various rehabilitation agencies, education of the managers and supervisors, and identification of workplace factors and individual factors which could influence the rehabilitation. Clear effects in the form of lower sickness absence rates were found. The risk of women being sick-listed or receiving disability pensions was more than double the rate for men. In-depth interviews with personnel revealed that their own motivation, the course of the healing process, the workplace, insurance and the family were important factors in the process of ‘getting back’ after sickness absence and rehabilitation.

Björkqvist et al. (1992), in a 24-month follow-up of an eight-week rehabilitation programme, showed that there is no direct support for the view that active rehabilitation in immediate conjunction with falling ill due to problems in neck or shoulders gives lasting effects in terms of health and working ability. The study shows, however, a positive effect of changing job and positive effects of improvements of the workplace in preparation for the individual’s return. The results show that a changed working situation is a more effective measure from the health point of view for the person who has already been taken ill with musculoskeletal problems, compared with rehabilitation directed at the individual.
Programmes directed towards individual problems

The motivation of the individual and the attitude of the workplace to rehabilitation are of decisive importance for a return to work and for long-lasting effects of rehabilitation measures (Knutsson et al., 1995; Ekberg & Linton, 1994).

Work training, which was the most common measure in the study by Arneson (2000) of workplace-based rehabilitation of over 600 sick-listed women, had no positive effect on their return to work.

In a literature review, Shepard (1992) stated that most work-site fitness and health programs were found to be a good investment for the company in the short term in relation to the cost of the measures, but there are no follow-ups of the effects over a longer term. Because all the activities are voluntary, there is a risk with this type of programme that those who take part are already involved in some form of fitness programme in their free time. A study by Josephson et al (1995:4), on the other hand, showed no connection between free time fitness activities and participation in exercise during work time among 102 doctor’s secretaries at a hospital. Difficulty of getting away from the workplace was the predominant reason for not training, despite their having the right to go training for one hour each week during working time. Only 12% exercised regularly during working time. Hagberg et al. (1993:20) showed in a study of nurse’s assistants, assistant nurses and hospital cleaners, that a training program for condition and another training program for strength during work time prevented musculoskeletal illness to the same extent as a control program which consisted of educational sessions. In addition, the training programme reduced problems which had already occurred to a greater extent than the educational programme in the health care personnel.

Greenwood et al. (1990) found that their early intervention case management approach (within 2 weeks after injury) for underground coal miners who had just suffered back injuries (284 reported cases), was started too early. The intervention comprised advice and coordinated medical, occupational therapeutic and psychological treatment. The 18-month follow-up showed that the case management approach was insufficient to prevent extended disability or to lower medical costs. Permanent partial disability awards, litigation rates, number of hospitalisations and return to work were similar between both the experimental and control groups.

Lindström (1994) showed in her thesis that traditional care plus an early intervention programme for patients with subacute low back pain was superior to traditional care only. Her results showed that the patients learned that it was safe to move while regaining function, the patients individually increased their mobility, strength, fitness and decreased their pain, pain behaviour and subjective disability. An independent cost-benefit analysis showed that the intervention programme produced four times the benefits as compared with the costs. During the second year after the exercise, fewer patients were sick-listed than the comparison group. The individually graded exercise program with a behavioural therapy approach was based on the individual capacity and the individual physical work demands. Each patient did his or her individually graded exercise program three days a week until he or she returned to work. The physical therapist gave continuous positive reinforcement for performed quotas and increased functional capacity.

In an intensive three-week rehabilitation program (53 hours a week) for patients with chronic disabling low-back pain (Hazard et al., 1989) the return-to-work rate for the programme graduates (82%) and the crossover group (100%) is impressive. 29% in the comparison group returned to work. The study also showed that the treatment group’s pain and self-assessed disability decreased, whereas the subjects’ physical capacity increased. Functional restoration with behavioural support was reported to be effective treatment for patients with chronic disabling low-back pain.
Bonsall and colleagues (1991) reported a study where they had compared sickness absence resulting from musculoskeletal problems at two manufacturing companies carrying out similar tasks, and where everyone in one of the companies was referred to the physiotherapist (several different treatment techniques were applied), and they showed that there were no differences in sickness absence resulting from the treatment. The study did show, however, that the change in attitude of the management affected short-term sickness absence.

As far as the cost-effectiveness of ‘back school intervention’ is concerned, Brown et al. (1992) showed clear financial advantages of an intervention programme for council workers with a history of sickness absence due to back trouble after undergoing 6 weeks of back school, compared with a control group who did not take part in the back school.

Linton and Bradley (1992) carried out follow-up studies of patients with back problems 18 months after a 5 week secondary prevention program (4h of physical reconditioning each day, ergonomic education with specific application to high-risk nursing manoeuvres, a cognitive-behavioural intervention that focused on pain-control techniques and the development of strategies for reducing the risk of future work-related injuries) for female licensed nurses. They found that positive effects remained, in the form of less pain, lower use of medicines and higher activity level compared with the starting levels (within-group changes). All individuals (36) had gone back to work, and a third had no pain-related sickness absence during the follow-up period. Before the study sickness absence had been rising, but at the follow-up it had dropped back to the original level. “A cost-benefit analysis indicated substantial economic savings when follow-up sick-listing data were compared with estimates based on an increasing trend for pain-related absenteeism found during the baseline period. Hindrance factors reported by subjects were related to personal time-management and workplace factors, especially psychosocial aspects of the work environment” (p. 227).

Participative interventions

Rest (1996) speaks of the importance of the participation of employees in occupational health programmes. In addition to referring to Karasek’s demand–control model (Karasek & Theorell, 1990; Karasek, 1993), she describes in more detail what is meant by worker participation and its importance to health. In a commentary to her article, McNeely (1996) stresses the importance of making a distinction between ‘real’ worker participation and management’s ‘window dressing’. Ekberg (1995) also underlines the importance of a combination of training and workplace changes, and also the value of the participation of the individuals in these changes in order to achieve successful rehabilitation. Workplace changes involve organisational and psychosocial aspects as well as physical working conditions. Theorell et al. (1993) showed in a study that the pain threshold was lowered in those people who reported that they had little possibility to control their working situation. Through considerable improvements in the psychosocial and the organisational working environment for postmen, the occurrence of problems in shoulders and thoracic and lumbar regions of the spine was reduced, especially among those below the 35 years of age (Wahlstedt et al., 1996:15).

Ekberg presents a new problem- and change-based method that has shown good results (Ekberg, 1995; Ekberg & Svedin, 1998). In those groups who have worked on problem-based rehabilitation methodologies, an overall goal was defined for the rehabilitation process even before they started to work in groups. This goal was ‘to learn to see the causes for their problems and find strategies for change’. The goal was formulated so that it contained an incentive for change rather than for achieving ‘freedom from pain’, full working ability, becoming well, which are too general and unspecific as goals, and in practice are difficult or impossible to achieve. Among other things,
regular meetings with the supervisors are included in the concept for those who take part in the rehabilitation group. Ahlberg-Hultén et al. (1995) discuss among other things how psychological demands, authority over decisions and skill utilisation affect the subjective experience of loading. One experience which Lagerström et al. (1998a) discuss in their study of a training programme for nurses is the need to set aside ‘organisational space’, so that the new knowledge which individuals have acquired through a training programme can be kept.

In a position paper produced by the Scientific Committee for Musculoskeletal Disorders of the International Commission on Occupational Health (ICOH) (Kilbom et al., 1996), the background to work related musculoskeletal disorders and their causes are discussed, together with more specific job factors. The group maintains that psychological demands, low decision latitude and lack of social support at work are established risk factors for musculoskeletal disorders. In addition, they stress the need that “surveillance systems should be further developed nationally and in workplaces, and more effort should be directed to information dissemination, education, and training.” (p. 239).

Description of other development projects within the cleaning and home help areas

In a summary by Vingård and Kilbom (1996) of the diseases of the musculoskeletal systems in men and women, it emerges that women still dominate work in care, administration, office and service work. Health and sickness care work and service work are characterised for the majority of employees by heavy lifting and carrying work. In relation to the lower physical working ability of women, especially with increasing age, the physical demands within care, cleaning and restaurant work can be characterised as high. Vingård and Kilbom think that it is remarkable that older women form such a large proportion of the women in service work. A large proportion of the jobs in this group are relatively low-skilled, but at the same time involve high physical demands. According to the authors, this certainly reflects a large group of women with poor schooling recruited into the market in the 1970’s and 1980’s. Unlike other groups, they have not been the target for measures to increase their competence and they have therefore been ‘stuck’ in low-skill jobs with poorer working environments. According to the researchers, double work is another possible reason why women are less involved in a working career, and why they therefore choose to work for a long succession of years in poorly qualified and physically demanding work. The double role also means that they have less time for exercise and recreation, which is thought to contribute to an increased risk of problems in the musculoskeletal system.

The work of the Working Life Fund between 1990 and 1995 resulted in numerous different development projects within the cleaning and home help areas. Characteristic for those workplaces within these areas which were given grants for workplace programmes were: high personnel turnover, unhappiness in the job, high sickness absence and low self-esteem. The vast majority of the projects showed by the end of the project period that sickness absence was reduced, the number of occupational accidents had fallen, comfort had increased and large savings had been made by both the employer and the social insurance office (Asplund, 1995). During the same period, the Working Environment Found made a special investment in research into the working environment of home helps and home carers (Aronsson et al., 1995; Svensson et al., 1995). 32 research and development projects were given funds in order to study work organisation, the content of care work and change, the control of the regulators, the physical and mental demands of the work, together with technical aids, working for change, and female and male work within home helping and nursing, and leadership.
Cleaners

The work with cleaners was developed mainly within five areas (Asplund, 1995):
1. The working time was changed to daytime instead of evening work.
2. Previously, many had worked mainly part-time; now, more had the chance to work full-time.
3. The cleaning work was previously mainly lone working; now the work was organised in groups.
4. Broadening of the cleaning work by the establishment of combination services, i.e. the introduction of other tasks such as caretaker work, watching over examinations and simpler office jobs.
5. The introduction of self-controlling working groups with their own budget responsibilities.

Measures were introduced at many different levels in the organisations. The measures could be at:
*The individual level*: for example occupational therapy, massage, training, giving up smoking, help with substance misuse, training in e.g. coping with stress, and relaxation.
*The group level*: for example group activities for reinforcing well-being, pleasure in work, fellowship and pride in work, physical training, cooperation, communication, finance, psychosocial working environment.
*The company level*: for example in improved rehabilitation routines, improvement of the physical working environment, new working methods, introduction of self-controlling working groups with their own budget responsibilities, training of managers.

A very interesting project was carried out at Linköping University. The cleaners also carry out tasks, which apart from cleaning include e.g. conference service, janitorial tasks, café work, library work and simpler office work. It was decided at an early stage in the development work that cleaning would form no more than 50% of the working time. In order for the cleaners to be able to manage the new tasks, basic educational courses were given in Swedish, English and computer studies. More specialised courses, such as archiving, were also offered. Instruction programmes and management were also important in the transition to new tasks. As a result of the development work the total sickness absence had been reduced by 64% and short-term absence has been reduced by 78% (Köpsten, 1994; Gustavsson, 1994).

Home helps

Home help services are carried out in a very special working environment – the recipient’s own home. Regard for the recipient’s personal integrity and the fact that many elderly people live in homes which are not particularly well adapted to their need for help often lead to difficulties in creating an ergonomically well thought-out working environment. It is often difficult to reconcile the recipient’s right to take decisions in their own home with the right to a good working environment which does not expose them to ill health and accidents. The increased heaviness of the work, i.e. that more elderly people live at home despite great needs for help, together with a lack of resources, means that the work is becoming more and more physically and mentally demanding. People who only work in the evenings or at night-time feel very isolated as they only have sporadic contact with their supervisors or work colleagues (Svensson et al., 1995, pp. 40-44).

Group development was the central idea behind the vast majority of working life programmes which were carried out within the home help area with the support of the Working Life Fund (Arbetslivsfonden, 1995). This development meant great changes for staff who previously, to a very great extent, worked alone. The development towards small group organisations (3-5 carers in each) contributed to a greater degree of responsibility and influence for the carers who took part in the different projects in the following areas, among others: planning, staff matters, working
environment factors, administration, information and contacts outwards, taking part in need assessments and care planning and group responsibility.

When the care assistants took over large parts of the planning and administrative work, contacts with relatives, etc., the supervisors could devote more time to managing, support, follow-ups, long-term planning and development work (Arbetslivsfonden, 1995; Aronsson et al., 1995). The measures undertaken were, for example:
- practical experienced education,
- education of a more theoretical nature,
- education with group participation, self-awareness and conflict handling,
- exchange of experience,
- participative training, and
- new working methods which are based on the idea of a more equal relationship where staff and client agree together what home care should consist of.

Ahlberg-Hultén et al. (1995, p. 435) has explored the relationship between psychosocial work environment and musculoskeletal pain among health care personnel (90 participants). “Low-back pain seemed to be related to job strain, while symptoms from the neck and shoulders were related to a greater extent to relational and emotional factors.” The 285 nursing personnel in Josephson et al’s study (1997) were healthy enough to work although they reported ongoing symptoms. A high proportion of the cases had both neck or shoulder symptoms and symptoms from the back. The nursing personnel participated in an education and training programme at the hospital. The study indicated that job strain is a risk for musculoskeletal symptoms and that the risk is higher when it is combined with perceived high physical exertion. Lagerström et al. (1998b) show in their review focusing on the relation between nursing work and low-back problems that the single individual factor related indisputably to low-back problems was ‘history of back problems’.

Aronsson et al. (1998) reviewed the reasons that home-care workers leave the working life. The results show a combination of causes in the form of functional impairment (pain when doing physical work), psychosomatic complaints and the nature of the relationship with/attitude to clients.

**Summary of comments on the literature review**

The literature review showed that there are in the main four approaches to the research in this area:

1) research dealing with mechanisms of the occurrence of the injury/problem
2) research on interventions directed towards the individual
3) research on interventions directed towards the work organisation, working environment and design of the workplace, and
4) research and development of methods for determining the costs for remedial measures in relation to financial benefits.

Research into mechanisms is of course important and foundational as a first stage in producing concrete proposals for remedial measures. What is important for the research into mechanisms to be meaningful in producing concrete interventions is that there should be clear relationships between the mechanisms and possible interventions. This is stated, for example, by Ekberg (1997), and underlined by Landstad et al. (Studies I, II and III).

The literature which has been studied and which deals with individually-directed interventions includes examples of studies on medical rehabilitation measures (Bonsall et al., 1991; Linton & Bradley, 1992), work training (Arneson, 2000), health promotion (Shepard, 1992; Josephson et al., 1995:4), motivation of individuals (Knutsson et al., 1995; Ekberg & Linton, 1994) and the cost-
effectiveness of ‘back school intervention’ (Brown et al., 1992). It is important that this research which deals with the matching of individuals to unsatisfactory working conditions is complemented by research into measures whose aim is to eliminate the occurrence of the problems/injuries.

Working conditions and the matching of the work organisation to the individual or groups of individuals are prioritised areas. In more recent research it is mainly the work organisational conditions which have been dealt with (e.g. Ekberg, 1995; Lagerström et al, 1998a; Wahlstedt et al., 1998). In previous times there was a prioritising of the matching of the physical conditions (above all ergonomic research) to the individual (e.g. Zotterman et al., 1948; Lundervold, 1951; Murrell, 1965; Åkerblom, 1948; Åstrand & Rodahl, 1970).

In order to be able to prioritise future intervention work, research is needed primarily on the costs versus the ‘use’ of the investments. From the point of view of evaluation, research needs to be carried out at both the company and the community economic levels. One example of community economic evaluation of rehabilitation investments was carried out by Fölster (2000). Larsson and Nilsson (1995) and Johanson (1995; 1995:3) are examples of personnel economic evaluations of preventive and rehabilitative investments, as is Landstad et al. (Study V). In conjunction with the granting of support from the Working Life Fund, the workplaces were required to make conventional cost calculations of the proposed measures, in other words a cost-benefit analysis (Larsson & Nilsson, 1995).

MATERIALS AND METHODS

Of the project proposals which came in to what was called the AMoRE project during the spring of 1996 (the project is described under the headline ‘Working environment and rehabilitation in coordination (the AMoRE project)’, one workplace was selected within cleaning and one within home help for the empirical studies which form the basis of this dissertation work. These workplaces are at the same time both largely dominated by women. The five subsidiary studies on which the dissertation is based are: (I) health-related quality of life, (II) experienced physical and psychosocial working environment conditions, (III) diagnoses and pain, (IV) changes in patterns of absence, and (V) sickness absence-related costs at the company level.

Aims

The overall aim of the thesis is to study the different effects of preventive and rehabilitative interventions for employees at work despite pain at predominantly female workplaces, and further development of analysis methods.

The five subsidiary studies will be summarised in the overview of the existing state of knowledge. The aim of this is to be able to see the connection between the subsidiary studies, and to place the studies into an overall context in relation to other research and knowledge in the area.

The main aims of the different subsidiary studies:

Study I
The aims were to investigate the level of quality of life in relation to that of a normal Swedish female population, and to map the possible effects of the interventions on health-related quality of life in order to support female hospital cleaners and home-help personnel remaining at work despite ill-health.
Study II
The aim was to study whether personnel support intervention at the workplace had an effect on the experience of physical and psychosocial working environmental conditions.

