Physical and Psychosocial Occupational Strain

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PHYSICAL AND PSYCHOSOCIAL OCCUPATIONAL STRAIN

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PHYSICAL AND PSYCHOSOCIAL OCCUPATIONAL STRAIN

This monography thesis is based on five empirical studies of physical and psychosocial occupational strain in working life. The first three studies concern the working environment of crane couplers. The questionnaire study showed that monotonous postures and movements, heavy lifting and long walking distances were common reasons for regarding crane coupling as a physically strenuous work. According to the medical study clinical findings were more prevalent in the right neck- and shoulder region. The electromyographic study indicated that crane coupling work may imply harmful effect in the neck- and shoulder region. This study also showed that the physical strain in crane coupling can be reduced by using wooden or other light weight spacers, by rearranging the layout so that slinging is always possible and by using slings made of fibre or other light weight material. The fourth study examined psychosocial strain and qualification in administrative computer work by questionnaires, interviews and physiological measurements at repeated occasions. The results indicated a good agreement between level of qualification, psychosocial work load and job satisfaction. Computerisation lead to increased qualifications at work. This improved job satisfaction but at the same time resulted in an increased workload. The fifth study concerns how patients visiting primary health care perceive physical and psychosocial occupational strain. It could be shown that the patients perceived physical as well as psychosocial strain as important working environment problems.

Key words: Musculoskeletal disorders, crane coupler, electromyography, computerisation, primary health care, physical strain, psychosocial strain, stress.

The monography is based on the following articles and reports:


SUMMARY

This monography thesis is based on five empirical studies of physical and psychosocial occupational strain in working life. The first three studies concern the working environment of crane couplers. The first study, a questionnaire study, showed that monotonous postures and movements, heavy lifting and long walking distances were common reasons for regarding crane coupling as a physically strenuous work. The second study, a medical study, showed that clinical findings were more prevalent in the right neck- and shoulder region. The third study, an electromyographic study showed that the physical strain in crane coupling can be reduced by using wooden or other light weight spacers, to rearrange the layout so that slinging is always possible or by using slings made of fibre or other light weight material. This study also indicated that crane coupling work may cause harmful effects to the shoulder- or neck region. The fourth study examined psychosocial strain and qualification in administrative computer work by using questionnaires, interviews and physiological measurements at repeated occasions. The results indicated a good agreement between level of qualification, psychosocial work load and job satisfaction. Computerisation lead to increased qualifications at work. This improved job satisfaction but at the same time resulted in an increased workload. The fifth study concerns how patients visiting primary health care perceive physical and psychosocial occupational strain. It could be shown that the patients perceived physical as well as psychosocial strain as important working environment problems.

Key words: Musculoskeletal disorders, crane coupler, electromyography, computerisation, primary health care, physical strain, psychosocial strain, stress.
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Luleå, february 1990

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1. **INTRODUCTION**

It is a well-known fact in working life that high physical workload may contribute to musculoskeletal symptoms and disorders (Hagberg, 1981, 1984; Kilbom et al., 1986). Mechanisation and automation has changed the pattern of physical load during the last decades from heavy to easier manual work often combined with unsuitable working postures and a concentration of physical strain to single muscles and joints. A further result of this development is the high frequency of repetitive movements in many jobs as for example in computer work. The physical environment always affects the mental function of a worker and consequently work environment factors as, for example, the organisation of production technique and/or the structure of an organisation may influence work-content, work rate, opportunity for control of planning of work, skill use and skill development. Inadequate solutions affect health and increase the risk of stress reactions, including psychosocial and psychosomatic symptoms. Since stress reactions are presumed to increase the level of muscular tension, a high level of psychosocial strain in work may also contribute to musculoskeletal symptoms and disorders (Coyne & Lazarus, 1980). A vicious circle can arise where poor health, physical and/or psychosocial, leads to a decrease in resistance to various conditions in the psychosocial environment, making it more difficult to cope with everyday situations.