Study III
One aim of the study was to throw light on the diagnoses behind the pain conditions causing the complaints of women working despite ill-health due to pain, and to describe the prevalence of different musculoskeletal diagnoses. Another aim was to find out the intensity, frequency, and location of pain in female hospital cleaners and home-help personnel working despite symptoms. A third aim was to attempt to demonstrate possible changes in clinical picture and pain ‘after’ personnel supporting interventions.

Study IV
The aim of the study was to investigate whether the preventive intervention carried out in one predominantly female workplace had any effect on absenteeism. As a background, a model for analysing complex patterns of absenteeism, including sickness absences, was also developed. A further aim was to study the interactions between different forms of absenteeism.

Study V
The study had two primary aims. The first aim was to combine a human resources costing and accounting approach (HRCA) with a quantitative statistical approach in order to get an integrated model. This integrated model could make it possible to discuss how the results might vary with different assumptions, and also to specify confidence intervals for estimates. The second aim was to apply this integrated model in a quasi-experimental study in order to investigate whether a preventive intervention affected sickness absence costs at the company level.

Study design
In Studies I, II and III the participants answered the same questionnaire on three different occasions. The reference groups were studied at corresponding points of time. The ‘before’ measurements were made ‘before’ the programme of remedial measures; the ‘during’ measurement was made half-way through the remedial period, and the ‘after’ measurement was made approximately one month ‘after’ the end of the program. The ‘during’ data were only used in part of the analysis. The reason why we chose to use the ‘during’ measurement was that we wanted to study the maximum influence of the intervention on the studied variables.

The medical examinations in Study III was done ‘before’ and ‘after’ the intervention and at the corresponding time for the reference subjects. In Studies IV and V data collection was carried out at the end of two measurement periods, one ‘before’ and one ‘after’ the intervention.

The study had two intervention groups and two non-randomised reference groups. The intervention lasted 12 months for the hospital cleaners and 8 months for the home-help personnel. There were no pre-requisites for randomisation into support and non-support at one workplace, since the support programme included all employees.

The methodological aspects of the various subsidiary studies are summarised in Table 1.

Selection of workplaces
Two predominantly female workplaces intending to conduct workplace support programmes were selected, one employing hospital cleaners and one home-help personnel. Comparisons were made with reference groups of employees in the same occupational categories and with musculoskeletal trouble but not receiving special personnel support. The reference groups were located in another
county (hospital cleaners) and another municipality (home-help personnel) and were not aware of the existence of the support programme of the intervention groups. Instead, the reference groups had customary personnel support according to Swedish regulations. The reason for the choice of just these reference workplaces was that contacts with the management had already been established. Our work at these workplaces was to carry out surveys of the working environment in order then – after the end of the investigation period – review the results for the members of the management and those who took part in the study.

Subjects
In Studies I, II and III the groups consisted of employed women with pain problems. The guidelines given to the management or the occupational health care were that women with long-term sick leave periods should not be included. Included were those with few or no occasions of sick-listing due to pain problems during the year prior to the investigation. Participation in the study was voluntary and all those invited accepted.

Forty-five hospital cleaners took part in the study, and these were divided into an intervention group and a reference group. The intervention group consisted of 23 women with an average age of 44.4 years (range 27-59 years), and the reference group consisted of 22 women with an average age of 44.2 years (range 28-62 years). The hospital cleaners intervention group was selected on the basis of management’s knowledge of their health problems and their absence on sick-leave. All the hospital cleaners at the reference workplace were first asked to complete an enquiry with simple questions regarding their health problems and sick-listing. This group was selected on the basis of information from the questionnaire according to the principles stated (see above). In addition, 54 women working as home-help personnel (employed by the local authority) took part; these were divided into an intervention group of 25 women with an average age of 43.1 years (range 29-56 years) and a reference group of 29 women with an average age of 42.3 years (range 25-65 years). The home-help intervention group was selected on the basis of occupational health-care knowledge of health problems and absence on sick-leave. The reference group was selected on the basis of management knowledge regarding their health problems and absence on sick-leave. The 99 women were living and working in a rural area about 600 km north of Stockholm.

The intervention and reference groups were comparable in terms of sex, age distribution within groups, educational level, similarity of jobs, and work carried out in the same environment.

In Study I, comparisons were made with a normal Swedish female population (n=4,582) (Sullivan et al., 1994).

In Study II, comparisons were made with Statistics Sweden’s (SCB) collected data for 1995 regarding female cleaners (n=198) and female health and sickness care workers (n=441) at the lower qualified level (i.e. less than three years’ education after primary school, which defines the group of assistant nurses, etc.).

In Study III, comparisons were made with the ‘Stockholm study’ material which is sufficiently similar (n=358) (Hagberg & Hogstedt, 1991).

In Studies IV and V, we decided to limit ourselves to studying only the hospital cleaners’ group. However, we broadened the selection to include all those who were employed at the workplace during our study period.
Table 1. Overview of methodological aspects of the five different studies.

<table>
<thead>
<tr>
<th>Study</th>
<th>Methods of data collection</th>
<th>Design of study</th>
<th>Time for data collection</th>
<th>Dependent (outcome) variables</th>
<th>Independent (explanatory) variables</th>
<th>Type of subjects in intervention groups</th>
<th>No. of subjects in intervention groups</th>
<th>Type of subjects in reference groups</th>
<th>No. of subjects in ref. groups</th>
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<tbody>
<tr>
<td>III</td>
<td>Register data of absenteeism</td>
<td>T-test, Wilcoxon-Matched-Pairs Signed-Test, Chi Square, Mann-Whitney U test, ANOVA</td>
<td>1993+94 1995 and 1997</td>
<td>Absenteeism: long term, short term, total</td>
<td>Intervention, age, children, civil status, cleaning experience, previous sickness absence, (interactions)</td>
<td>Hospital cleaners</td>
<td>97 female and a few male</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>Register data of absenteeism</td>
<td>Multiple regression analysis, with and without interaction terms</td>
<td>1. 1993+94 1995 and 1997 2. 1999</td>
<td>Costs of absence: HCRA model + Statistical model = Integrated model</td>
<td>Intervention, age, children, civil status, cleaning experience, previous sickness absence, (interactions)</td>
<td>Hospital cleaners</td>
<td>97 female and a few male</td>
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<td>V</td>
<td>Register data of absenteeism</td>
<td>Interview with managers</td>
<td>1. 1993+94 1995 and 1997 2. 1999</td>
<td>Costs of absence: HCRA model + Statistical model = Integrated model</td>
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1. All studies are quasi-experimental and non-randomised.
In Studies IV and V, the intervention group consisted of a group of 97 hospital cleaners (89 women and 8 men). The average age in the group in 1995 was 42.1 years (range 21-59), and 97% worked full time. Only those who were employed for the whole of the period (1st May 1995 – 31th December 1997) were included in the study. Those who finished/left (46), retired (9), left on disability pension (6), were newly recruited (20), were in unpaid training (2) and administrative personnel (4) were not included in the study, and are thus not counted among the 97. In order to study the effects of the intervention, it was important that identical individuals were studied both ‘before’ and afterwards.

The reference group consisted of 30 hospital cleaners (29 women and 1 man). The average age in the group in 1995 was 40.7 years (range 27-59), and all worked full time. Only those who were employed for the whole of the period were included in the study. Those who finished/left (9), retired (9), disability pension (1) and administrative personnel (1) were not included in the study, and are thus not counted among the 30.

**Instruments and methods for data collection**

The various methods and instruments used for the collection of data within the framework of the five subsidiary studies are reviewed below.

**Questionnaires**

In Studies I, II and III, questionnaires were used for the collection of data. The intervention and reference groups filled in three different questionnaires on three different occasions (one for each of Studies I, II and III), involving a total of 120 questions. The time taken to fill in the questionnaires was between 40-60 minutes.

**Health-related quality of life**

The Swedish version of the SF-36 questionnaire used in Study I was developed by Sullivan and co-workers (Sullivan et al., 1994; 1995; Ware & Sherbourne, 1992; Ware et al., 1993; 1994). The questionnaire contains 36 questions combined into 8 dimensions. Results are expressed as values on standardised scores for each dimension and can thus be presented as a profile. Highest and lowest scores are defined. Normalisation of the SF-36 in the population enables comparisons to be made with a normal Swedish population (Sullivan et al., 1994).

**Experienced physical and psychosocial working conditions**

In order to gain an understanding of how the participants felt about their physical and psychosocial working environmental conditions (Study II), we used a selection from the questions which the SCB sends out to about 15,000 people every two years. The questionnaire gives an indication of how individuals themselves experience their working environment and working situation. In this study, 55 questions were processed.

Detailed response scales were used for the questionnaire. In the main, three types of scale were used in order to give as exact a quantification of the actual conditions as possible. The first type of response scale gave frequencies in numbers of occasions per day/week/month. The second gave the duration in fractions of the working time. The third was more general, and was used in situations where a more exact quantification was judged to be impossible. The scales not only gave a picture of whether the problems existed, but also an estimate of their frequency and duration (Wikman, 1991).
Pain

In Study III the subjects filled in a four-page screening questionnaire for persons with pain. The questionnaire was a selection and modification of material regularly used at the Department of Rehabilitation Medicine, Karolinska Hospital and had questions about frequency of pain and rating of perceived intensity of pain (visual analogue scales (VAS) for worst, least and present pain were used). The subjects indicated the location of their pain on drawings.

Medical examinations

In Study III the subjects were examined by two physicians with specialist licences in rehabilitation medicine ‘before’ and ‘after’ the intervention and at the corresponding time for the reference subjects. The same physician examined the subject ‘before’ and ‘after’ intervention.

Certain definitions and criteria were used in the establishment of diagnoses. The prevalence of the diagnoses myalgia and tendinitis was based on (i) information from the medical history and (ii) findings at the physical examination. Information from medical history alone was thus not considered as a diagnosis. The presence of disturbed sensibility was based on alterations found during the physical examination.

Myalgia/tendinitis in neck-and-shoulder regions was diagnosed specifically for the muscles/tendons generating the symptoms/signs. The classical signs of tendinitis were applied such as pain elicited or worsened on direct tension or active contraction through attempted movement against resistance of structure. The elicited pain should be adequately located. Examples are tendinitis of levator scapulae, myalgia of trapezius pars descendens, tendinitis of supraspinatus and myalgia of the neck extensors. The findings and the medical history were noted after each investigation.

In a second phase these specific ICD-10 diagnoses (WHO, 1997) relating to the neck and shoulder regions and noted in the records were categorised as: (i) myalgia/tendinitis of the shoulder girdle elevators (ICD-10: M70.8; M62.6), (ii) myalgia/tendinitis of the shoulder joint rotator cuff (M70.8; M62.6: M75.5), (iii) myalgia/tendinitis of the dorsal neck muscles regulating neck/head movements (M70.8; M62.6).

Other musculoskeletal diagnoses were humeral epicondylitis (M77.1; M77.0; M70.8), carpal tendovaginitis (M70.0), and myalgia/tendinitis of the hip abductors and short hip rotator muscles (Trochanter tendinitis M70.6; gluteal tendinitis (M76.0).

The concept low-back pain was used for local symptoms from the lumbosacral spine and dorsal aspect of the pelvis. Pain conditions located in the above region were denominated musculoskeletal disorder of the lumbosacral back. The denomination thoracic pain means here pain from the middle and lower part of the thoracic back.

Thorough ‘bedside’ neurological examination of sensibility was performed in both upper and lower extremities to detect sensory changes indicative of neurogenic pain. The occurrence of referred pain from musculoskeletal pain foci was assessed. The definition of referred pain/sensation presented by IASP’s international task force (Merskey & Bogduk, 1994) was applied.
Register data of absenteeism and interviews with managers

In Studies IV and V, data collection was carried out at the end of two measurement periods, one ‘before’ and one ‘after’ the intervention. The measurement periods for both the intervention and the reference groups were eight months. Because of a lack of resources in the project, we were obliged to limit the collection of data to an eight-month period. The absence data was obtained partly from the database of the National Social Insurance Board (e.g. different types of sickness absence, care of sick children etc.), and partly from the personnel data from the two workplaces in question (e.g. short sickness absences, days in lieu, holidays etc.). This means that sickness absence data during the sick pay period, i.e. the two weeks for which the employer pays sickness benefit, was included in our analyses. Account was also taken of various background data (such as age, civil status, number of children under 12, years in current employment) with regard to both the intervention and the reference groups. Previous sickness absence (1993 and 1994), which is recorded in the database of the National Social Insurance Board, also provided an important background factor.

We wish to stress that the information for both the intervention and the reference groups refer to an 8-month period. If one could assume that sickness absence is equally spread throughout the year one would be able to calculate the sickness absence for the whole year, but because sickness absence varies in a complex manner for different groups during the year, we must refrain here from making a yearly calculation.

As a background, for investigating whether the specific preventive and rehabilitative intervention had any effect on patterns of absenteeism in Study IV, a model for analysing complex patterns of absenteeism, including sickness absences, was developed. By studying the relationship between different types of absence, it was possible to establish a good basis for putting forward more specific measures of absence rather than the overall measure which is often used in absence analyses. The outcome variables in the intervention analysis comprised partly a summary measure of the ‘total’ change in number of days absence, and partly measures of the change in ‘short-term’ absence and ‘long-term’ sickness absence.

In Study V, complementary interviews and the collection of factual information for the Human Resource Costing and Accounting analysis (HRCA) were gathered from the managers, personnel department and the finance department concerned with the two workplaces (e.g. labour cost, staff maintenance costs, personnel turnover costs and indirect personnel costs in order to valuate the working time. Costs during sickness absence; administrative costs, costs due to shortfall in production, replacements etc.).

Quality of data

This sections begins with certain views on the choice of reference groups and their influence of the quality of data. This is followed by a discussion of the scale levels and statistical distributions.

Quasi-experimental study with non-randomised reference groups

The comparability of the reference groups is discussed more in detail in each of the articles included. Only some of the general aspects are discussed below.

All employees at the intervention workplaces were affected by the remedial programmes. This meant that people in the reference groups have not been able to be randomised from the intervention workplaces. In the other conditions which have prevailed in this study, we have
therefore been obliged to find reference groups who are as like the research group as possible, and who were practically and geographically accessible during the relevant time period. It has therefore not been possible to randomise people to a reference/control group.

In order to compensate for this we have collected background data about the individuals in the intervention and reference groups. This information has then been used as covariates in the statistical analyses (Studies IV and V). This has allowed us to achieve a certain statistical control. This will be discussed in more detail in the final discussion.

One risk of this type of design using ‘before’ and ‘after’ measurements is that the results of the reference group can be affected by the so-called Hawthorne Effect (Mayo, 1933). In this case, however, this effect should be able to be seen to be limited, because the corresponding effect should in this case also have affected the intervention groups. In addition, the comparisons made have primarily been between intervention and reference groups in relation to the differences of ‘before’ and ‘after’ measurements.

There were seen to be a number of differences between the intervention and reference groups. Against this background, the statistical control became particularly important.

Comparisons with a selection of the Swedish population

In Studies I, II and III, comparisons have been made with a selection of the Swedish population. The aim of this was to compensate even more for any differences there may have been between intervention and reference groups.

Scale levels and statistical distributions

Non-parametric statistical methods have been mainly used in Studies I, II and III. In these studies the data collection has mainly been by the use of questionnaires. It is doubtful whether the scales used fulfil the criteria for interval scales. In order to be on the safe side, they have been judged to be at least on the ordinal scale level. Observations on the characteristics of the distributions have shown that in several cases these were considerably skewed. This is a further argument for choosing to use non-parametric statistics.

In Studies IV and V, the data were judged to be such that parametric statistics could be used, as the variables were either categorical (dummy variables) or clearly on an interval level. The distributions were found to be sufficiently normally distributed and the data material sufficiently comprehensive for e.g. parametric factor analyses and multivariate regression analyses to be used.

Ethical inspection

The research study underwent ethical inspection by the Regional Research Ethics Committee at the Karolinska Institutet (KI d nr: 97-268).

This section presents a background description of the working environmental conditions at the relevant workplaces before the interventions began. The descriptions are based on the questionnaire which formed part of Study II. The aim of this background description is to show the working environments in which the interventions were carried out. Then follows more specific descriptions of the workplaces and the content and design of the interventions for the hospital cleaners and the home-help personnel respectively.

Physical and psychosocial working conditions

On the questions about the physical working conditions, (based on data collection ‘before’ the interventions) between 68-91% of the women asked (hospital cleaners’ intervention and reference groups and the home-help personnel’s intervention and reference groups) stated that they felt physically exhausted after work on one day per week or more often. The corresponding figures for the selection of cleaners and health and sick care workers in the Swedish population were 61% and 50% respectively. In the hospital cleaners’ intervention group 39% felt physically exhausted every day and 35% felt exhausted on a couple of days a week. About 90% of the hospital cleaners’ groups and 65% of the home-helps’ groups replied that on two or more days per week they bent and twisted many times per hour and many hours per day. The corresponding figures for the Swedish population selection of cleaners and health and sick care workers were 75% and 39% respectively.

The home-help personnel in particular stated that they carried out frequent and heavy lifting. 56% of both groups replied that on two more days per week they lifted 15-25 kg at a time, several times a day. The corresponding figure for the Swedish population selection of health and sick care workers was 50%. 40% of the intervention group and 28% of the reference group estimated that they just as often lift more than 25 kg at a time a couple of days a week or more often, several times a day. The corresponding figure for the Swedish population selection was 35%.