Accordingly, a musculoskeletal disorder can arise as a result of various factors. It may have medical origins, or be caused by physical or psychosocial strain at work or outside of work. It may be the result of momentarily high strain, or prolonged low muscular or tendinous strain. It is, however, the sum and interaction of effects that in the end result in musculoskeletal disorders.
Various methods have been used in this thesis to describe and analyse physical and psychosocial occupational strain. In the first three studies of the working environment of crane couplers questionnaires, clinical examinations and electromyography have been used. The aim has been to identify important aspects of physical strain in crane coupling as possible contributing factors to musculoskeletal disorders, and as a result of this provide appropriate suggestions for improvement. In the fourth study, physical and psychosocial strain and qualification in administrative computer work have been evaluated through questionnaires, interviews and physiological measurements on repeated occasions. The aim has been to study how computerisation affects working conditions and physical, psychosocial and psychosomatic health. The fifth study concerns how patients visiting primary health care perceive physical and psychosocial occupational strain. It could be shown that the patients perceived physical as well as psychosocial strain as important working environment problems.
2. PHYSICAL STRAIN – A THEORETICAL FRAMEWORK

2.1 Introduction

Problems of fatigue and pain elicited by physical work load on joint, muscular or tendinous structures are of great importance in the ergonomic field and also in the field of rehabilitation (Harms-Ringdahl, 1986). Analysis of the genesis of load elicited fatigue, pain and diseases is of central importance in the work of physical therapy. An assessment of physical load in work, as well as the relation of load to disability, is often included both in programmes for rehabilitation of patients, and in programmes concerning preventive information (Nordin, 1982; Möller, 1984; Öberg, 1984; Harms-Ringdahl, 1986).

However, it has not yet been possible to define thresholds and durations for optimal physical loading. It is of ergonomic interest that both the load and the muscular activity in work postures should be maintained at low levels (Ekholm et al, 1981). Researchers have tried to find the upper limits for pain-provoking load (Björksten and Jonsson, 1977; Hagberg, 1981 a and b; Snook, 1985). Variables such as load moment and muscle activity, joint position and load duration are not factors necessary for provocation of pain, but each might reach a value sufficient to induce pain in various conditions (Harms-Ringdahl, 1986). All such factors must be taken into account in analyses aiming at the prevention of pain induced by load (Harms-Ringdahl, 1986).
2.2 From high physical work load to fatigue and pain

Work involving relatively high physical workload, especially static workload is very frequent in industry today. The same applies to highly repetitive movements of the hand and arm.

There are reports which link for example repetitive movements of the hand and arm with static contractions and subsequent discomfort/disorder of the upper limbs and the region of the neck and shoulders, e.g. scissor makers (Kuorinka and Koskinen, 1979), assemblers in the automobile industry (Rjelle et al, 1981) and workers in the electronics industry (Kvarnström, 1983). In fact, manufacturing work is associated with high prevalence of cervicobrachial disorders, ascribed to repetitive manual often short-cycled tasks, raised arms, together with high demands on accuracy and speed of work (Hagberg, 1984; Kilbom et al., 1986). It has been suggested that local muscle fatigue is an important causal factor of these disorders (Bjelle et al., 1981; Chaffin, 1973; Hagberg, 1981, a, b, 1984; Luopajärvi et al, 1979).

Heavy work may result in repeated incidents of muscular fatigue which in turn in combination with some "individually predisposing factor" will result in a disorder. Differences between individuals in age, sex, psychosocial factors, anthropometrics or muscle strength may be possible predisposing factors (Hagberg, 1982). Sudden incidents of muscular over-loading may also contribute to musculoskeletal disorders (Hagberg, 1981 a). A high physical strain can result in fatigue or discomfort. Improvements of the working environment or working methods may resolve the problem. Otherwise if the work continues unchanged, the disorder will be emphasized and registered as an illness and further work will not be possible. Medical treatment and rest (sicklisting) lead in most cases to improvement. It is unclear why fatigue and discomfort which in its initial stage is of a temporary nature develop into an illness.
The introduction of brief pauses has been suggested as a way to reduce musculoskeletal fatigue (Sundelin et al., 1986). Pauses increase the duration of endurance (Björksten et al., 1977; Hagberg, 1981 b), reduce fatigue and improve output (Granjean, 1980). A significant negative correlation has been found between pauses and static strain on the right upper trapezius muscle (Hagberg and Sundelin, 1986) indicating the importance of pauses in decreasing the static component in highly repetitive work.

Work postures can be analysed with regard to level of muscular activity, static muscular load or joint load (Harms-Ringdahl, 1986). The level of muscular activity increases to a high level in work postures involving long duration of forward and backward flexed positions of the head, arms raised above shoulder height and a forward flexed and rotated back (Hagberg, 1981 b; Herberts et al., 1984).

Studies of correlations between disorders, working postures and movements have been made (Kilbom and Persson, 1987). Factors such as the percentage of work cycle involving flexion of the neck, percentage of work cycle with upper arm abucted > 30° or maximum static strength in abduction, are relevant in predicting disorders (Kilbom and Persson, 1987).

The magnitude of sustained activity levels of shoulder muscles required to induce fatigue, and probably pain, change with the duration of exposure (Björksten and Jonsson, 1977; Hagberg, 1981 a). An isometric contraction can be maintained at about 10% MVC for 10 to 15 minutes (Björksten and Jonsson, 1977; Granjean, 1980; Hagberg, 1981 b). The level of static load on a muscle should not exceed 5% of a maximum voluntary contraction (MVC) in a 8 hour working day (Jonsson, 1982).
Working with one's joints in extreme positions will induce pain (Brodin, 1977; Harms-Ringdahl, 1986). A maximum flexed position of the neck can cause fatigue and pain within 15 minutes (Harms-Ringdahl, 1986), probably due to high levels of static activity in muscles of the neck and shoulder (Schüldt et al, 1986). It is important to analyze all working postures, if possible, with respect to the position of joints. Preventive ergonomic strategies could be to avoid extreme and immobile work postures and to reduce the weight of the loads, to shorten the leverage of the loads and to use ergonomic aids when possible.

Pain from occupational cervicobrachial disorders (OCD) is a symptom commonly referred to in literature (Maeda, 1977; Jonsson, 1982; Hagberg, 1982, 1984). Epidemiological studies have shown increased incidence of such pain when working postures include heavy load on the arm muscles and/or static activity of the neck and shoulder (Kuorinka and Koskinen, 1979; Luopajärvi et al, 1979; Bjelle et al, 1981).
Figure 1 shows a model of factors related to such occupational cervicobrachial disorder (Kvernström, 1983).

Figure 1. A hypothetical model showing the connection between factors contributing to occupational cervicobrachial disorders and static workload.
The factors provoking occupational cervicobrachial disorders (OCD) can be divided into two categories i.e. in what way the workers use their musculature and the conditions in which the job is organized into the work system and is controlled (Maeda, 1977). Time factors such as long work spells and lack of rests are important causal factors. The disease is a functional and organic disorder occupationally produced on the basis of muscular and mental fatigue resulting from static and/or repetitive exertion of the arm and hand muscles. OCD may occur in any task that imposes static load on postural muscles of the neck and shoulder region as well as static and/or dynamic load on arm and hand muscles. The advance of OCD would be promoted by both daily work load and insufficient recovery of fatigue in off-duty hours. The symptoms developing at the mild stage of the disease are mainly stiffness and dullness at the neck and shoulders. General symptoms of OCD are headache, heaviness in the head, irritability, forgetfulness and sleep disturbance. Daily repeated severe fatigue may eventually lead to chronic fatigue which is accompanied by increased irritability, a tendency to depression, general weakness in drive and dislike for work. A vicious circle may occur. Pain due to acute muscle fatigue or tendovaginitis would stimulate the sympathetic nervous system and decrease blood flow in the muscles by way of vasoconstriction by which static contraction of the muscles is even more liable to induce pain. (Maeda, 1977). Mental fatigue is liable to accompany sleep disturbance which makes it difficult for the worker to recover from fatigue. Important factors when preventing occupational cervicobrachial disorders may be ergonomic improvement decreasing the physical work load, limitations of the workspeed and output per day and revision of the work control system to allow the workers spontaneous rests.
2.3 References

Bjelle, A., Hagberg, M. & Michaelson, G.:  
Occupational and individual factors in acute shoulder - neck disorders among industrial workers.  
British Journal of Industrial Medicine, 38: 356-368, 1981.

Björksten, M. & Jonsson, B.:  
Endurance limit of force in long-term intermittent static-contractions.  

Brodin, H.:  

Chaffin, D.:  
Localized muscle fatigue. Definition and measurement.  

Ekholm, J., Arborelius, U. P., Nemeth, G.,  
Harms-Ringdahl, K. & Schüldt, K.:  
Biomekanik och muskelaktivitet vid träningsevenemang i arm- och handområden.  
In proceedings, Scandinaviskt symposium i Fysiologi, Rehabilitering; pp. 281-301, Köpenhamn, 1981 (In Swedish).

Cranjean, E.:  
Fitting the task to the man. An ergonomic approach.  