Between 24% and 72% of the women in the four groups stated that for half the time or more they were working in a twisted posture. The corresponding figure for the selection of the Swedish population of cleaners and health and sick care workers was 33% and 26% respectively. In the hospital cleaners’ groups 26% and 45% respectively, and 20% and 17% respectively of the home-help personnel, replied that for half their working time or more they worked with their hands at shoulder height or higher. The corresponding figures for the Swedish population selection of cleaners and health and sick care workers were 24% and 10% respectively.

On the questions about the psychosocial working conditions, 22% and 18% in the hospital cleaners’ groups and 24% and 38% respectively in the home-help personnel’s groups said that on one or more days per week they had difficulty in getting away from thinking about the job in their free time. The corresponding figure for a selection from the Swedish population of cleaners and health and sickness care workers were 17% and 41% respectively. In the hospital cleaners’ intervention and reference groups, 61% and 50% respectively, and 48% in both the intervention and the reference groups of home-help personnel, stated that during the previous three months they had felt tired and listless for one day or more per week. The corresponding
figure for the selection of the Swedish population of cleaners and health and sickness care workers was 42% (for both groups). Despite the fact that they often felt tired and listless, there were proportionately few who felt unwilling when they went to work. One day per week or more often, 17% and 9% respectively in the hospital cleaners’ intervention and reference groups, and 20% and 3% respectively in the home-help personnel’s intervention and reference groups felt unwilling to go to work. The corresponding figure for the selection of the Swedish population of cleaners and health and sickness care workers was 24% and 17% respectively.

On questions about appreciation, it came out clearly that the women asked received much greater appreciation for something they did from, for example, work colleagues, patients or clients than from their managers. The majority of women in both the hospital cleaners’ and home-helps’ groups felt that they received appreciation from their manager on a maximum of a couple of days per month, or else not at all/seldom in the previous three months. The same trend can be seen among the selection from the Swedish population.

On the other hand, a majority in both hospital cleaners’ groups stated that it was always or usually possible to get support or encouragement from managers when the work was felt to be difficult. The same can be seen among the selection of cleaners in the Swedish population selection. In the home-help personnel’s intervention group, the women were not as certain that they could receive support or encouragement in a difficult situation. A small majority stated that they could rarely or never expect support or encouragement from their managers in such a situation. In the selection of the Swedish population of health and sickness care workers, on the other hand, 69% stated that support or encouragement was always or usually available.

A majority in all four groups felt that they were always or usually involved in decisions about the planning of their work. The same could be seen among the selected Swedish population. To questions about the opportunities of being involved and deciding their own working speed, 79% and 68% in the hospital cleaners’ intervention and reference groups respectively, and 60% and 41% in the home-help personnel’s intervention and reference groups respectively, felt that this was the case for half the time or more. The corresponding figures for the Swedish population selection of cleaners and health and sickness care workers were 81% and 63% respectively.

On the question of whether the work gave the opportunity to learn something new and to develop in the job, a majority in the hospital cleaners’ intervention group and the home-help personnel’s reference group felt that such opportunities were present to a certain extent.

**Description of the hospital cleaners’ workplace**

The demands of recent years for reduced costs, efficiency and renewal have resulted in extensive organisational changes in the public sector. Since 1994 the services administration has been its own cost centre at a hospital in the northern part of Sweden. This means that the services administration buys and sells goods and services to the various departments of the county council, and to a certain extent to external customers. From having previously been a budget-financed activity within the county, the services administration is now an income-financed business which invoices the core business for work carried out. The services administration is divided into five different basic business units: cleaning, apartment blocks, materials, transport and media.

The county is still the service administration’s biggest customer, but there are no guarantees that the county will continue to choose to use their services in the future. In order to meet the new demands in the best way possible, the cleaning unit was reorganised in June 1995.
The cleaning unit had for a long time been bedevilled by high sickness absence, which had a negative effect on the organisation. The cleaners’ unit therefore decided to try to reduce the absence and to increase well-being and self-esteem among the cleaners. The starting point for this development work was that all the staff had a desire to take an active part in the work, and that all staff needed constantly to increase their competence in different areas.

**Organisation**

The reorganisation of the cleaners’ unit led to the number of supervisors/managers being reduced from twelve to four posts. The organisation now consists of one cleaners’ manager who shares the supervisory function with three section heads. The section heads are each responsible for their own section. The sections are divided up in turn into blocks, where each block forms a separate work team. The work teams meet in an organised manner together with their section head about once a fortnight. Information and educational inputs occur on a regular basis in connection with full monthly meetings.

One consequence of the reduction in demand for the cleaners’ services was a reduction in personnel costs during 1995 corresponding to 23 posts. During 1996, a further reduction of about 11 posts was carried out.

**Nationwide development project**

The services administration, with its five units, took part in a nationwide project between 1st September 1995 – 31st August 1996. The project was initiated by the Swedish Municipal Workers’ Union (In Swedish: Svenska Kommunalarbetarförbundet), and had the aim of increasing efficiency and raising quality within the public sector. All the employees in the services administration took part in a process where they looked step by step at every aspect of the business and its organisation. Work in the project was both theoretical and practical, on questions about finances, planning and follow-ups, communication and information, purchasing, quality development, education and training, and organisational improvements (Svenska Kommunalarbetarförbundets utvecklingsbolag KOMANCO HB, 1995).

The practical work comprised for the most part group work and reviews. The main emphasis in the project was on the development of the work groups. The aim of the services administration was to take account of everyone’s ideas during the development work, to increase competitiveness, and to try to maintain the number of employees with the assumption of maintaining the quality of the service. During the project period 427 suggestions for changes and improvements were received. Many of the improvements were able to be carried out during the project, although others were more time-consuming.

**The hospital cleaners’ rehabilitation programme**

One starting point for the rehabilitation programmes was the knowledge of the high level of sickness absence, and another starting point was the knowledge of the special features which characterised the work group – low status and predominance of women. In order to achieve lasting changes, the newly-appointed cleaning manager realised that a combination of measures was needed, directed towards individuals, as well as comprehensive change and development work where everyone at the workplace took an active part. All personnel within the cleaning unit therefore took part in the project, whether well or ill, man or woman. The
The project cost a total of 1.8 million Swedish kronor, of which the AMoRE project contributed one third.

The aim of the cleaning unit in the programme was to carry out preventive and rehabilitative activities, including those in the form of education and training, information and investment in welfare measures which would contribute to:

- a reduction of sickness absence by 20%. In actual figures, this means that sickness absence should be reduced by 10 days per employee during 1996,
- further development of the communication within the cleaning unit,
- working out individual development plans for all personnel,
- carrying out special educational programmes for managers within the personnel care area,
- development of planning discussions in order to give them the character of development coordination instruments.

A female behavioural scientist was employed half-time as project leader for the duration of the project. The project leader soon formed a project group consisting of 7 selected cleaners. The task of the project group was to represent their work colleagues by gathering viewpoints, ideas and suggestions. During the project the group worked on trying to find ways of improving the working environment within the cleaners’ unit.

**Content of the hospital cleaners’ intervention programme**

Activities were carried out at the organisational, group and individual levels. When the training and development activities were carried out, replacements went in and took over their ordinary work. This was in order that the cleaners would be able to concentrate on their activities and not to feel stressed about not being able to manage to do their ordinary jobs.

**1. Group development**

Early on during the project period, everyone at the workplace took part in two development days in a different place. There were several reasons for the development days: to strengthen the ‘we’ feeling and confidence in the working group, to have fun together, for everyone to take part and be seen, and so that together they would try to find a pride in their role as hospital cleaners. Both individually and in groups, the cleaners were able to give their views and to come up with suggestions for what improvement work they judged to be important in the work for change. During the whole of the project period, the wishes of the staff determined the choice of actions to be taken.

During the autumn of 1996, the project leader continued the work of developing the ‘block’, together with the respective section heads. This work was carried out in close cooperation with the nationwide development project described earlier. During the project the work groups took over the responsibility for the distribution of work within the groups. Previously, this responsibility had lain with the section heads.

**2. Leadership development**

In order to bring about a change or development of the culture within the organisation, the cleaners’ manager felt that it was important for the supervisors to go ahead and show the way. Manager development therefore became a part of the project. The process was started during the development days, when each individual manager got a number of very personal questions to reflect on. An individual follow-up was carried out at a later stage. The management group were also posed a number of questions to think about in groups under the observation of two consultants who led the work. A form of so-called reflective team was applied. The
management group then had a development day where the focus was placed on the feelings, thoughts and the energy which controls the way people behave.

3. Lectures and activities connected with physical and mental development

During the course of the project, the project leader had individual talks with the employees. The content of these individual talks centred around personal development, self-confidence and work satisfaction, and also on problems and subjects of a more personal or private character. During the remedial period the staff had been able to listen to a number of different lectures dealing with quality of life, how we can make use of our experiences in order to develop and grow as people, how to learn to control situations where one has to stand up and talk in front of groups, on the working and life conditions of women, stress and ill-health.

Other lectures dealt with zone therapy and homeopathy (several people who had had difficulties for many years then started treatment – the project paid for their first five treatments, and then the employee had to pay half for themselves), foot care, how women can prevent brittleness of the bones (osteoporosis), and lectures on health, drugs and tobacco.

A range of different voluntary activities were made available in order to strengthen the physical and mental stamina of the cleaners. The hospital cleaners were given free exercise cards by the project for the hospital’s own welfare department where a trained health care consultant managed those taking exercise. The health care consultant also arranged courses for those who wanted to stop smoking, for those who wanted to lose weight, meetings for long-term sickness absentees, etc. The staff were offered either free of half price access to other sports activities. ‘Soft gymnastics’ were carried out for the cleaners once a week. A course in mental training was given, and advice on make-up, colours and fashion was offered with the aim of increasing the self-esteem and self confidence.

A masseur was employed half-time during the project year. The workplace set up their own massage and relaxation room for this purpose. All employees had the opportunity to have a massage about every three weeks. When needed, some received treatment more often during this period.

4. Better cleaning methods and training in floor care

The reduction in staff numbers has caused larger floor area to clean for each hospital cleaner. In order to reduce the risk of stress injuries, new cleaning methods were introduced. Instead of the traditional wet cleaning method, dry cleaning was now introduced using the so-called KBM method (KBM stands for Knowledge, Behaviour and Method). The floor was now mopped without water or cleaning fluid, which led to a reduction in the use of chemicals in cleaning by 80%. The material in the mop consisted of split fibres which are positively charged. When the mop is pushed over the floor static electricity is built up, which leads to the dust being effectively sucked up into the mop. Machines to both scrub and polish the floor are now used to a greater extent than before. All cleaners underwent the training in floor care for four half-days. The main subjects in the training were: cleaning fluids, the importance of entrances, floor materials, floor scrubbing, and polishing.

During 1996 an external evaluator looked at how the positive effects of the KBM method could be used within the workplace. The evaluation showed that the KBM method produced a gain in productivity of 20%. By increasing each cleaner’s area by 10%, the workplace could make a profit which the evaluator suggested could be used to pay replacements for those absent for sickness or holidays. No increase in load would then result on their work colleagues when people were absent.
5. The ‘Shorter working day’ project

During the autumn of 1996, a project group worked to produce a model to enable them to bring about a shorter working day for the hospital cleaners. The hope was for a reduction of the working day from eight hours to seven. The aim was that the positive effects of the new cleaning methods (KBM) and a new system of calculating cleaning areas would create the financial breathing space needed in order to allow the change. The project group based the project at the level of the county council management, took account of the experience of others in the area, made study visits and had open discussions with the whole of the staff.

The discussions created a good deal of worry in the organisation, and the employers’ side wanted a greater degree of unanimity in the cleaners’ group. By the middle of November 1996 it had become clear that because of the lack of agreement, the project should stop with immediate effect. The business plan for the working environment work in 1997 shows that the alternative to shorter working time is timetabled physical training.

6. Development of suggestions activities

The management actively promoted the inventiveness and innovation of the hospital cleaners by rewarding and putting into effect good suggestions for changes.

7. Individual rehabilitation activities

During the project period the section heads, personnel staff and the occupational health care gave particular attention to the group who were on long-term sick leave when the project started. Three employees received individual rehabilitation efforts in the form of life style changing courses. Some got individually adapted work aids, while others started work training.

8. Working out a working environment programme

A working group consisting of unit managers and the union representatives worked in conjunction with the personnel manager to produce a working environment programme. The working environment programme included, among other things:

- Long-term goals for the rehabilitation work.
- Routines for sickness absence, rehabilitation, occupational accidents, near-accidents, bullying and abusive treatment, introduction of new colleagues and routines for resignations.
- Alcohol and drug policy. The whole of the services administration had previously worked out an alcohol and drugs policy, but this work was intensified during the project period. Resource people were appointed within each unit with the task, among others, of being the support person for their work colleagues with misuse problems.
- Recommendations regarding rewards for e.g. new ideas produced.

9. Development of cooperation with other authorities

Occupational health care, the social insurance office and the Labour Inspectorate, together with the workplace, met during the project period to discuss methods and strategies in the work for change.

Welfare activities after the end of the project

Once the internal questionnaire studies had been carried out, it was decided during early autumn 1996 (the project year) that the massage should also continue during 1997. Physical training during working time and the chance for private conversations should also remain. In addition, the chance was offered for subsidised free-time access to zone therapy, foot care, weight watchers, stopping smoking and cheaper working shoes. The occupational health care
service carried out a survey during 1997 of the cleaners’ working situation in order to be able to give good advice on ergonomic aspects.

**Description of the reference group’s workplace**

The cleaning section has been an independent basic unit in a hospital since 1992. This means that goods and services were sold to the different departments of the hospital, and to a certain extent to external customers.

**Organisation**

In 1990 the cleaning section was subjected to strong demands for savings from the hospital management. Groups were formed in order to discuss and produce suggestions for savings measures and organisational changes. In order to strengthen the team spirit and sense of belonging, it was decided that the cleaning should be divided into smaller working groups.

At present the organisation consists of a cleaning inspector who is equivalent to the base unit manager, a cleaning supervisor and two senior cleaners. The base unit is organised as four self-governing groups where the groups are led by one of the working senior cleaners. From May 1995, two senior cleaners have acted as group leaders instead of four. Each group comprises 6-8 hospital cleaners, and these have a common responsibility for their part of the hospital.

Previously, the organisation had a high level of staff turnover and high sickness absence. During recent years, however, this has reduced partly because of the existing labour market conditions. Six people, corresponding to four full-time people, had to leave during 1996 because of requirements for economies. Some of these were long-term supply cleaners.

**Development activities**

During parts of 1993 and 1994 the cleaning section made some working environmental improvements. The hospital cleaners got instruction in cleaning techniques by an occupational therapist, regular welfare and exercise time with a leader twice a week for 30 minutes per time, training in floor care and new equipment in the form of scrubbing machines. At the end of 1994 the cleaning section introduced the KBM method.

**Health care input during 1996**

- Regular welfare and exercise time with a leader for 30 minutes twice a week.
- During Spring 1996, two people took part in a rehabilitation course on two afternoons per week for eight weeks. These two people did not form part of the reference group.
- During the autumn, half of the cleaners went on a combined study and recreation trip.
- Three people went on a basic course in understanding computers in the Spring of 1996.

**Description of the home-help personnel’s workplace**

During 1996 the district employed 809 posts with conditional tenure. Of these employees, just over 83% were women (48% of the women worked part-time). The two largest administrations in the district are the child- and youth administration and the social
administration. The predominant working environment problem for many of the working groups was stress, high workloads, heavy lifting, difficult working postures and unclear distribution of responsibility. Studies carried out by the occupational health care service showed that about 45-50% of the staff within the social administration had different types of load-related trouble. Of about 600 employees within the child and youth administration, the health care service judged that over 200 were at work with clearly documented medical problems, and with need of early rehabilitation measures. In order to get to grips with part of the problem, therefore, a working environment project was planned for the staff within the child- and youth administration and the social administration.

**Organisation**

The home-help service in the district is divided into three geographical admission areas. Two area managers are responsible for the three admission areas. The manager and the district nurses form a management team which is responsible for the home-help service within their working area. Within each area there are, for example, working environment plans.

**Other working environment input in the district**

During 1996 all staff employed within the home-help service took part in an introductory day because of the psychiatric reform (in Swedish: Psykädelreformen). In 1996 the care assistants at a nursing home formed a study circle on care in the closing stages of life. The home-help service took part in the district-wide project ‘Early, coordinated rehabilitation’, which in its turn had generated several spin-off projects. One of these was the employment of a rehabilitation coordinator for one year. The coordinator worked on developing care planning between the home-help service and the district health service. During Autumn 1996, special attention was given to the rehabilitation of the elderly. As part of this, all the home-help personnel received a two-day training course in rehabilitation.

**The home-help personnel’s rehabilitation programme**

The total cost of the project was 1.4 million Swedish kronor, of which the AMoRE project contributed nearly 600,000 Swedish kronor.

The goals and ambitions of the project were:
- to work in a structured way by combining rehabilitation efforts with improved working environment and work organisation.
- to work preventively in order to minimise the need for rehabilitation efforts in the future.
- to reduce sickness absence by 7 days per employee per year.
- to structure the coordination system.

The working environment and rehabilitation programme was worked out by the school director, social services manager and departmental heads within the social services administration in cooperation with the occupational health care service. Activities were carried out at both group and individual levels. The target group was mainly all staff within the child and youth administration and the social services administration. Thirty-five employees with pain problems were selected for a stay at an orthopaedic rehabilitation unit. When some of these activities were being carried out, replacement staff went in and took over their ordinary tasks. The personal manager had a coordinating responsibility, while the social
services manager and the chief education officer had the overall responsibility for the rehabilitation programme.

**Content of the home-help personnel’s intervention programme**

1. **Two-week stay at an orthopaedic rehabilitation unit**

Thirty-five employees, of whom 25 were from the home-help service, stayed at an orthopaedic rehabilitation unit for two weeks. One criterion which was set was that the individuals should be at work despite having pain problems, i.e. in work without taking frequent or long-term sickness absence. In other words, a risk group which had not yet incurred heavy sickness absence.

The stay at the orthopaedic rehabilitation unit started with a medical examination following which decisions were made regarding diagnosis, prognosis and a treatment plan. The rehabilitation team included doctors, psychologists, occupational therapists, dieticians and nurses. The examination was followed by education and training.

The content of the various elements was as follows:

- Investigation and documentation; individual investigation, assessment, diagnosis, prognosis, treatment plan.
- Education; anatomy, ergonomics, training skills, stress management and relaxation, mental training, bullying at the workplace, crisis and crisis management, sleep disturbances and food skills.
- Every person had an individually designed training program which included carriage and balance, pool training, outdoor training, stress management and relaxation.

During their stay at the unit, the participants worked according to their own plans, which included what they themselves would need to change in order to feel better, the changes which would need to be made in their own families, and those changes which could be carried out in their own working environments. Meetings were arranged at the end of the second week at the orthopaedic rehabilitation unit with the participants’ work supervisors in order to go through the plans and to discuss practical solutions for the workplace. At the end of their residential period, all participants received a report containing the reasons for and the diagnosis of their pain, together with any requirements for investigation and treatment. One of the psychologists followed up the participants’ personal plans about 6 months after the residential period. The aim of this follow-up was to find working methods and patterns in order to maintain new customs and behaviour.

2. **Training to become local lay representatives for back and health care**

In the project application, the intention was expressed that those people who took part in the two-week program at the rehabilitation unit would also be trained as back and health care representatives in their respective workplaces. Some months after the visit there, the occupational health care invited those who took part in the two-week programme along to a follow-up meeting in order to pass on advice and concrete hints on what was involved in working with health care in their own workplace. The supervisors also took part in this meeting.

3. **Massage by colleagues**

All the employees spent one day receiving training in massage, and they then got to practise their new-found skills on their work colleagues. It was hoped that this activity would be able to be practised regularly in the various workplaces.
4. Courses and information
Courses in life skills and handling stress, together with information on the damaging effects of smoking.

5. Purchase of training equipment
Training equipment was bought in for two workplaces.

6. Education of supervisors
Over a four-day period the county personnel manager trained the managers/supervisors in, among other things, their responsibilities for rehabilitation. All managers/supervisors in the county also received training in life skills and handling stress. The training coincided in part with another project which county personnel managers were carrying out. The aim of this project was to create better psychosocial working conditions for key people in the rehabilitation work of the county, the primary care functions, the employment service and the national insurance offices; this was being done by early training, consultation and job development work. The hope is that this work will in time help to produce better co-ordination and results in the effort to achieve quick and effective rehabilitation.

Welfare actions after the end of the project
Some months after the end of the project, some of the workplaces, a little more than others, had got started with the health promotion activities. At two workplaces the staff went to the swimming pool in the evenings once per week. At one workplace the staff were able to walk for half an hour each day during working time, and exercises were also carried out during breaks on some occasions. At two workplaces, training apparatus had been bought in and some of the staff trained there voluntarily. Some of the staff at one workplace had requested, and got, guidance on several occasions from a psychiatric nurse.

Description of the reference group’s workplace
The district employs about 1200 posts with conditional tenure. Of these 80% are women, and 45% of the women work full-time. About 400 people work in the home-help service, and of these 94% are women. The average age of the district’s employees is 43 years.

Organisation
The district is divided into three home-help service areas. As well as these there is one independent nursing home. Four area directors have the overall responsibility for the service. Every home-help service area is led by one, or in one case three, home-help service assistants. Each area is divided in turn into smaller units. Responsibility and management of personnel, finance and activities is delegated to the respective home-help service assistant.

Investment in the working environment in the district
During May 1996 a 35-hour project started (shortened working time) within one of the three home-help service areas. Reduction in the working time allowed time for exercise/training, which was expected to result in lower sickness absence rate in the long term. Apart from the shorter working time, the project contained an increased participation in both the organisation and content of the work. The project finished in 1997. The home-help service areas to which the reference group belonged had only taken part to a very small extent in the rehabilitation
activities which were carried out during 1996. The home-help service area did not take part in
the 35-hour project.

The home-help service area in question, on the other hand, had a booking board where the
staff members filled in their wishes for working time for a 6 week period at a time. There was
no planning group, as the adjustment of the times could be done directly on the notice board.
The need of the service for personnel has to be covered, and staff have to work their time
quota. This method of distributing working time is known as the laundry room model.

RESULTS

Study I: Health-related quality of life

Low quality of life related to the dimensions (i) bodily pain, (ii) general health perception and
(iii) vitality, proved in the study to apply both to hospital cleaners and to home-help
personnel, compared with a Swedish female normal population. The home-help personnel
intervention group also experienced lower quality of life related to mental health.

No lowering in quality of life was demonstrated regarding the dimensions (i) ability to
perform physical activity (physical functioning), (ii) role limitation due to physical problems
(role - physical), (iii) the maintenance of normal social relations because of physical or mental
ill health (social functioning), or (iv) the performance of regular activities because of
emotional problems (role limitations due to emotional problems) and (v) mental health
(except for home-help personnel). In summary however, all these four groups experienced
substantial lowering in quality of life related chiefly to the same three dimensions: bodily
pain, general health perception, and vitality.

No specific effect of the present interventions on health-related quality of life was
demonstrated during the study in the comparison of differences between the intervention
group and the comparison group (for both hospital cleaners and home-help personnel).

Following the intervention/period of customary measures, experienced quality of life was
somewhat changed in the groups compared with the Swedish female normal population.
The hospital cleaners’ intervention group was no longer below the normal population in
general health perception, while the reference group was no longer lower in bodily pain
and general health perception (Figure 3). The home-help personnel intervention group was
no longer below the normal population in perceived mental health while the reference
group was no longer below in general health perception and vitality (Figure 4).
Figure 3. Health-related quality of life for the intervention and reference groups of hospital cleaners ‘before’ and ‘after’ intervention. Scores (SF-36, means, 95% confidence intervals) for all groups investigated. Comparison with Swedish female normal population (Sullivan et al., 1994).

Figure 4. Health-related quality of life for the intervention and reference groups of home-help personnel ‘before’ and ‘after’ intervention. Scores (SF-36, means, 95% confidence intervals) for all groups investigated. Comparison with Swedish female normal population (Sullivan et al., 1994).
Study II: Experienced physical and psychosocial working environmental conditions

There were many statistically significant differences between the study groups and the respective selections of the Swedish population ‘before’ the interventions, especially in relation to the psychosocial working environmental conditions. The differences which occurred went in both directions, i.e. there were variables where the study groups felt the working environmental conditions to be better than the selection of the Swedish population, and there were variables where the experience of the groups was worse. The summary in Table 2 shows that with the exception of the hospital cleaners’ intervention group, all the other three groups started out with a certain over-representation of the ‘worse’ category compared with the selection of the Swedish population.

The study showed that there were statistically significant differences (8 variables) between the hospital cleaners’ intervention and reference groups ‘before’ intervention as regards ergonomic loading factors, social support, influence and opportunity to develop in the work. In the home-help personnel’s intervention and reference groups there were differences (6 variables) in the need for concentration at work, the degree of difficulty of the work tasks and the opportunity to develop in the work.

It was seen that most of the statistically significant within-groups changes had occurred in the home-help personnel’s reference group as regards both the physical and the psychosocial working environmental conditions. Fewer significant changes were seen in the other three groups. Taken as a whole, all changes in the four groups had involved improvements.

In the hospital cleaners’ intervention group, statistically significant effects in the form of improvements ‘before-after’ intervention compared with the reference group can be seen within four different variables (Table 3).

Statistically significant improvements between the home-help personnel’s intervention and reference groups ‘before-after’ intervention occurred within four variables (Table 4).

Table 2. The differences between the four groups ‘before’ the intervention/control period compared with the selection of the Swedish population of women cleaners (n=198) and women health and sickness care (home-help) workers (n=441). These summary figures include both physical and psychosocial working environmental variables. Total numbers of variables 55.

<table>
<thead>
<tr>
<th>Differences in comparison with the selection of Swedish population</th>
<th>Better</th>
<th>Worse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cleaners’ intervention group(^1) (n=23)</td>
<td>11</td>
<td>9</td>
</tr>
<tr>
<td>Cleaners’ reference group(^1) (n=22)</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>Home-help personnel intervention group (n=25)</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Home-help personnel reference group (n=29)</td>
<td>5</td>
<td>8</td>
</tr>
</tbody>
</table>

\(^1\) Because of the nature of these variables, there is one occasion where it is not possible to determine whether the starting situation is better or worse.
Table 3. Statistically significant differences between the hospital cleaners’ intervention and reference groups where the effects have been calculated in terms of the changes in the ‘before-after’ differences and the answers have been grouped into positive, unchanged or negative values (Chi-square test). Physical and psychosocial working environmental variables. Hospital cleaners’ intervention group (n=23). Hospital cleaners’ reference group (n=22). ‘Before’ and ‘after’ in the reference group refer to the control period. B = got better, W = got worse.

<table>
<thead>
<tr>
<th>Question category/Question</th>
<th>'Before-after'</th>
<th>p value</th>
<th>Intervention group compared with reference group</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physical working environment</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exposed to vibration from hand-held machines</td>
<td></td>
<td>0.005</td>
<td>B</td>
</tr>
<tr>
<td>Strenuous heavy work/very light work physically</td>
<td></td>
<td>0.010</td>
<td>B</td>
</tr>
<tr>
<td><strong>Psychosocial working environment</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Work sometimes so stressful that there is no time to talk or think about anything other than work</td>
<td></td>
<td>0.030</td>
<td>B</td>
</tr>
<tr>
<td>Possible to talk to colleagues while working</td>
<td></td>
<td>0.026</td>
<td>B</td>
</tr>
<tr>
<td>Work tasks too difficult/simple</td>
<td></td>
<td>0.008</td>
<td>W&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>1</sup> In the direction of the work tasks being too simple.

Table 4. Statistically significant differences between the home-help personnel’s intervention and reference groups where the effects have been calculated in terms of the changes in the ‘before-after’ differences and the answers have been grouped into positive, unchanged or negative values (Chi-square test). Physical and psychosocial working environmental variables. Home-help personnel’s intervention group (n=25). Home-help personnel’s reference group (n=25). ‘Before’ and ‘after’ in the reference group refer to the control period. B = got better, W = got worse, U = unchanged.

<table>
<thead>
<tr>
<th>Question category/Question</th>
<th>'Before-after'</th>
<th>p value</th>
<th>Intervention group compared with reference group</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physical working environment</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physically exhausted after work</td>
<td></td>
<td>0.004</td>
<td>B</td>
</tr>
<tr>
<td><strong>Psychosocial working environment</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heartburn, acid regurgitation, stomach pains/upsets</td>
<td></td>
<td>0.015</td>
<td>B</td>
</tr>
<tr>
<td>Uneasy and despondent due to difficulties at work</td>
<td></td>
<td>0.045</td>
<td>B</td>
</tr>
<tr>
<td>Part of working day spent solving difficult problems</td>
<td></td>
<td>0.018</td>
<td>B</td>
</tr>
<tr>
<td>Can decide for oneself when different jobs will be done</td>
<td></td>
<td>0.048</td>
<td>W</td>
</tr>
</tbody>
</table>
Study III: Diagnoses and pain

No differences were found between the hospital cleaners’ intervention group and reference group ‘before’ intervention in intensity of pain and spread of pain. The intervention group had a slightly higher occurrence of diagnoses within the neck-shoulder region, but regarding other musculoskeletal diagnoses the groups were rather similar (Table 5). The home-help personnel’s intervention and reference groups were similar in rated perceived intensity of pain. The intervention group had somewhat more spread and frequency of pain. They also had more musculoskeletal diagnoses (Table 5). There are thus important similarities but also dissimilarities between the compared groups of the home-help personnel, indicating that the intervention group had non-negligibly more medical problems than the reference group.

Myalgia/tendinitis of shoulder girdle elevators occurred in 61%, of rotator cuff in 18%, of dorsal neck muscles in 16%, and of hip muscles in 29%. There was musculoskeletal pain in the low back in 28%. Referred pain from a musculoskeletal focus occurred in 20-35%. Neurogenic pain occurred in 6% (Table 5). No fibromyalgia syndrome was found.

The effects on pain intensity ‘during’ and ‘after’ intervention among hospital cleaners and home-help personnel were seen in both intervention and reference groups. ‘Least’ pain tended to be less in the hospital cleaners’ intervention group ‘after’ personnel support.

Table 5. Occurrence of diagnoses/groups of diagnoses in the musculoskeletal system and occurrence of neurogenic pain/disturbed sensibility at examination ‘before’ intervention in all four groups. Absolute numbers (No) and percent (%) are given. Some subjects had several diagnoses also within two groups of diagnoses. Interv. = intervention group. Ref. = reference group.

<table>
<thead>
<tr>
<th>Diagnoses/ groups of diagnoses</th>
<th>Hospital cleaners</th>
<th>Home-help personnel</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Subtotal n = 45</td>
<td>Subtotal n = 54</td>
<td>n = 99</td>
</tr>
<tr>
<td></td>
<td>Interv. n = 23</td>
<td>Ref. n = 22</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>No</td>
<td>%</td>
</tr>
<tr>
<td>Myalgia/tendinitis in shoulder girdle elevators</td>
<td>13</td>
<td>10</td>
<td>23</td>
</tr>
<tr>
<td>Myalgia/tendinitis in rotator cuff</td>
<td>6</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Myalgia/tendinitis in dorsal neck muscles</td>
<td>6</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Epicondylitis</td>
<td>4</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>Tendovaginitis in wrist region</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Musculoskeletal pain in middle or lower part of thoracic spine</td>
<td>4</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Musculoskeletal pain in the lumbar sacral spine</td>
<td>5</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Myalgia/tendinitis in hip muscles</td>
<td>5</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Neurogenic pain/ disturbed sensibility</td>
<td>1</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
Figure 5. Distribution of mean pain-marked areas in self-administrated pain drawings. Differently shaded areas show frequency intervals according to symbols shown in figure. Symbol unshaded means no mark in area.
The distribution of mean number of pain-marked areas in the self-administrated pain drawing of all subjects in the two intervention and two reference groups, respectively, is shown in Figure 5. The hospital cleaners’ intervention group and reference group are fairly similar in pain distribution. No differences in number of pain-marked areas were found between intervention groups and reference groups ‘before’ intervention in any of the three regions neck-shoulder-upper-extremity, lumbosacral-spine-thigh, and knee-lower-leg-foot (Figure 6).

The home-help personnel reference group had significantly fewer pain-marked areas than the intervention group in the regions neck-shoulder-upper-extremity (p=0.022) and lumbosacral-spine-thigh (p=0.002) ‘before’ the intervention (Figure 6). There was no difference between the groups in the knee-lower-leg-foot region.

There was a tendency towards reduction in pain-marked areas in neck-shoulder-upper extremity was seen among the hospital cleaners (p=0.057). The ‘before-during’ within-group comparison showed a reduction of pain-marked areas (p =0.0152) (Figure 6).

![Figure 6](image-url)

**Figure 6.** Occurrence of pain-marked areas of self-administrated pain drawing. Number of pain-marked areas (mean, SD) in neck-shoulder-upper extremity (above, maximum 23 areas), lumbosacral-spine-thigh (middle, maximum 9 areas), and knee-lower leg-foot (below, maximum 12 areas) for all four groups indicated under horizontal axis of lowest diagram ‘before’, ‘during’ and ‘after’ intervention/control period. Levels of statistical significance are indicated for comparisons between intervention and reference groups ‘before-during’ and ‘before-after’ intervention, respectively. * p<.05; **p<.01; *** p<.001.
In the between-groups comparison of ‘before-during’ and ‘before-after’ differences, no changes in pain-marked areas for the neck-shoulder-upper-extremity were found among the home-help personnel (p=0.753 and p=0.453, Mann-Whitney U test). The ‘before-during’ and ‘before-after’ within-group comparisons in the home-help personnel intervention group and also the reference group showed reductions of pain-marked areas for the neck-shoulder-upper extremity. In the intervention group reduction was also found for the lumbosacral spine-thigh region (p=0.0052 and p=0.0002) (Figure 6). In the between-groups comparison of ‘before-after’ differences for the lumbosacral spine-thigh region, a significant reduction in pain-marked areas was found in the intervention group (p=0.043, Mann-Whitney U test).

The subjects often had more than one musculoskeletal pain condition and the examinations showed that ‘after’ intervention some subjects improved in certain aspects but deteriorated in others. Table 6 shows changes in assessed clinical picture based on examinations made ‘before’ intervention/control period and at follow-up. In the hospital cleaners’ intervention group 73.9% (34.8% + 39.1%) were clearly improved or slightly improved (categories A + B) compared to the reference group’s 27.3% (9.1% + 18.2%). In the hospital cleaners’ intervention group 17.3% (13.0% + 4.3%) were clearly deteriorated or slightly deteriorated (categories D + E) compared with the reference group’s 45.5% (18.2% + 27.3%). Statistical analysis (Chi² test) of the differences between the intervention group and the reference group showed that ‘after’ intervention more intervention group subjects had improved clinical pictures than reference group subjects had.