Hagberg, H.:  
Work load and fatigue in repetitive arm elevations.  
Hagberg, H.:
Electromyographic signs of shoulder muscular fatigue in two elevated arm positions.

Hagberg, H.:
Arbetsrelaterade besvär i halsrygg och skuldra.
Arbetarskyddsfonden 2, 1982 (In Swedish).

Hagberg, M.:
Occupational musculoskeletal stress and disorders of the neck and shoulder: a review of possible pathophysiology.

Hagberg, M. & Sundelin, G.:
Discomfort and load on the upper trapezius muscle when operating a word processor.
Ergonomics, 29, 0, 1986.

Harms-Ringdahl, K.:
An assessment of shoulder exercise and load elicited pain in the cervical spine.

Herberts, P., Kadefors, R., Högfors, C., Sigholm, G.:
Shoulder pain and heavy manual labour.

Jonsson, B.:
Measurement and evaluation of local muscular strain in the shoulder during constrained work.

Kilbom, A., Persson, J. & Jonsson, B.:
Disorders of the cervicobrachial region among female workers in the electronic industry.
Kilbom, A. & Persson, J.:
Work technique and its consequences for musculoskeletal disorders.

Kuorinka, I. & Koskinen, P.:
Occupational rheumatic diseases and upper limb strain in manual jobs in a light mechanical industry.

Kvarnström, S.:
Occurrence of musculoskeletal disorders in a manufacturing industry with special attention to occupational shoulder disorders.

Luopajärvi, T., Kuorinka, I., Virolainen, M. & Holmberg, M.:
Prevalence of tenosynovitis and other injuries of the upper extremities in repetitive work.

Maeda, K.:
Occupational cervicobrachial disorder and its causative factors.

Möller, M.:
Athletic training and flexibility.
Linköping University Medical Dissertations, No 182, Sweden, 1984.

Nordin, M.:
Methods for studying work load.
Gothenburg University Medical Dissertations, Dept. of Orthopaedic Surgery, Sweden, 1982.


Öberg, B. Lower extremity muscle strength in soccer players. Linköping University Medical Dissertations, no 190, Sweden, 1984.
3. **THE WORKING ENVIRONMENT OF CRANE COUPLERS**

3.1 *Crane coupling*

Within the iron and steel industry large quantities of products, e.g. sheet metal, beams, rods or tubes are handled by overhead cranes. People working with preparing and coupling loads to the overhead cranes are called crane couplers and there are about 25,000 of them in Sweden. Traditional crane coupling is today carried out through cooperation with a crane driver who operates the crane and the coupler who secures various types of hoisting gear round the load. The physical stress in crane coupling varies mainly with the appliances and methods used (fig 1 a - c) and the performance rate. Various types of lifting appliances can be coupled to the hook. Fibre slings (weight 4.5 - 5 kg) are mostly used when the products are cold and chains (weight 14 kg) when they are hot (fig 1 a, b). Chains are used even with cold materials despite the heavy weight. Spacers of various types are put between the loads to keep them separated. Wooden spacers (weight 2.5 - 3.5 kg) are normally used when the products are cold, rail spacers (weight 11 - 16 kg) when they are hot (fig 1 c). The work often involves holding and handling the material at a distance of 30 to 100 cm from the body which increases the biomechanical load. Production layout and work organisation often determine the way fibre slings and chains are handled. They are usually slinged around the products (fig 1 a). But when there is little space around the material stands the crane coupler has to release the slings from the crane hook, place them round the load and couple them again to the hook (fig 1 b). Radio control is a new working method where coupling is combined with operating the crane as well (fig 1 a). This implies a rationalization as the crane operator is released for other duties. Transition to radio control is
assumed by the safety representatives to affect performance rate as well as physical stress. The work rate in crane coupling is self-paced. However it is often strongly affected by the number and importance of actual orders present and social group pressure.

3.2 Decisions regarding occupational injuries

At the present time there is no scientific documentation available concerning the exact limits of acceptable physical strain. Practical rules are used today in order to decide whether or not a job has harmful effects, when dealing with the question of occupational injuries. An occupational injury decision is always taken in two steps. The first step is to determine if there is any harmful effect in the actual job. This can be done by electromyography, registering the muscular activity in relevant muscles on healthy individuals. If there is any harmful effect then the second step is to determine if the actual clinical symptoms have any relation to this harmful effect. This can be done by comparing the results of a medical study, including clinical investigation of the musculoskeletal system, with results from an EMG-study on healthy individuals. If there is a correspondence between the clinical symptoms and the EMG-findings in relevant muscles the actual job could be a contributing factor to actual symptoms. However, since the work load during leisure time also can have harmful effects on the muscles in question the effects of leisure time activities must also be checked and excluded.