In the home-help personnel intervention group 60% (28% + 32%) improved or slightly improved (category A + B) compared to the reference group’s 17.2 % (3.4% + 13.8%) (Table 6). The home-help personnel’s intervention group, at 28% (24% + 4%), had deteriorated or slightly deteriorated (categories D + E) compared with the reference groups’ 51.7% (37.9% + 13.8%). Statistical calculations of the differences between the intervention group and the reference group demonstrated that more had an improved clinical picture ‘after’ intervention in the intervention group than in the reference group (Table 6).

| Category | Hospital cleaners | | Home-help personnel | |
| --- | --- | --- | --- |
| | inter. gr. | ref. gr. | inter. gr. | ref. gr. |
| | n=25 | n=22 | n=25 | n=29 |
| A-E | No | % | No | % | No | % | No | % |
| A | 8 | 34.8 | 2 | 9.1 | 7 | 28.0 | 1 | 3.4 |
| B | 9 | 39.1 | 4 | 18.2 | 8 | 32.0 | 4 | 13.8 |
| C | 2 | 8.7 | 6 | 27.3 | 3 | 12.0 | 9 | 31.0 |
| D | 3 | 13.0 | 4 | 18.2 | 6 | 24.0 | 11 | 37.9 |
| E | 1 | 4.3 | 6 | 27.3 | 1 | 4.0 | 4 | 13.8 |

Table 6. Change of clinical picture at follow-up ‘after’ intervention in all four groups. Number of persons (No) and percentage (%). Classification of clinical picture A-E. A = obviously improved clinical picture. B = slightly improved clinical picture or improved in some aspects and deteriorated in some aspects but with a preponderance for improvement. C = unaltered clinical picture, or improved and deteriorated to about the same total extent. D = slightly deteriorated clinical picture or deteriorated in some aspects and improved in some aspects with a preponderance for deterioration. E = obviously deteriorated clinical picture. Interv.gr.= intervention group. Ref.gr.=reference group.
Study IV: Change in pattern of absenteeism

In the intervention group the total absence rate was largely unchanged ‘after’ the intervention compared with ‘before’ (26.1 days ‘before’ intervention and 25.6 days ‘after’), while there was a tendency for it to have increased in the reference group (11.0 days ‘before’ intervention and 29.2 days ‘after’). This difference, however, was not significant at the group level in a simple comparison, but gave a significant intervention contribution to the total absence in the younger age group when a number of covariates were included in a multiple regression analysis.

The statistical analysis of the intervention focused on three things:

- investigation of the relationship between the change in absence rates and the intervention, with regard to five background variables; the ages of the people, the number of children under 12, civil status (single, married/partnered), how long they had worked on cleaning or other similar work for the County (the measurement values refer to the year 1995), and the total number of sickness absence days during the years 1993 +1994.
- a study of differences in the structure of the relationship between models using short-term absence and long-term absence respectively as the dependent (‘outcome’) variables.
- to illuminate as far as possible the differences between different statistical model specifications.

Three different measures of change in absence (1997-1995) were used:

- change in the total number of days absence (including sickness absence, care of sick children and parenthood leave) (Table 7).
- change in short-term absence not including child-related absence (not shown here).
- change in long-term sickness absence (Table 8).

Using ‘total change in absence’ as the dependent variable in the additive model without interaction terms (Table 7) shows that previous sickness absence days 1993+1994 and the intervention variable made significant contributions (1% level) in the younger group, but not in the older group. The degree of explanation ($R^2_{adj}$) is 26% for the younger group and very low for the older group. With the interaction terms the degree of explanation is considerably higher, but the interpretation of the contribution of the variables becomes complicated.

The interaction between age and previous sickness absence is significant for the older group (42+). The interaction between number of years in the work and previous sickness absence gives a significant contribution at the 1% level in both age groups. Previous sickness absence is significant as a separate factor (1% level) for the older group (42+).

The coefficients with ‘change in long-term sickness absence’ (Table 8) as dependent variable are similar to the analyses with the change in total absence as dependent variable. This is probably connected with the fact that long-term sickness absence is a large part of the total measure of absence. In the additive model without interaction terms, previous sickness absence 1993+1994 and the intervention variable give a significant contribution to the change in absence in the younger group, but not in the older group. The degree of explanation ($R^2_{adj}$) is 29% for the younger group, and very low for the older group. With interactions the degree of explanation is considerably higher, but the interpretation of the contribution of the variables becomes complicated.

The interaction between age and previous sickness absence is significant for the older group (42+). This means that the increase in long-term sickness absence is amplified when both previous sickness absence and age in the 42+ group are high.
Table 7. The dependent variable is 'change in total absence'. The values in the table for the results of the regression analysis are the non-standardized (b-) regression coefficients, with the standard deviation in brackets. Coefficients significant at 5% are printed in **bold**. Coefficients significant at 1% level are in **bold underlined**. Meanings of the interaction terms: AGECHILD = Age * Number of children under 12; AGEEXP = Age * No. of years cleaning; AGESICKD = Age * Long-term sickness absence days 1993+1994; CHILDEXP = Number of children under 12 * No. of years cleaning; CHILDSICKD = Number of children under 12 * Long-term sickness absence days 1993+1994; EXPSICKD = No. of years cleaning * Long-term sickness absence days 1993+1994. R² = proportion of explained variation which can be related to the explanatory variables; R² adj = R² adjusted for the number of explanatory variables. The variables of age, numbers of children under 12, married/partnered and number of years' cleaning experience refer to the year 1995.

<table>
<thead>
<tr>
<th>Explanatory variables</th>
<th>Model without interactions</th>
<th>Model with interaction terms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n=63</td>
<td>n=64</td>
</tr>
<tr>
<td></td>
<td>Age</td>
<td>Age</td>
</tr>
<tr>
<td></td>
<td>– 41 years</td>
<td>42+</td>
</tr>
<tr>
<td>Age</td>
<td>0.21 (1.26)</td>
<td>0.42 (2.81)</td>
</tr>
<tr>
<td>No. of children under 12</td>
<td>4.47 (6.96)</td>
<td>-25.5 (22.5)</td>
</tr>
<tr>
<td>Married/partnered</td>
<td>-8.99 (14.3)</td>
<td>3.05 (13.3)</td>
</tr>
<tr>
<td>No. of years cleaning experience</td>
<td>-1.46 (1.57)</td>
<td>0.11 (0.99)</td>
</tr>
<tr>
<td>Previous sickness absence 93+94</td>
<td><strong>-0.21</strong> (0.05)</td>
<td>0.05 (0.05)</td>
</tr>
<tr>
<td>Intervention</td>
<td>-40.9 (14.2)</td>
<td>11.1 (15.7)</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>-35.7 (13.7)</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>8.72 (15.3)</td>
</tr>
</tbody>
</table>

Table 8. The dependent variable is 'change in long-term sickness absence'. For the rest see Table 7.

<table>
<thead>
<tr>
<th>Explanatory variables</th>
<th>Model without interactions</th>
<th>Model with interaction terms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n=63</td>
<td>n=64</td>
</tr>
<tr>
<td></td>
<td>Age</td>
<td>Age</td>
</tr>
<tr>
<td></td>
<td>– 41 years</td>
<td>42+</td>
</tr>
<tr>
<td>Age</td>
<td>0.70 (1.31)</td>
<td>-1.58 (1.51)</td>
</tr>
<tr>
<td>No. of children under 12</td>
<td>1.59 (7.24)</td>
<td>-32.9 (24.4)</td>
</tr>
<tr>
<td>Married/partnered</td>
<td>1.20 (14.9)</td>
<td>-1.22 (14.4)</td>
</tr>
<tr>
<td>No. of years cleaning experience</td>
<td>-1.16 (1.63)</td>
<td>0.09 (1.07)</td>
</tr>
<tr>
<td>Previous sickness absence 93+94</td>
<td><strong>-0.25</strong> (0.05)</td>
<td>0.09 (0.05)</td>
</tr>
<tr>
<td>Intervention</td>
<td>-35.95 (14.8)</td>
<td>-10.7 (17.1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>-31.7 (14.7)</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>8.72 (15.3)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Model with interaction terms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n=63</td>
</tr>
<tr>
<td></td>
<td>Age</td>
</tr>
<tr>
<td></td>
<td>– 41 years</td>
</tr>
<tr>
<td>AGECHILD</td>
<td>1.63 (1.32)</td>
</tr>
<tr>
<td>AGEEXP</td>
<td>-0.03 (0.31)</td>
</tr>
<tr>
<td>AGESICKD</td>
<td>-0.003 (0.01)</td>
</tr>
<tr>
<td>CHILDEXP</td>
<td>2.73 (1.55)</td>
</tr>
<tr>
<td>CHILDSICKD</td>
<td><strong>0.243 (0.10)</strong></td>
</tr>
<tr>
<td>EXPSICKD</td>
<td>-0.03 (0.016)</td>
</tr>
<tr>
<td>R²</td>
<td>0.33</td>
</tr>
<tr>
<td>R² adj</td>
<td>0.26</td>
</tr>
</tbody>
</table>
Study V: Sickness absence-related costs at the company level

According to the HRCA model used, the sickness absence costs increased in both the intervention group and the reference group ‘before’ compared with ‘after’ the intervention (Table 9). The increase in the reference group was much higher than in the intervention group, which can be interpreted as saying that the intervention used counteracted a rise in sickness absence costs at the company level, giving an average net effect of 266.5 Euros per person (full-time working) during an 8-month period.

Using an analogue statistical analysis on the whole of the material, the contribution of the intervention counteracted a rise in sickness absence costs at the company level giving an average net effect of 283.2 Euros (Table 10). The models therefore gave similar quantitative measurements of the net contribution of the intervention. The statistical analysis gave a p-value of 0.223 for the whole material.

| Table 9. Change in sickness absence cost per employee in both groups ‘before’ and ‘after’ the intervention/control period. The costs are given in Euros. |
|---|---|---|---|
| | Cost per employee ’Before’ | Cost per employee ’After’ | Increase in Euros | Increase in % |
| Intervention group | 828.5 | 913.4 | 84.9 | 10.2 |
| Reference group | 562.4 | 913.8 | 351.4 | 62.5 |
| **Net effect (Reference group – Intervention group)** | | | **= 266.5** |

| Table 10. Model without interaction terms. The dependent variables are ‘change in total sickness absence costs’. The values of the regression analysis results in the table are the non-standardised (b-) regression coefficients, with the standard deviations in parentheses. \( R^2 \) = the proportion of the variation which is explained by the independent variables, \( R^2_{adj} = R^2 \) adjusted for the number of independent variables. |
|---|---|---|
| Independent variables | n=122 | p-value |
| Age | 1.9 (12.3) | .876 |
| No. children under 12 | -139.0 (138.5) | .318 |
| Married/partnered | -11.5 (213.7) | .957 |
| No. years in cleaning work | 13.5 (17.9) | .452 |
| Previous sickness absence 93+94 | 2.4 (0.8) | .003 |
| Intervention | -283.2 (231.3) | .223 |
| \( R^2 \) | | 0.11 |
| \( R^2_{adj} \) | | 0.06 |
Table 11. Model without interaction terms. The dependent variable was ‘change in total sickness absence costs’. The material has been divided into two age groups. Other conditions as in Table 10.

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>n=59 Age – 41 years p-value</th>
<th>n=63 Age + 42 years p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>-28.3 (29.4)</td>
<td>48.3 (28.9)</td>
</tr>
<tr>
<td>No. children under 12</td>
<td>-65.0 (161.9)</td>
<td>-191.0 (466.6)</td>
</tr>
<tr>
<td>Married/partnered</td>
<td>-144.8 (333.3)</td>
<td>163.8 (275.2)</td>
</tr>
<tr>
<td>No. years in cleaning work</td>
<td>4.8 (36.5)</td>
<td>24.2 (20.5)</td>
</tr>
<tr>
<td>Previous sickness absence</td>
<td>3.8 (1.2)</td>
<td>1.7 (1.0)</td>
</tr>
<tr>
<td>Intervention</td>
<td>-605.6 (330.4)</td>
<td>-45.4 (326.3)</td>
</tr>
<tr>
<td>R²</td>
<td>0.23</td>
<td>0.12</td>
</tr>
<tr>
<td>R² adj</td>
<td>0.14</td>
<td>0.02</td>
</tr>
</tbody>
</table>

Using a statistical method we were able to study the correlations in sub-groups and calculate the p-values for these specific correlations: in the younger group the intervention gave a calculated net contribution of 605.6 Euros with a p-value of 0.073, while the net contribution in the older group had a very high p-value (Table 11).

In the stepwise model with interaction terms for the younger group, several statistically significant differences appeared. There was a significant interaction between age and previous sickness absence, and also between having children or not and previous sickness absence. The net contributions to counteract absence costs from the variable ‘children’ and the variable ‘age’ tended to reduce when there had been previous high sickness absence.

The total cost for the intervention was 209,302 Euros. As our follow-up period only included eight months we started from an intervention cost based on eight months, i.e. 139,534 Euros. According to the statistical analysis (Table 10), the intervention used counteracted a rise in sickness absence costs at the company level during the eight month period, giving a net total of 24,100 Euros (283.2 Euros per person multiplied by 85.1 full-time jobs; see Study V, Table 1). This means that the pay-back time would be 5.8 eight-month periods, i.e. just less than 4 years (excluding interest costs). If we chose instead to start with the model with the division by age (Table 11), the intervention used counteracted a rise in sickness absence costs at the company level for the younger group during the eight month period, giving a net total of 25,738 Euros (605.6 Euros per person multiplied by 42.5 full-time jobs)\(^7\). This means that the pay-back time would be 2.7 eight-month periods, i.e. 1.8 years, excluding interest costs.

In order to illustrate how great the uncertainty would be for the estimates of the size of the intervention effect, the confidence intervals were calculated at different levels (90%, 95% and 99%). The 90% confidence interval in the younger group ranged from $-1,158.0$ to $-53.2$ Euros. A 95% confidence interval in the same group would cover an interval from $-1,268.6$ to $+57.4$ Euros. In this case the interval crossed the zero values, which in a common interpretation means that it is not likely at this level that the intervention has had any ‘effect’.

\(^7\) Because the younger group formed half the group studied, and most of the intervention measures were directed towards everyone in the workplace, we halved the intervention cost of 139,534 Euros, i.e. 69,767 Euros.
in monetary terms. A 99% confidence interval gives a range of –1,485.1 to + 273.9 Euros. It is therefore only at the 90% confidence interval that the zero value fell outside the range.

If we start from a 90% confidence interval for the b-coefficient for the intervention, the upper and lower limits of the interval become –53.2 to –1,158.0 Euros. Using the same calculation method as above, the pay-back period at the lower interval limit was 1.4 eight-month periods, i.e. just under one year, while at the upper interval limit it would be 30.9 eight-month periods, i.e. just short of 21 years. If we proceeded instead on the basis of the 95% confidence interval (which is the common one), these upper and lower interval limits for the younger group would become 57.4 to –1,268.6 Euros. The payback time at the lower limit then becomes 1.3 years. The upper limit corresponds in financial terms to a cost which over an eight-month period would equal the intervention cost (69,767 Euros) plus a yearly cost of 2,440.0 Euros. At the 99% confidence intervals these upper and lower limits for the younger group become 273.9 to –1,485.1 Euros, and the payback time for the upper interval limit becomes even higher.

DISCUSSION

Discussion of methods

This section begins with a discussion of the strategy selected for the work in this dissertation. There then follows a discussion of methodological questions such as the advantages and disadvantages of questionnaires, the disadvantages of not carrying out the studies on physicians blind, and reliability and validity of the of the different methods which were used and of the interventions.

Research paradigm

Within the research paradigm of the social and human sciences, it is common to discuss on one hand a traditional positivistic natural scientific approach, and on the other hand a post-positivistic approach whose main starting point is that the individuals involved take an active part both in the execution of the research project and in the selection and implementation of the different types of interventions. Choice of research paradigm and the approach for the research are also a question of valuation, and in this context of who the client is. The research can be carried out in order to create new knowledge which is of direct use to the employees affected, or in order to provide employers with a basis for the development of new business. It may also have as its main aim the more general creation of new knowledge about methods, and in order to explain the context of causation. My direction tends towards the latter point of view. Corlett (in Wilson & Corlett, 1998, p. 1097) points out:

"The temptation to see problems from the standpoint only of certain techniques is one of which we must always remain aware. The measurements we make constrain our understanding of the problem and where we have a bias towards certain methods it is almost inevitable that we shall have limited the range of that understanding. Since the above argument suggests that we have to understand the problem before we choose the methods, it leaves us in something of a quandary. If we understand the problem we don’t always need to do the study, but if we don’t then how do we choose a method?"

I shall be summarising below some of the main features which are of direct relevance for my dissertation work. My frame of reference in this context is based to a certain extent on the following references:

1) action research; Karlsen (1991),
2) participative research techniques and methods; Wilson & Corlett (1998),
3) participation in interventions; Wilson & Corlett (1998),
4) positivistic research and particular quasi-experimentation; Cook & Campbell (1979),
5) development and design of experiments and data collection; Meister (1986).