In accordance with this frame of reference a questionnaire study, a medical study and an EMG-study have been done of crane couplers.

The aim has been to identify important aspects of physical strain in crane coupling work as contributing factors to musculoskeletal disorders and as a result of this provide appropriate suggestions for improvement.
Fig. 1. A crane coupler slings (a) and pulls (b) a chain around the load. In (c) a rail spacer is put on top of the upper load. The underlying loads are separated by wooden spacers. In (a) the coupler wears a box for radio control of the crane.
3.3 A Questionnaire study

3.3.1 Introduction

People working with preparing and coupling loads to overhead cranes within iron and steel industry are called crane couplers. Traditional crane coupling is today carried out through cooperation between a cranedriver, who operates the crane and the coupler who secures various types of hoisting gear round the load. A typical worksituation consists of slinging a chain around the load and coupling it to a hook and pulling wooden spacers between the loads. The work also involves risky moments as walking or running long distances on oily floors between the couplings or climbing on hot material. Problems of physical strain and risks of accidents are supposed to be considerable. No study has been made of work environment problems in crane coupling. The aim of this questionnaire was to describe the work environment problems of crane couplers, including physical strain and musculoskeletal symptoms. The level of perceived physical strain can probably be described as high in crane coupling work. A high frequency of musculoskeletal symptoms can probably also be found. The study was made in order to facilitate protective work within the Swedish Iron and Steel Works Association and the Swedish Metal Workers Union as well as within the Social Insurance Service and the National Swedish Insurance Board.

Note. This article is based on technical report 1982:-058T, Luleå University of Technology, Luleå, 1982. A Swedish version is published in Nordisk ergonomi (Gard, G. Krakopplarnas arbetsmiljö, en enkätstudie, Nordisk Ergonomi i forskning och praxis, 1, 1988).
3.3.2 Material and methods

Test group

The questionnaire study included all crane couplers at SKF in Hofors and at Smedjebacken/Boxholms Stål AB in Smedjebacken who in May 1982 were occupied at least 75% of their time with crane coupling. These two companies were selected to participate in the study, representing one large and one smaller steelworks. A total of 145 crane couplers were included. Due to sick leave or holiday a dropout of 21 subjects were registered, 124 crane couplers participated in the study. The number of dropouts was equivalent in Hofors and Smedjebacken.

Questionnaire

Data was collected by a questionnaire which was filled in during working hours. (appendix 1). The survey dealt mainly with musculoskeletal symptoms and physical strain, but also with physical and psychosocial aspects of the working environment. The questionnaire was validated in a pilot study before the main study.
3.3.3 Results and discussion

Musculoskeletal symptoms

The results showed that 70% of all crane couplers experienced symptoms from some part of the body the past year. 40% regarded their symptoms as related to their present work. Musculoskeletal symptoms from the upper part of the body (head, neck/shoulders) dominated followed by the lumbar region, the knees and feet (Table 1).

Table 1. The prevalence of musculoskeletal symptoms in different body regions among crane couplers, compared to the total number of crane couplers in each group. Men (n=88) and women (n=36)

<table>
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<tr>
<th>Crane couplers with symptoms from</th>
<th>Men %</th>
<th>Women %</th>
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<tr>
<td>Neck</td>
<td>30</td>
<td>46</td>
</tr>
<tr>
<td>Shoulders</td>
<td>26</td>
<td>30</td>
</tr>
<tr>
<td>Elbows</td>
<td>14</td>
<td>25</td>
</tr>
<tr>
<td>Wrists/hands</td>
<td>14</td>
<td>18</td>
</tr>
<tr>
<td>Lumbar region</td>
<td>25</td>
<td>48</td>
</tr>
<tr>
<td>Hips</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>Knees</td>
<td>13</td>
<td>26</td>
</tr>
<tr>
<td>Feet</td>
<td>17</td>
<td>24</td>
</tr>
</tbody>
</table>

A comparison of the prevalence of musculoskeletal symptoms between some other occupational groups showed that crane couplers had a high prevalence of symptoms from the neck and shoulders compared to other groups comparable to manufacturing workers (Ydreborg and Kraftling, 1987). Crane couplers had a lower prevalence of symptoms than dental hygienists (Hedberg and Lipping, 1981), who work with the arms abducted almost all the time with a high physical strain on the shoulder and neck. Crane couplers had a lower prevalence of musculoskeletal disorders from all different body regions than railway station workers, whose level of physical strain is supposed to be high (Brulin et al., 1985).
They also had a higher prevalence of symptoms from the shoulder/neck region than women and men selected at random (Westling and Jonsson, 1980). Musculoskeletal symptoms from all parts of the body were more common among women than men in the present study. The usually lower length among women could be one possible explanation. Crane coupling implies working on different distances from the floor according to the height of the material in the material stands. When coupling the highest load of pipes in a material stand of 220 cm the coupling is done close to maximal backward flexion of the neck and forward flexion of the arm, probably implying musculoskeletal fatigue and pain. The differences in muscular strength between women and men may also explain differences in the frequency of symptoms. Women also have more demanding tasks even during their "off-work" hours e.g. carrying children, housework etc.

The frequency of musculoskeletal symptoms in different body regions varied among crane couplers between different age groups. The frequency of symptoms dominated in the age groups "25 - 34 years" and "more than 55 years". Usually the frequency of symptoms increases with age (Brulin et al, 1985). There can, however, be a decrease in prevalence of complaints in older groups due to the "healthy workers effect" (McMichael, 1976), but this was not relevant for the crane couplers. One explanation to the high frequency of symptoms in the age group 25 - 34 years could be that people with minor symptoms change their job voluntarily or are transferred to crane coupling. Of all crane couplers 55 % began the job because they wanted to leave or had to leave their previous work which could have been physically demanding and a possible cause of the actual symptoms perceived. The frequency of symptoms in different body regions also increased with increasing employment time.

Radio control is a new working method, in which the crane coupler operate the overhead crane as well.
A total of 24% of the crane couplers worked with the aid of radio control. Of the ordinary crane couplers 64% reported symptoms from the neck and shoulders, compared to 50% of those working with radio control.

The majority of crane couplers using radio control have done so for less than three years i.e. a relatively short period of time. The number of work-related symptoms tended to increase with the length of time they had been working with radio control. That the ordinary crane couplers had a higher frequency of symptoms than the others may be due to the fact that their time of exposure was longer. Other investigations have indicated that exposure time in a task is important for the prevalence of complaints (Brulin et al, 1985; Westgaard and Aarås, 1984).

Physical strain

A majority (75%) of the crane couplers considered their work to be heavy or physically strainful. Table 2 exemplifies the most important reasons given by the crane couplers.

Table 2. Percentage distribution of yes-answers to the question “Do you consider your work to be heavy?” (n=124).

<table>
<thead>
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<th>Yes, due to:</th>
<th>%</th>
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</thead>
<tbody>
<tr>
<td>Unsuitable equipment</td>
<td>42%</td>
</tr>
<tr>
<td>Slippery or uneven floor</td>
<td>36%</td>
</tr>
<tr>
<td>Long way to walk</td>
<td>35%</td>
</tr>
<tr>
<td>Unsuitable working postures</td>
<td>34%</td>
</tr>
<tr>
<td>Lifting too heavy or unsuitable</td>
<td>27%</td>
</tr>
<tr>
<td>Cramped space</td>
<td>18%</td>
</tr>
</tbody>
</table>

Physical strain due to the reasons in table 2 were considered as important working environment problems for crane couplers compared to other occupational groups answering the same questions (Ydreborg and Kraftling, 1987).

A majority (65%) of the crane couplers considered their work to be sometimes so tiring that they find difficulty
in doing anything after working hours, e.g. taking exercises, meeting friends. Only 8% of the crane couplers judged the work to have become, on the whole, less strenuous during the last few years.

A hypothetical model has been developed illustrating possible factors contributing to occupational cerviobrachial disorders (OCD) (Kvarnström, 1983). These factors are very relevant in relation to the high frequency of symptoms in crane coupling work as they can develop into OCD through mechanisms of local muscular fatigue and pain. The model deals with factors influencing either the static work-load or the exposure time in repetitive manual work.