My approach is related to the overall aim, namely to study the outcome of two interventions
of a preventive and rehabilitative character, and further development of analysis methods.
There were a number of restrictions in the choice of workplaces, which were that:
interventions in the form of remedial programmes were carried out, a combination of
preventive and rehabilitative remedial measures occurred in the intervention, there were a
sufficient number of employees at the workplace, the workplaces were predominantly
women, and that the geographical boundaries were Jämtland county. The data collection was
therefore done within two job categories, cleaners and home help personnel. The main task of
the work has thus been to enable an evaluation of any intervention effects occurring in the
given job categories. The prerequisites included the fact that within the framework for the
research project itself it was neither possible nor desirable to influence the character of the
intervention or how it was carried out. It is worth mentioning that at one of the workplaces
involved (hospital cleaners), the management chose to involve the employees to a great extent
in both the choice of measures and in how they were carried out.

In this case the problem, with its assumptions and limitations, excludes an approach of a pure
action research character. Because it deals with following up and evaluating two interventions
which were carried out at real life workplaces, classical laboratory-orientated controlled
experiments are also excluded. Against this background, it is apparent that there are excellent
motives for the extensive use of a quasi-experimental approach in the work for this
dissertation. The affected employees did not take part in either the design or the execution of
the research project. They, in other words, were the object and not the subject in relation to
the research work. This had both advantages and disadvantages. Among the disadvantages are
that we as researchers did not make full use of the employees’ own knowledge and
experiences in the design and execution, which was advocated by, for example, Silverstein
and Silverstein (1992). A clear advantage was that the evaluation in its entirety was carried
out separately from the interventions. This means, for example, that those who were
responsible for the content of the interventions and for carrying them out did not have any
chance of influencing the evaluation. The evaluation was also completely financed by
independent research sponsors.

Even if it was a disadvantage that we were not able to make use of the knowledge and
experience of those affected in the design of the study, choice of questionnaire etc., we did
instead use reference knowledge in the area. In addition, the reference knowledge in the area
is overwhelming. Action research which is not carried out in a well balanced manner, taking
account of research carried out previously, can mean that understanding of the true problems
becomes more difficult, and thereby delays the introduction of good remedial measures
(Karlsen, 1991). On the other side, the lack of involvement of the employees in the evaluation
process means that they are distanced from the research project. The consequences of this
may be that they do not feel themselves involved in that part.

Experimental design vs. statistical control

It was stated earlier that it was not possible to use classical experimental controls in this
research project. In studies carried out under realistic conditions in the working life, there are
many and great hindrances in this procedure. In laboratory studies there are completely
different opportunities for optimising experimental control. In laboratory studies,
experimental control consists not just of matching the experimental and control subjects, but
also of a whole series of other questions such as, for example, the order of presentation of the measures/interventions (Meister, 1986).

A classical model for quasi-experimental studies was used in the first three studies. The control consisted primarily of matching reference groups in the best way to the intervention groups (Cook & Campbell, 1979). In order to increase the efficiency of the statistical hypothesis testing, shortcomings in the experimental control can be compensated for by statistical control. In the last two studies, a certain degree of statistical control has been applied as a complement to the experimental. Statistical control is based on, among other things, the use of covariates within the framework for multivariate analyses, such as, in this case, complex regression analyses.

Cook and Campbell (1979, p. 9) write:

"...it was assumed that statistical controls were adequate substitutes for experimental controls and that the functions served by random assignment, isolation, and the rest could be served just as effectively by passive measurement and statistical manipulation. The belief became widespread that random assignment was not necessary because one could validly conceptualise and measure all of the ways in which the people experiencing different treatments differed before their treatment was implemented, and that one could rule out any effects of such initial group differences by statistical adjustment alone. (Some researchers believed that all extraneous sources of variation in the dependent variable [that isolation and reliable measurement largely deal with] could be conceptualised, validly measured, and then partialled out of the dependent variable.) The difficulties inherent in fully modelling initial group differences, validly measuring each of the concepts in the model, and then removing the variance attributable to these concepts, seem to us more conspicuous today than ten years ago. This is true even among the sociologists, political scientists and economists who are most widely associated with using correlational data for purposes of inferring cause (Duncan, 1975; Heise, 1975; Rivlin, 1971). Thus, there were two major reasons for using experimental designs in theoretical and practical research in field settings. The first was an increasing unwillingness to conduct experimental test in controlled – and usually laboratory – settings that were irrelevant for both theory and practice."

The classical laboratory experiment apparently presents extensive possibilities for control, and thereby precision and efficiency in the research. Conversely, it may appear that carrying out quasi-experimental studies at real workplaces can involve insurmountable problems with factors which are difficult to control – different research subjects, managers, working environmental conditions, economic conditions, etc. In reality it is just these latter difficulties which give the quasi-experimental methods their strength, because reality cannot be affected. Cook & Campbell (1979, p. 9) go so far as to say:

"... the deliberately intrusive and manipulative nature of experimentation is closely related to some philosophy of science conceptions of a particular type of cause, to most persons’ everyday understanding of the notion of cause, and to the way that most changes would have to be made to improve our environment by introducing successful new practices and weeding out harmful ones."

Questionnaires

There are of course both advantages and disadvantages with using questionnaires compared with interviews. Table 12, taken from Meister (1986), shows examples of both advantages and disadvantages.

One of the disadvantages which Meister points out is the risk that the respondents can misunderstand the questionnaire questions. In the present research program this risk has been minimised by me being present while all the questionnaires were filled in on all three investigation occasions, and in this way I have been able to answer any questions which

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group administration (more respondents available more quickly)</td>
<td>Almost impossible to clarify obscurities if questions misinterpreted</td>
</tr>
<tr>
<td>Remote administration (can be mailed)</td>
<td>Less motivating to respondents than interviews</td>
</tr>
<tr>
<td>No variations possible</td>
<td>Opportunity for analyst to explore response details missing</td>
</tr>
<tr>
<td>Requires less time and/or fewer personnel to administer</td>
<td>Speaking more natural to most respondents than writing</td>
</tr>
<tr>
<td>More rapid responses and more data available in shorter time</td>
<td>Little opportunity for respondent to explain responses</td>
</tr>
</tbody>
</table>

arose. Comprehensive verbal instructions were given before, and if necessary also during, the filling in of the questionnaire. My personal visits to the workplaces probably also increased the motivation for answering the questions, which is another area which Meister mentions as a disadvantage. In this research work no shortfall occurred.

The various advantages and disadvantages of the different collection methods can be discussed in an unbiased manner. It is mainly practical reasons, together with the ability to carry out quantitative statistical analyses, which underlay the decision to use questionnaires which to a certain, but small, extent were complemented by follow-up interviews (Study V). It can be stated that the data quality from the questionnaire is as high as that from other collection methods. Meister (1986, p. 168) refers to Walsh who established that interviews, questionnaires and information from a personnel databank gave the same information. Studies by Härenstam (2000, p. 66) showed that the same result was achieved regardless of whether the working conditions were assessed by the employees themselves or by the researchers.

Physicians’ investigation

The subjects were examined by two physicians with specialist licences in rehabilitation medicine before and after the intervention and at the corresponding time for the reference subjects. The same physician examined the subject before and after intervention. The circumstances of this research project did not allow neutral persons for assessment. This is a methodological drawback but we judged it important to take the opportunity to investigate these groups of women working despite pain problems.

Reliability and validity

In order to understand better the connection between the five different studies which are reviewed here, it may be of interest to discuss briefly the reliability and validity of the different methods which were used. In particular, it may also be valuable to look at the
'validity'\textsuperscript{8} and 'reliability'\textsuperscript{9} of the interventions from an analogue viewpoint as a method for preventing and rehabilitating injuries and stresses for the work groups in question. Two other concepts which can clarify the view of the different research methods and interventions used are to discuss deep as opposed to broad/whole in the approach.

It can be seen in the summary table (13) under the section ‘Summary of results and conclusions’ that there may exist a certain shortcoming in validity in the interventions. One recurring conclusion is that the interventions were not sufficiently well matched to the problems which occur at the workplaces or to the actual needs of the individuals. On the other hand, it is not adequate to discuss the reliability in the interventions more closely, as these were to a certain extent self-selected and individual. If we had had a more extensive knowledge of the interventions and the mechanism of their effects, however, it would have been relevant to have a discussion about reliability. A more detailed discussion on validity assumes the availability of developed models for the relationship between measures and expected outcomes.

Validity in the methods of investigation selected is closely related to the degree of control which is achieved. In order to achieve a high degree of validity in an actual research situation, it is also important that the method is matched both to the problem and to the characteristics of the individual affected. The first three studies were mainly based on the use of questionnaires on subjective experience. Study III also includes ‘objectivised’ clinical investigations by physicians. Reporting of subjective experiences at a group level can easily give rise to large variations. In these contexts there is therefore a need to deepen and refine the measuring instrument used. The use of clinical investigations (Study III) is another example of a valuable complementary deepening which can increase validity. The testing of different covariates, as in Studies IV and V, has allowed the explanatory value to be increased. This in turn also increases the understanding of the whole.

The review of the results from the different studies shows that there are certain systematic differences in the outcomes. With the research methodology used in Studies I and II, it is difficult to see any clear results of the interventions. Subjective data which is processed at the group level is considered in this connection to give too great a level of uncertainty in the results. One of the reasons for this is that the studies have an experimental design which was carried out under field conditions. The literature review shows that there are large gaps in our knowledge of the effects of interventions, and it is therefore extremely important to be able to verify effects of different preventive and rehabilitative measures under realistic conditions. Despite this, quasi-experimental studies under field conditions are a good alternative. One requirement, however, is that the studies are backed up by suitable research methodology and statistical analysis in order for the effects to be clear. Studies III, IV and V are examples of this.

In Study III, where clinical investigations were carried out, significant results were found from the interventions. The clinical investigations involved more in-depth analyses of the effects at the individual level. In the part of Study III which included the collection of subjective data of frequency, intensity and spread of pain, on the other hand, significant results are sparse. The analyses of these data were carried out at the group level. In this

\textsuperscript{8} Validity for a measure/intervention in this context means that the measure achieves what it set out to achieve (relevance, suitability for a certain purpose, http://testinfo.com).

\textsuperscript{9} Reliability for a measure/intervention in this context means that under specific conditions the measure achieves what it set out to achieve on repeated use (the measure is carried out correctly, reliability, http://testinfo.com).
connection, the deeper clinical studies of the individuals gave additional information over and above what had been obtained when the subjective data at the group level was analysed.

In Studies IV and V, the complex relationship between different variables was taken into account. In Study IV, the outcome of the intervention was studied, in the form of absence patterns including sickness absence, and in Study V in the form of monetary costs of sickness absence at the company level. Intervention in Study IV made a significant difference to the total absence of the younger group. A number of covariates were included in the statistical analysis model. In this context, therefore, a multivariate statistical model compensated for defects in the experimental design.

Study V also showed that the integrated model used gave a better explanatory value for the intervention than the HRCA model used. The integrated model also made it possible to discuss how the results might vary with different assumptions, and also to specify confidence intervals for estimates. Without this form of complementary multivariate statistical analyses it would not have been possible to create this more in-depth understanding of the results.

Discussion of main findings and comments

The aims of Study I were to investigate the level of health-related quality of life in relation to that of a Swedish normal female population and to map the possible effects of the interventions on health-related quality of life.

Low quality of life, which was related to the dimensions (i) bodily pain, (ii) general health perception and (iii) vitality, proved in the study to apply both to hospital cleaners and to home-help personnel, compared with a Swedish female normal population. Hence all the groups experienced bodily pain as troublesome with consequences for both physical and mental activities, their health status was assessed as poor and worsening, and the respondents felt tired and worn out. The home-help personnel intervention group also experienced a lower quality of life related to mental health, with feelings of nervousness and depression.

No specific effect of the present interventions on health-related quality of life was demonstrated during the study in the comparison of differences between the intervention group and the comparison group (for both hospital cleaners and home-help personnel). The SF-36 is held to have good sensitivity, so we do not believe lack of responsiveness explains the result (Beaton et al., 1997).

Experienced quality of life was somewhat different in the groups compared with the normal female population. The hospital cleaners’ intervention group was no longer below the normal population in general health perception, while the reference group was no longer lower in bodily pain and general health perception. This may indicate a certain improvement in experienced quality of life in both groups. The home-help personnel intervention group was no longer below the normal female population in perceived mental health while the reference group was no longer below in general health perception and vitality. This indicates a certain improvement in experienced quality of life in both groups.

The aim in Study II was to study whether personnel support intervention at the workplace had an effect on the experience of physical and psychosocial working environmental conditions.

There were many statistically significant differences between the study groups and the respective selections of the Swedish population ‘before’ the interventions, especially in relation to the psychosocial working environmental conditions. One explanation for this may just be that our selection was already based on the fact that the group had problems or symptoms of pain in the musculoskeletal system. Their problems were probably a
contributory reason why, to a greater extent than in the selection from the Swedish population, they felt physically exhausted after work, experienced tiredness and listlessness, had headaches more often, and felt that they had less opportunity to determine their own working pace.

The study showed that there were statistically significant differences (8 variables) between the hospital cleaners’ intervention and reference groups ‘before’ intervention as regards ergonomic loading factors, social support, and influence and opportunity to develop in the work. In the home help personnel’s intervention and reference groups there were differences (6 variables) in the need for concentration at work, the degree of difficulty of the work tasks and the opportunity to develop in the work. Against the background of the rather large number of questions in the questionnaire (55), we judged that despite the differences which existed, the groups were sufficiently similar that comparisons could be made.

It was seen that most of the statistically significant within-groups changes had occurred in the home help personnel’s reference group as regards both the physical and the psychosocial working environmental conditions. Fewer significant changes were seen in the other three groups. Taken as a whole, all changes in the four groups had involved improvements.

In the hospital cleaners’ intervention group, statistically significant effects in the form of improvements ‘before-after’ intervention compared with the reference group can be seen within four different variables. The introduction of new cleaning equipment and new cleaning methods are felt to have contributed to the reduction of workload during the intervention period, which in turn gave more time for rest breaks during work time. Deterioration can be seen within one variable. After the intervention period the intervention group thought that their work tasks were too simple. This could possibly be seen as an expression of the development which the group had undergone during the course of the project. At the same time as the individuals’ competence and self-confidence increased, so too did their requirement for encouragement and work satisfaction.

Statistically significant improvements between the home help personnel’s intervention and reference groups ‘before-after’ intervention occurred within four variables. This result shows that the home help personnel’s intervention group were thought to have had a reduction in workload and more responsible jobs, while at the same time the psychosomatic stress reactions were reduced after the intervention.

One aim in Study III was to throw light on the diagnoses behind the pain conditions causing the complaints of women working despite ill-health due to pain, and to describe the prevalence of different musculoskeletal diagnoses. Another aim was to find out the intensity, frequency, and location of pain in female hospital cleaners and home-help personnel working despite symptoms. A third aim was to attempt to demonstrate possible changes in clinical picture and pain after personnel supporting interventions.

The study of the Stockholm county (Hagberg & Hogstedt, 1991) showed a prevalence of female rotator cuff tendinitis of 3.9% while we show a 4.6-times higher prevalence of rotator cuff myalgia/tendinitis. The ‘tension neck syndrome’ in the Stockholm study had a prevalence in women of 11.7%. As defined in the Stockholm study, this syndrome can approximately be compared with myalgia/tendinitis of the dorsal neck, with a 1.5-times higher prevalence in women in the present study.

The relatively high occurrence of myalgia/tendinitis, 29%, in hip muscles is remarkable. In the Stockholm county the prevalence of tenderness in short rotator muscles/tendons of the hip joint at physical examination was 7.5%. Part of such myalgia/tendinitis in the present study may be load-related due to occupational activities (Kourinka & Forcier, 1995). The possible
relation of these complaints to early idiopathic osteoarthrosis in the present study is unknown (Hagberg & Hogstedt, 1991; Vingård et al., 1991). However, no subject had limited range of motion in the hip joints as a sign of osteoarthrosis.

Fibromyalgia syndrome is often given as a reason for pain. Therefore it is of interest to observe that no subject fulfilled the criteria for this syndrome before intervention; neither was there any psychogenic pain apart from one case where depression may have contributed.

Regarding pain caused by nerve root/peripheral nerve lesions, there is no certain information about the prevalence among women with this kind of work. Interestingly the frequency was low (6%) compared with the musculoskeletal pain frequency.

The results indicate that personnel support of hospital cleaners and home help personnel has some effect on the clinical picture. No such effect has been demonstrated for these occupational groups earlier.

Effects on the other outcome measures used in the present study were limited, though some changes were demonstrated. The effects on pain intensity during and after intervention among hospital cleaners and home-help personnel were seen in both intervention and reference groups, and were thus non-specific (not shown to be due to personnel support). ‘Least’ pain - which for the patient is often an important factor - tended to be less in the hospital cleaners’ intervention group after personnel support. There was a tendency to fewer pain-marked areas in the neck, shoulder and upper extremity in the hospital cleaner’s intervention group during the personnel support and in the lumbosacral spine and thighs of the home-help personnel’s intervention group during and after personnel support.

The aim of Study IV was to investigate whether the preventive intervention carried out in one predominantly female workplace had any effect on absenteeism. As a background, a model for analysing complex patterns of absenteeism, including sickness absences, was also developed. A further aim was to study the interactions between different forms of absenteeism.