Crane coupling is a repetitive work, probably with a high static workload on the right shoulder/neck and arm region. A too high work rate including competition and lack of spontaneous rests are work-organisational factors of great importance for the perceived level of physical strain. A high noise and poor illumination level, cramped space implying a forced work posture and/or unsuitable working methods or equipment including heavy manual lifts can possibly be other factors influencing this level. Insufficient introduction in work or psychosocial stress due to alienation, worries about illness or social pressure can be other relevant factors increasing the level of physical strain. Insufficient physical training may be another such factor. All these factors may be relevant when explaining the high frequency of symptoms in crane coupling work.

The present study also showed that physical working environment problems like a high noise level, draught, cold climate and frequent changes in temperature were perceived by about 50% of the crane couplers as physically strenuous. A comparison with an investigation by the Swedish Workers Union (Bolinder et al, 1981) showed
that the frequency of physical working environment problems among crane couplers are higher than those among the Swedish Metal Workers Union.

This general frequency was also higher than the average among the Swedish Workers Union. The noise level was decided to be one of the greatest problems in the physical environment according to steel workers (SOU 1975:83). On the whole, 35% of the crane couplers were of the opinion that they had to take too big risks in their work. Using radio control implied an increasing risk for accidents according to 45% of the crane couplers. There were also practical problems when using the safety equipment. Only 75% used helmets frequently.

The most important causes of accidents were, according to the crane couplers in the questionnaire study slowly moving material or old damaged chains and slings. These physical working environment problems may increase the level of perceived physical strain and may be possible contributing factors to the high frequency of symptoms in crane coupling work.

A high frequency of psychosocial problems was noted. The present study showed that crane coupling implies a great deal of adaptation to the work rate of others (80%), monotony (65%) often in combination with a high level of attention (90%) and responsibility (80%). Such factors could also be possible contributing factors to the high frequency of symptoms in crane coupling work.

3.3.4 Conclusions

The present study showed that the level of physical strain in crane coupling was perceived as high. Unsuitable, monotonous postures and movements (34%), heavy lifting (27%) and long walking distances (35%) were common reasons for regarding crane coupling as a physically strenuous work. That the equipment e.g. chains
and spacers are heavy and difficult to handle (42 %) and that the floor often is slippery (36 %) are other important reasons mentioned. A high frequency of musculoskeletal symptoms particularly from the shoulder/neck region was perceived by the cranecouplers.

Physical environment problems as a high noise level, draught, cold climate and frequent changes in temperature as well as psychosocial problems and risks of accidents were also common.
3.3.5 References

Bolinder, E., Magnusson, E., Nilsson, C. and Rehn, M.:
Vad händer med arbetsmiljön?

Brulin, C., Jonsson, B. and Karlehagen, S.:
Musculoskeletal troubles in railway station workers.
A descriptive epidemiological study.

Hedberg, G. and Lipping, H.:
Yrkesförarnas hälsotillstånd - en enkätstudie,

Kvarnström, S.:
Förekomst av muskel-och skelettsjukdomar i en verkstadsindustri med särskild uppmärksamhet på arbetsbetingade skulderbesvär.

McMichael, A. J.:
Standardized Mortality Ratios and the "Healthy Worker Effect". Scratching Beneath the Surface.

SOU. 1975:83.:

Westgaard, R. H. and Aarås, A.:
Postural muscle strain as a causal factor in the development of musculoskeletal illnesses.
Westling, D. and Jonsson, B.:

Ydreborg, B. and Kraftling, A.:
3.4 A Medical study of cranecouplers with musculoskeletal symptoms

3.4.1 Introduction

Musculoskeletal symptoms and disorders may develop as a consequence of high physical and/or psychosocial strain during working or nonworking hours. The questionnaire study of crane couplers indicated that musculoskeletal symptoms were very common among crane couplers (Gard et al., 1982). In fact 70% of all crane couplers experienced symptoms the past year, particularly in the head, neck or shoulders. The questionnaire study showed that unsuitable monotonous postures and movements, heavy lifts and long walking distances were the most common reasons for regarding crane coupling as a physically strainful work.

No clinical examinations has previously been done of musculoskeletal symptoms among crane couplers. The aim of the present study was to describe musculoskeletal symptoms among crane couplers at one small and one medium sized steelworks. The aim was also to investigate whether or not underlying medical causes or overstrain during non-working hours could be contributing factors to the symptoms.