In the intervention group the total absence rate was largely unchanged after the intervention compared with before, while there was a tendency for it to have increased in the reference group. This difference, however, was not significant at the group level in a simple comparison, but gave a significant intervention contribution to the total absence in the younger age group when a number of covariates were included in a multiple regression analysis. Looked at objectively, this could mean that the intervention had tended to counteract a ‘normal’ tendency towards increased absence, rather than reducing absence.

The consequences of intervention were different in different age groups. Intervention among those aged less than 42 contributed to the lowering of total absence in comparison with the reference group by about 36 days per person-year according to the interaction model, and by approximately 41 days per person-year in the additive model. With the simple regression model used, there was also a clear correlation in the ‘younger’ group between the person’s previous sickness absence during 1993+1994 and the change in total absence between 1997 and 1995; the younger ones with high previous sickness absence tended to show a greater reduction in their total absence than the other young ones. In the group which was 42 or older in 1995, a similar clear correlation pattern is not seen. In the model without interactions the intervention contribution was not significant, and the person’s previous sickness absence 1993+1994 showed a weak (non-significant) tendency to co-vary with the change in total absence.

One result running through the study was the clear relationship between previous sickness absence measured as the number of sickness absence days in 1993+1994 and the reduction in
absence in 1997 compared with 1995. It was primarily those who had high previous sickness absence rates who reduced their absences markedly during the later period, while those whose absence increased most tended to have had quite low sickness absence during 1993+1994. This result is especially interesting because earlier research indicated that those on sick leave who have previously had a long period of sickness absence have a worse outlook for remaining on the sick list (RFV, 1997:6).

One clear result from the analyses was that the changes in long-term sickness absence were affected in roughly the same way as the changes in the total absence, while this did not hold true for short-term absence as these variables were defined in this study. Because long-term sickness absence formed a large part of the total absence, the similarity of structure for these two outcome variables was not surprising. On the other hand, it was not expected that the changes with regard to the short-term absence measures used here would show no clear connection with the intervention. In the 42+ age group the short-term absence tended to reduce with increasing age and numbers of years’ cleaning experience (the coefficients were negative in the model without interactions, and significantly negative in the model with interactions, even though the interaction term AGEEXP (age and experience) had a positive value there).

One possible interpretation is that it was the long previous experience in cleaning work which contributed to this reduction. It is interesting that both increased cleaning experience and increasing age reduced the short-term absence significantly (5% level) for the older group (42+). In addition, the interaction term for these two was also significant (5% level). This means that the effect was amplified and that there was an additional high reduction in short-term absence with long experience in cleaning work in combination with higher age. One can speculate as to what this could depend on. It was probably due to some form of long-term selection effect which in turn may depend on the fact that those who were unable to continue the work either changed job or else had some form of long absence (in other words, they were perhaps on the way to leaving the job). The heavy loading in cleaning work should thus have been a contributory reason for the selection effect. This hypothesis is also supported by the fact that those with previous high sickness absence among the older members of the 42+ age group showed a higher increase in their total absence than the younger ones in the same group. The interaction effects for these older people (42+) also showed that there was a positive interaction between age and previous high absence. The older people within the group with previous high absence thus had an additional increase in their long-term absence. Conversely, there was a negative interaction effect between the factors of experience and previous high absence. This means that those who had previously had a high level of sickness absence in combination with long experience of their present job would have a relatively higher increase in long-term absence than those with short experience in the work. In other words, high previous absence in combination with long experience caused a greater increase in long-term absence than in those with short experience. Long experience of cleaning work thus meant, especially for the older ones, that the risk of long-term absence increased, which strengthens the hypothesis of an increased risk of giving up the work.

It appears as though it is easier to influence long-term sickness absence than short-term by means of programmes of different preventive and rehabilitative measures (Ekberg & Linton, 1994; Landstad et al. Study IV). In Study IV the younger group (41 or younger) was the one which showed the most dramatic reduction in long-term absence due to the intervention. The younger people usually had a shorter time of experience in the work, and could thus be assumed to have had considerably fewer load related injuries from the work; these were therefore thought to be more receptive to the type of intervention which was used here. In Ingemarsson et al.’s study (1997), it was found that previous sickness absence was the
strongest risk factor for long periods of sickness absence among patients with back and neck problems after treatment by physiotherapy. In Johanson’s evaluation of rehabilitation programmes sponsored by the Working Life Fund (1995), a significant reduction in long-term sickness absence was found after compared with before the workplace programmes the longer the sickness absence had been before the programmes. The only study found that shows effects on short-term sickness absence is by Bonsall et al. (1991), who showed that a change in attitude from the management affected short-term sickness absence.

It is somewhat surprising that the younger group did not show any effect of the intervention on short-term sickness absence. This was in spite of the fact that the intervention was judged to be relatively powerful. One possible reason for this may be that both the reference group and the intervention group showed an increase in efficiency at the same time (the amount of cleaning done increased in both groups during the period), which means that the positive effect of the intervention on short-term absence could have been balanced out by a higher work rate.

The results of the correlation study showed that the correlation between short-term sickness absence and ‘short-term leave’ in the intervention group was statistically significant before but not after the intervention. This indicates that short-term sickness absence and ‘short-term leave’ tended to be interchangeable before the intervention, but not after it. One possible explanation, which is interesting in the circumstances, is that the intervention contributed to this change. Future research should investigate further whether this could, for example, depend on the psychosocial effects of the intervention.

It is important to be able to see the economic consequences of the interventions within the preventive and rehabilitative area. In Study V we limited ourselves to a business economic perspective. The study had two primary aims. The first aim was to combine a Human Resources Costing and Accounting approach (HRCA) with a quantitative statistical approach in order to get an integrated model. This integrated model could make it possible to discuss how the results might vary with different assumptions, and also to specify confidence intervals for estimates. The second aim was to apply this integrated model in a quasi-experimental study in order to investigate whether a preventive intervention affected sickness absence costs at the company level.

The results show that according to the HRCA model, the sickness absence costs increased in both the intervention group and the reference group after compared with before the intervention. The increase in the reference group was much higher than in the intervention group, which can be interpreted as saying that the intervention used counteracted a rise in sickness absence costs at a company level, giving an average net effect of 266.5 Euros per person (full-time working) during an 8-month period. Using an analogue statistical analysis on the whole of the material, the contribution of the intervention counteracted a rise in sickness absence costs, giving an average net effect of 283.2 Euros per person (full-time working) during an 8-month period. The models therefore gave similar quantitative measurements of the net contribution of the intervention. Using a multi regression analysis we were able to study the contribution in sub-groups and calculate the p-values for these specific contributions; in the younger group the intervention gave a calculated net contribution of 605.6 Euros per person (full-time working) during an 8-month period, with a p-value of 0.073, while the net contribution in the older group had a very high p-value.

There was a significant interaction between age and previous sickness absence, and also between having children or not, and previous sickness absence. The net contributions to sickness absence costs from the variable ‘children’ and the variable ‘age’ tended to reduce when there had been previous high sickness absence. The age interaction in Study V
illustrates an assumption from Study IV that there can be a long-term selection effect which may be due to the fact that those who were unable to manage the work either changed job or else had some form of long absence. A study by the National Board of Occupational Safety and Health and Statistics Sweden (Arbetarskyddsstyrelsen & Statistiska Centralbyrån, 2000, pp. 3-4) showed that both occupational accidents and diseases increased among women with increasing age, and were most common in the age group 55-59 years. The fact that the disease frequency is somewhat lower in the oldest age group is explained primarily by the fact that many of those who were most exposed to health risks are no longer in their jobs at these ages (Ibid., p. 20).

Several studies also show the importance of having analysed the individual’s previous sickness, absence and working history before measures are taken, as this affects the result of the rehabilitation efforts (Bellaby, 1991; Bush, 1996; Hellzén Ingemarsson et al., 1997; Landstad et al., Study IV and V).

There are many different ways for a workplace to influence sickness absence costs. These costs can of course be reduced by reducing the number of sickness absence days, which may for example occur through multi-component workplace health promotion programmes; they can also occur by changing the absence structure, or the pattern of sickness absence, e.g. by reducing the high-cost sickness absence time. The cost of sickness absence can also be reduced by the organisation learning to cope with absence in a more effective way, thereby reducing the cost per sickness absence day. These changes in the absence structure and the sick-leave patterns may mean that the distribution of costs between the company and community has to change. The workplace can also contribute to changing the system of rules, informal community norms and salary structure rules at the highest levels.

The result shows that the pay-back time would be 2.7 eight-month periods, i.e. 1.8 years for the younger group, excluding interest costs. These calculations are similar to those which are commonly used in various HRCA calculations, in that the results are expressed as single values (e.g. Johanson, 1995). The statistical analyses in this study allowed us to provide quantitative results by means of confidence intervals, and by converting the confidence interval given in the review of the results into a pay-back time. At a 90% confidence interval, for example, the pay-back period at the lower interval limit was 1.4 eight-month periods, i.e. just under one year, while at the upper interval limit it would be 30.9 eight-month periods, i.e. just short of 21 years for the younger group. In the HRCA calculation mentioned above we came up with a pay-back time of 1.8 years, and the spread around this value was very large. The very large range of the probable pay-back time indicates the need to use criteria other than just economics as a base for decision about investments in preventive actions. Of particular value is the employer’s willingness to be engaged in the ‘process of change’ in close co-operation with the employees.

We do not intend to imply that the area of application for the integrated model is general; we are using the model for testing in this particular study and more far-reaching conclusions must be based on further research. The economic outcome of preventive and rehabilitative interventions at workplaces are not alternatives but complements to other important achievements. A good work environment has primarily a value in itself. But if this value also can be expressed in economic terms, the additional cost for the improvement of the environment will be much easier to market.

In order to get an overall view of the costs, it is desirable to widen the company economic perspective to include society economic aspects as well. Figure 7 shows an idealised picture of how one should reason in order to minimise the total costs. If I as employer have many rehabilitation cases per year, then one could believe that I have spent very little on preventive
Figure 7. An idealised model on how to minimise the total costs of the sum of investments cost for prevention and costs for rehabilitation cases per year.

measures. Conversely, this means that spending enormous amounts would reduce the number of rehabilitation cases to nearly zero. The cost to society and the company for rehabilitative measures are more or less directly proportional to the number of rehabilitation cases per year; in other words, zero rehabilitation cases means zero costs, and a large number of rehabilitation cases means large costs. By summing the curves for the preventive and the rehabilitative measures, one could expect to produce a curve with whose help a minimum could be determined.

In future studies it would therefore be important in this connection to try to throw light on all the factors which are included. One of the great difficulties in this respect is in casting light on the costs of the preventive measures required in order to achieve a certain degree of reduction in the number of rehabilitation cases. Future research should therefore be able to be a combination of studies of which mechanisms lead to a reduction in the number of rehabilitation cases and in the costs of implementing these mechanisms. It was shown in the literature review that there was a need for a better understanding of the causal connections between preventive measures and a reduction in the rehabilitation cases. Our own study (V) is an example of how a business economic perspective illuminated effects of interventions on sickness absence costs.

In the two intervention programmes which form the empirical material in the articles presented, expensive and comprehensive measured were carried out. The following discussion of the studies is more general. We have already shown in Study V that the measures counteracted a rise in sickness absence costs at the company level, and especially in the younger group. What we had hoped for was a greater effect on the other variables studied as well, such as certain dimensions in the health-related quality of life (‘general health’, ‘vitality’ and ‘pain’ which lay below the Swedish female comparison population), the physical and psychosocial working environmental conditions where only a few variables were affected in the positive direction, the short-term sickness absences, etc. This was in spite of the fact that the intervention, particularly that of the hospital cleaners, could be seen as comprehensive from the point of view of both the measures undertaken and the costs. The management showed a strong involvement in the project while at the same time having closely ties with the employees. The program contained a broad spectrum of measures concerning work
organisation, skills development, physical and psychosocial working environmental measures, together with individual and group rehabilitation efforts. In addition, work was also carried out on improving the working environmental and rehabilitation routines in the workplace. In the discussion of methods in the previous section, I have attempted to discuss critically our own research methods as part of the reason why we cannot see greater effects of the interventions. Another comment to which we shall return in several of the studies (I, II and III) is that the impact of a support program is dependent on how well the remedial measures match the need for such measures at the workplace, in a work group and among the individual people at the workplace. This emphasises the importance of designing effective analysis tools for determining what remedial measures are needed before the measures themselves are tried out.

Programmes of multidisciplinary measures can initially be seen as very expensive, but there are several studies which show good results and which state that such programmes are economically viable in the longer term (e.g. Bendix et al., 1995; Grahn et al., 2000). With the aid of a multidisciplinary programme, it is, for example, easier to reach more people with measures at a workplace where it is well-known that there are many risk factors, both inside and outside the work, which can contribute to an occurrence of, for example, problems in the musculoskeletal system, heart, blood vessels, etc. (Shepard, 1992; Ekberg 1995). Heaney and Goetzel (1997) were able to show that the programme of measures was even more successful where the specially selected participants were at the same time offered advice and support in individual risk management with the aim of reducing health risks. Feuerstein et al. (1994) also showed in a literature review of multidisciplinary rehabilitation programmes for chronic back pain that 67% of the patients were working at the 12-month follow-up time in contrast to an average of 44% in the control groups. In Johanson’s (1995) evaluation of rehabilitation programmes with financial support from the Working Life Fund, he shows a significant reduction in long-term sickness absence after compared with before the workplace programmes.

Several studies show that the length of the programme of measures is important for the result (Johanson, 1995; Heaney & Goetzel, 1997). Here, one could imagine that the longer a programme lasted, the greater the chances that the workplace would manage to carry out organisational improvements, and that everyone involved would be able to train in the new working methods, change old ingrained behaviour patterns, etc. Lagerström et al. (1998a) stress the importance of allocating ‘organisational space’, so that the new knowledge which individuals have acquired through a training programme can be kept.

There are rather diverse views on the ways in which the extent of the programme of measures and its intensity play a role in achieving a positive result. Ferraz-Nunes (1996) showed, in his follow-up of rehabilitation measures that large investments showed low effectiveness in comparison with less comprehensive (and cheaper) programmes. Large programmes demand greater knowledge on what the problem is and whether the measures really do lead to the desired result, i.e. technical effectiveness. Shi (1993), on the other hand, showed that more comprehensive programmes of measures had a greater effect when the aim was to reduce the costs of sickness absence, contact with the health care services and the use of medicines.

Of the individual rehabilitation measures, education seems to be one proactive form of rehabilitation which to a great extent leads to people being taken off the sick-list (RFV Redovisar, 1997:6, p. 64; RFV Redovisar, 1997:10, pp. 34-36). Of course, education gives the individual a chance to change jobs or workplaces completely, i.e. the individual has the opportunity to get away from the working environment which perhaps caused or contributed to the health problem. Indeed, Björkqvist et al. (1992) showed that changing job and
improvements of the workplace in preparation for the individual’s return showed positive effects.

After the programmes of measures had finished, we asked the women to answer a written questionnaire containing some questions on their views about the activities they had taken part in (Landstad & Bylund, 1997). To the question on ‘Which of the activities carried out within the project do you think had the greatest effect on your well-being at work?’ the participants could rank-order those activities which they felt to be the most important on a scale of 1-7, where 1 = the activity they felt was most important, 2 = the activity they felt to be the next most important, etc. The activities which had been most important to the hospital cleaners were: better cleaning equipment, massage, health care activities, closely followed by development of the work group, zone therapy/homeopathy and training in floor care. In the home help personnel group, everyone thought that the visit to the orthopaedic rehabilitation unit was of the greatest importance. Those activities which were of greatest importance during the rehabilitation visit were the comprehensive health check-up, getting illnesses diagnosed with their associated prognoses, getting help with an individually adapted training programme, training in the pool, theoretical and practical knowledge in stress control and relaxation.

Because one important part in the home help personnel’s programme of measures was that the women who visited the orthopaedic rehabilitation unit should function as ‘back and health care representatives’ at their respective units, we put the question, ‘Do you think that you received sufficient support in the role as ‘back and health care representatives’ while the rehabilitation programme was in progress?’ Twenty of the 25 women asked felt that they did not receive sufficient support (Landstad & Bylund, 1997). The majority of the participants also thought that they lacked concrete discussions on the content of the back and health care representatives’ role. This resulted in those involved remaining largely passive to a very important intention of the project. The fact that the project was in some respects not well ‘anchored’ by the closest levels of management also affected the experience that it was difficult to bring about changes at the workplace. The two-week visit to the orthopaedic rehabilitation unit was therefore felt to be measure directed more towards the individual; it was certainly of great importance to the individuals involved, but the peripheral effects which had been hoped for were perhaps not fully realised.

There was an important difference between the two intervention groups which it is worth pointing out. The hospital cleaners had a great deal of influence in the work of changing, which the home help personnel did not have. They were not involved in the planning of the project, which is seen as being very important if long-lasting changes are to be brought about (Svensson et al., 1995, p. 67; Ekberg, 1995). Changes to the work which are planned and carried out at the organisation’s management level have little chance of gaining the involvement of the personnel. The risk is rather that the changes would create uncertainty among the personnel affected. The motivation of an individual and the attitude of the workplace to the rehabilitation would seem to be of decisive importance for a return to work and for the long-lasting effects of the rehabilitation measures (Knutsson et al., 1995; Ekberg & Linton, 1994). Ekberg’s new problem and change-based methods were the individuals are highly involved have shown good results (Ekberg, 1995; Ekberg & Svedin, 1998). Hetzler et al.’s (1995) evaluation of Working Life Fund projects showed that what determines the degree to which a rehabilitation programme achieves success is whether a holistic view of the working environment, sickness absence and rehabilitation have become prevalent in the organisation, and in particular among its management or wherever the responsibility for these questions lies, and also the extent to which the company has introduced structures in order to monitor that the holistic view is also manifested in active work contributions.
Despite a large number of studies on rehabilitation directed towards the working life, it is difficult to draw any in-depth conclusions on the results and effects of the rehabilitation efforts of the 1990’s in Sweden (Statskontoret, 1997:27, p. 39; SOU 2000:78). There are still difficulties in the assessments of the results of rehabilitation in separating the selection effects and the programme effects, i.e. the effects of the rehabilitation programme itself. Many studies which set out to evaluate rehabilitation programmes suffer from methodological problems. Small research groups, risk of selective drop-out during longer follow-up periods, lack of control groups, control groups who obtain other treatment outside the framework of the project, are not at all uncommon. Another problem in many studies is that the content and aims of the measures are often insufficiently described (Shepard, 1992; Statskontoret, 1997:27, p. 39; Kertz et al., 1995, pp. 146-148). People who take part in rehabilitative measures directed towards the workplace often receive several treatments in parallel, which means that it is difficult to separate out the effects of the individual treatments. In one survey of rehabilitation measures for long-term sick-listed workers and civil servants, or those receiving disability benefits, and who were suffering from spinal problems, overlaps of 20-80% occurred (Jensen, 1998).

On further aspect which Ekberg and Linton (1994) point out in a review of evaluation studies of early rehabilitation of patients with problems in the neck, shoulders and upper back, is that the intervention studies are often orientated towards the individual, and that information is lacking on the extent to which the programme contains e.g. workplace changes (or adapted return to work), better coordination or measures aimed at e.g. psychosocial problems in the home environment.

In this thesis, a number of aspects are lacking which, apart from the research methodological ones already discussed, could contribute to clarifying further the effects of the programmes of measures studied. It would have been very valuable to have had a better matching of the measures to the individual people, and at the same time more in-depth interviews with the aim of gaining a deeper understanding of the processes of change at the individual level would have been able to provide important information. In this type of research into the effects of large programmes of remedial measures, the organisational and management aspects must be brought out very clearly. In Study II, only the hospital cleaners’ and the home helps’ understanding of the management’s support and encouragement in difficult working situations was investigated. We know that very large organisational changes were carried out at the hospital cleaners’ workplace, but no follow-up of the effects of these was carried out. I have already mentioned that, apart from the business economic perspective, it is important to be able to see the society economic consequences of interventions within the area of prevention and rehabilitation. In our studies, measurements were made before the intervention started and a short time after they finished. Longer-term following-up is needed, especially as there is information which shows that the effects can sometimes first appear several years after the measures have finished (Nutbeam, 2000).

Nutbeam (2000) summarised experiences from a large number of health promotion studies, and stresses that different goals are achieved at different speeds, and that the processes appear different for different goals. Long-lasting changes in behaviour and long-term improvements in health status are first shown 4-5 years after the remedial measures have been started (Figure 8).
SUMMARY OF RESULTS AND CONCLUSIONS

The overall aim of the thesis was to study the different effects of preventive and rehabilitative interventions for employees at work despite pain at predominantly female workplaces, and further development of analysis methods.

Study I

- Low quality of life related to the dimensions (i) bodily pain, (ii) general health perception and (iii) vitality proved in the study to apply both to hospital cleaners and to home-help personnel compared to a Swedish female normal population. The home-help personnel intervention group also experienced lower quality of life related to mental health.

- No specific effect of the present interventions on health-related quality of life was demonstrated during the study in the comparison of differences between the intervention group and the comparison group (for both hospital cleaners and home-help personnel).

- Experienced quality of life was somewhat changed in the groups compared with the Swedish female normal population. The hospital cleaners’ intervention group was no longer below the normal population in general health perception, while the reference group was no longer lower in bodily pain and general health perception. The home-help personnel intervention group was no longer below the normal population in perceived mental health while the reference group was no longer below in general health perception and vitality.

Our conclusion is that interventions with this content are insufficient to change the scores that were below the Swedish norm, i.e. ‘bodily pain’, ‘general health perception’ and ‘vitality’, so that they would match those of the Swedish female normal population. The experienced quality of life was somewhat changed in the groups compared with the normal Swedish
female population. This indicates a certain improvement in experienced quality of life in all four groups.

Study II

- There were many statistically significant differences between the study groups and the respective selections of the Swedish population ‘before’ the interventions, especially in relation to the psychosocial working environmental conditions.
- There were statistically significant differences in eight variables between the hospital cleaners’ intervention and reference groups ‘before’ intervention. In the home-help personnel’s intervention and reference groups there were differences in six variables.
- It was seen that most of the statistically significant within-groups changes had occurred in the home-help personnel’s reference group as regards both the physical and the psychosocial working environmental conditions. Taken as a whole, all changes in the four groups had involved improvements.
- In the hospital cleaners’ intervention group, statistically significant effects in the form of improvements ‘before-after’ intervention compared with the reference group can be seen within four different variables. The introduction of new cleaning equipment and new cleaning methods are felt to have contributed to the reduction of workload during the intervention period, which in turn gave more time for rest breaks during work time.
- Statistically significant improvements between the home-help personnel’s intervention and reference groups ‘before-after’ intervention occurred within four variables. This result shows that the home-help personnel’s intervention group were thought to have had a reduction in workload and more responsible jobs, while at the same time the psychosomatic stress reactions were reduced ‘after’ the intervention.

The results indicate that effects on the experienced working environment conditions can be produced by a general multi-component support program at the workplace, but that the number of variables influenced was very small. This was in spite of the fact that the intervention, particularly that of the hospital cleaners, could be seen as comprehensive from the point of view of both the measures undertaken and the costs.

These relatively limited effects may be explained by the fact that the impact of a support programme is dependent on how well the remedial measures match the need for such measures at the workplace, in a work group and among the individual people at the workplace. This emphasises the importance of designing effective analysis tools for determining what remedial measures are needed before the measures themselves are tried out.

Study III

- No differences were found between the hospital cleaners’ intervention group and reference group ‘before’ intervention in intensity of pain, spread of pain or frequency of pain. The intervention group had a slightly higher occurrence of diagnoses within the neck-shoulder region, but regarding other musculoskeletal diagnoses the groups were rather similar.
- The home-help personnel’s intervention and reference groups were similar in rated perceived intensity of pain. The intervention group had somewhat more spread and frequency of pain. The intervention group also had more musculoskeletal diagnoses.
- Myalgia/tendinitis of shoulder girdle elevators occurred in 61%, of rotator cuff in 18%, of dorsal neck muscles in 16%, and of hip muscles in 29%. There was musculoskeletal pain
in the low back in 28%. Referred pain from a musculoskeletal focus occurred in 20-35%. Neurogenic pain occurred in 6%. No fibromyalgia syndrome was found.

- The study showed a 4.6-times higher prevalence of rotator cuff myalgia/tendinitis than the so-called Stockholm Study and a 1.5-times higher prevalence of myalgia/tendinitis of the dorsal neck.
- The effects on pain intensity ‘during’ and ‘after’ intervention among hospital cleaners and home-help personnel were seen in both intervention and reference groups.
- ‘Least’ pain tended to be less in the hospital cleaners’ intervention group ‘after’ personnel support.
- There was a tendency to fewer pain-marked areas in the neck, shoulder and upper extremity in the hospital cleaner’s intervention group ‘during’ the personnel support and a in the lumbosacral spine and thighs of the home-help personnel’s intervention group ‘during’ and ‘after’ personnel support.
- Statistical calculations of the differences between the intervention group and the reference group demonstrated that more had an improved clinical picture ‘after’ intervention in the intervention group than in the reference group.

The results in the study indicate that personnel support of hospital cleaners and home-help personnel has some effect on the clinical picture. No such effect has been demonstrated for these occupational groups earlier. Effects on the other outcome measures used in the present study were limited, though some changes were demonstrated.

The results indicate that certain effects can be reached with preventive and early rehabilitative programmes of the kind studied here. The effects may depend on the duration of the support programme and e.g. how well the programme corresponded to individual needs. An early analysis of individual needs could be an instrument for selecting programme contents.

Study IV

- In the intervention group the total absence rate was largely unchanged ‘after’ the intervention compared with ‘before’, while there was a tendency for it to have increased in the reference group. This difference, however, was not significant at the group level in a simple comparison, but gave a significant intervention contribution to the total absence in the younger age group when a number of covariates were included in a multiple regression analysis.
- Intervention among those aged less than 42 contributed to the lowering of total absence in comparison with the reference group by about 36 days per person-year according to the model with interactions, and by approximately 41 days per person-year in the model with interactions.
- With the simple regression model used, there was a clear correlation in the ‘younger’ group between the person’s previous sickness absence during 1993+1994 and the change in total absence between 1997 and 1995; the younger ones with high previous sickness absence tended to show a greater reduction in their total absence than the other young ones.
- In the 42+ age group the short-term absence tended to reduce with increasing age and numbers of years cleaning experience (the coefficients were negative in the model without interactions, and significantly negative in the model with interactions, even though the interaction term AGEEXP (age and experience) had a positive value there).
• Both increased cleaning experience and increasing age reduced the short-term absence significantly (5% level) for the older group (42+). In addition, the interaction term for these two was also significant (5% level).

• The older group (42+) with high previous absence significantly increased their long-term sickness absence. The interaction effects for these older people (42+) also showed that there was a positive interaction between age and previous high absence. The older people within the group with previous high absence thus had an additional increase in their long-term absence. Conversely, there was a negative interaction effect between the factors of experience and previous high absence.

• The younger group (41 or younger) was the one which showed the most dramatic reduction in long-term absence due to intervention.

• The younger group did not show any effect of the intervention on short-term absence.

• Short-term sickness absence and ‘short-term leave’ tended to be interchangeable ‘before’ the intervention, but not ‘after’ it.

In the intervention group the total absence rate was largely unchanged ‘after’ the intervention compared with ‘before’, while there was a tendency for it to have increased in the reference group. Looked at objectively, this could mean that the intervention had tended to counteract a tendency of increased absence during this time-period, rather than reducing absence.

One clear result from the analyses was that the changes in long-term sickness absence were affected in roughly the same way as the changes in the total absence, while this did not hold true for short-term absence as these variables were defined in this study. Because long-term sickness absence formed a large part of the total absence, the similarity of structure for these two outcome variables was not surprising. On the other hand, it was not expected that the changes with regard to the short-term absence measures used here would show no clear connection with the intervention. This was in spite of the fact that the intervention was judged to be relatively powerful.

The study points to the importance of studying different types of absence in conjunction, using multivariate statistical analysis. There is also a need for tests of models with interactions, based on more advanced conceptual models, in order to be able to clarify how different forms of absence are affected and the interactions between background factors and intervention aspects. Different multivariate analysis models should be used to study the robustness of the conclusions. In this study covariance analyses were also carried out, giving largely the same results as the regression analyses. More in-depth models and methodological comparisons will be needed in future research.

**Study V**

• According to the HRCA model, the sickness absence costs increased in both the intervention group and the reference group ‘before’ compared with ‘after’ the intervention. The increase in the reference group was much higher than in the intervention group.

• According to the HRCA model, the intervention used counteracted a rise in sickness absence costs at the company level, giving an average net effect of 266.5 Euros per person (full-time working) during an 8-month period.

• According to the integrated model, the intervention counteracted a rise in sickness absence costs at the company level giving an average net effect of 283.2 Euros per person (full-time working) during an 8-month period.
Using an integrated model, the intervention in the younger group gave a calculated net contribution of 605.6 Euros with a p-value of 0.073, while the net contribution in the older group had a very high p-value.

Previous sickness absence days (1993+1994) made a significant contribution to the change in the total sickness absence costs in the younger group, but not in the older.

In the stepwise model with interaction terms for the younger group there was a significant interaction between age and previous sickness absence, and also between having children or not and previous sickness absence. The contributions to sickness absence costs from the variable ‘children’ and the variable ‘age’ tended to reduce when there had been previous high sickness absence.

In a calculation similar to those which are commonly used in various HRCA calculations, where the results are expressed as single values, the pay-back time would be 2.7 eight-month periods, i.e. 1.8 years for the younger group.

The statistical analyses in this study allowed us to provide quantitative conclusions by means of confidence intervals. At a 90% confidence interval for the b-coefficient for the intervention the pay-back period at the lower interval limit was 1.4 eight-month periods, i.e. just under one year, while at the upper interval limit it would be 30.9 eight-month periods, i.e. just short of 21 years for the younger group.

In this study we have established that the HRCA model used and the integrated model produce approximately the same monetary outcomes. The integrated model, however, allows a deeper understanding of the various possible correlations and quantifies the conclusions with confidence intervals.

We do not intend to imply that the area of application for the integrated model is general; we are using the model for testing in this particular study and more far-reaching conclusions must be based on further research. The economic outcome of preventive and rehabilitative interventions at workplaces are not alternatives but complements to other important achievements. A good work environment has primarily a value in itself. But if this value also can be expressed in economic terms, the additional cost for the improvement of the environment will be much easier to market.

The conclusions in Study V are different in certain respects from those in Study IV, where the outcome was measured in terms of the number of days of sickness absence and occurrences, instead of in monetary terms. One reason for this is that different patterns of sickness absence can produce different outcomes depending on whether one measures in terms of time or money. In the HRCA model, it is the short-term sickness absence which generates the highest costs for the workplace. Remedial action may therefore reduce the sickness absence as measured by the total number of sickness absence days, but it could also raise the total sickness absence costs if a net flow occurred towards shorter but costlier sickness absence periods.

Table 13 shows in highly condensed form the aim, main results and conclusions for each of the five subsidiary studies.
<table>
<thead>
<tr>
<th>Study</th>
<th>Aims</th>
<th>Main results</th>
<th>Conclusions</th>
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</thead>
<tbody>
<tr>
<td>I</td>
<td>To investigate the level of quality of life in relation to that of a Swedish normal female population and to map the possible intervention effects on health-related quality of life.</td>
<td>All four groups experienced substantial lowering in quality of life related to the three dimensions: bodily pain, general health perception and vitality. No effects of the intervention were demonstrated for any dimension. Some significant differences were obtained within the four groups.</td>
<td>Interventions are insufficient to change the scores that were below the Swedish norm. We do not consider that lack of power due to few subjects could be a reason for the non-significant effect.</td>
</tr>
<tr>
<td>II</td>
<td>To study whether personnel support intervention at the workplace had an effect on the experience of physical and psychosocial working environmental conditions.</td>
<td>Very few significant results of the interventions. Hospital cleaners’ intervention group: introduction of new cleaning materials and new methods seemed to contribute to a reduction in workload, which gave them a better chance of taking rest breaks during working time. Home-helps’ intervention group: a reduction both in workload and in more responsible tasks. Reduced psychosomatic stress reactions.</td>
<td>The number of variables influenced was very few. Impact of a support program depends on how well the remedial measures fulfil the need for such measures.</td>
</tr>
<tr>
<td>III</td>
<td>To map the diagnoses behind the pain conditions, particularly musculoskeletal problems, and to describe the prevalence of different musculoskeletal diagnoses. To find out the intensity, frequency and location of pain. To demonstrate possible changes in clinical picture and pain ‘after’ interventions.</td>
<td>Very high prevalence of rotatorcuff myalgia/tendinitis, myalgia/tendinitis of the dorsal neck and relatively high prevalence of myalgia/tendinitis in hip muscles. Neurogenic pain was rare. No fibromyalgia syndrome was found. Limited effects on the pain outcome measures. ‘After’ the intervention, more intervention group subjects had improved clinical picture than reference group subjects.</td>
<td>Fewer effects than expected were demonstrated. The effects depend on e.g. how well the programme corresponded to individual needs.</td>
</tr>
<tr>
<td>IV</td>
<td>To investigate whether the preventive intervention carried out had any effect on the absence pattern. To develop a model to analyse complex pattern of absenteeism and to study the interactions between different forms of absenteeism.</td>
<td>A simple comparison was not significant, but the intervention gave a significant contribution to the total absence in the younger age group when a number of covariates were included. Those with previously high sickness absence reduced their total absence most. Those who do not cope with the working conditions are leaving and might create a long-term selection process. The interchangeability of short-term sickness absence and short-term leave was reduced.</td>
<td>The intervention counteracted a tendency of increased absence during this time-period, rather than reducing absence. Important to relate types of absence in conjunction, using multivariate analysis, including interactions. Sample size need to be increased and the understanding of mechanism at work improved.</td>
</tr>
<tr>
<td>V</td>
<td>To combine an HRCA model with a quantitative statistical model in order to get an integrated model and to apply this integrated model in a quasi-experimental study in order to investigate whether preventive intervention affected sickness absence costs at the company level.</td>
<td>The intervention can be stated as having contributed to preventing an increase in sickness absence costs at the company level. The two models give approximately the same monetary outcome. However, the effects were not significant. An integrated model showed that the intervention had a greater net effect on the younger group, and showed a number of significant interactions. The payback time for the younger group was just under one year, but with a very wide spread.</td>
<td>The integrated model gives a better explanation. The statistical analysis allows the calculation of a confidence interval which shows that the personnel economic result regarding the profitability of the intervention shows large variability.</td>
</tr>
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</table>
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http://www.testinfo.com (definitions of the concepts of validity and reliability)