Note. This article is based on technical report 1984:20T, Luleå University of Technology, Luleå, 1984. A Swedish version was published in Nordisk ergonomi (Gard, G. Krankopplarnas arbetsmiljö – en medicinsk studie av krankopplare med besvär från rörelseorganen, Nordisk ergonomi i forskning och praxis, 1, 1988).
The present study was made in order to provide background information for those dealing with occupational injuries, e.g. physicians, the Social Insurance Service, National Swedish Insurance Board, and also to facilitate protective work in the Swedish Iron and Steel Works' Association and the Swedish Metal Workers Union.

3.4.2 Material and methods

Medical examination

Patients. Crane couplers at SKF in Hofors (a medium sized steelworks) and at Smedjebacken/Boxholms Stål AB in Smedjebacken (a small steelworks) participated in the examinations. All those showing current symptoms with a duration of more than fourteen days at the time of their yearly medical examination in 1984 were selected to participate. According to this criterion 32 crane couplers out of a total of 150 in Hofors and 14 out of 40 crane couplers in Smedjebacken were selected.

The examination procedure. The medical examination consisted of an anamnesis, a general examination and laboratory and clinical tests. The anamnesis was registered according to a particular framework concentrating on causal relationship to musculoskeletal illness. The general examination consisted of medical examination of the heart and lungs, a neurological test and notation of anthropometric data.

The clinical tests were concentrated on clinical findings related to muscles and joints, including palpation, range of movements and tests of root involvement. The laboratory tests included blood pressure, blood values, blood sedimentation reaction and determination of liver enzymes (ASAT, ALAT), electrolyte status and tests regarding rheumatic illness (Waaler-Roose, ANF).
Criteria for evaluation of symptoms

The criteria when judging patients' symptoms were palpation pain, diagnosed tendinitis, restricted movement and confirmation of nerve root involvement (Brodin, 1981). These criteria can be classified as illness or precursors of illness due to overstrain (Hagberg, 1982 b).

When judging palpation pain the expression "threshold of pain" (lowest observable sensation of pain) was used because it is not possible to make an objective assessment of the actual degree of pain. Palpation pain was recorded at a point when the patient indicated that the threshold of pain was passed. The diagnosis tendinitis was given when a patient indicated pain from actual palpated muscle attachments when the tested muscle was loaded isometrically, when passively stretched to its maximal length or when palpated. Active and passive movement of all joints was examined. Joints were loaded slightly at the extended position which gave an impression of tolerance to pain and also the character of the resistance, i.e. "end-feel" (Brodin, 1981). The degree of movement was measured. Notes were made of joints displaying restricted movement. Nerve root involvement was confirmed when three or more of the following signs were observed:

- Radiation of pain when compressing the nerve root
- Sensory disorder corresponding to dermatome
- Radiation of pain when stretching the nerve root
- Hypotrophy corresponding to myotome
- Tenderness corresponding to myotome
- Weakness of muscle corresponding to myotome
3.4.3 Results and discussion

Anamnesis

The crane couplers reported symptoms of muscular fatigue and pain from several parts of the body in particular the right shoulder and neck region. A majority (53%) were of the opinion that the symptoms increased in intensity towards the end of the working day and were directly related to their work as crane couplers (61%). Examples of relevant operations mentioned were lifting and slinging of chains, walking/running on hard oily floors, and climbing on piles of material. Most of the crane couplers (61%) also answered yes, when asked if they regarded their work as heavy or physically strainful. Lifting and carrying of spacers and chains and the high frequency of working postures with the arms above shoulder height were possible causes mentioned. Only three patients were of the opinion that leisure time activities of some kind may have caused or contributed to their complaints. Of the 46 crane couplers examined 32 (69%) were engaged in physically demanding activities during leisure time, mostly normal physical training exercises. Seven patients had changed their spare time activities as a result of musculoskeletal complaints. Four patients mentioned activities that could possibly have affected the course of their disorders, namely; gardening, building maintenance/house building, forestry and football (Table 1). The effects of leisure time activities could have contributed to the development of the disorders in question.
Table 1. Reported leisure time activities, exerted parts of the body, and complaints, demonstrated by four patients engaged in particularly demanding activities.

<table>
<thead>
<tr>
<th>Patient</th>
<th>Spare time activity</th>
<th>Assumed load on:</th>
<th>Symptoms from:</th>
<th>Patient believes that relation exists</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Gardening</td>
<td>Shoulders, back, knees</td>
<td>Lumbar region, shoulders</td>
<td>No</td>
</tr>
<tr>
<td>2</td>
<td>Building maintenance house building</td>
<td>Neck, shoulders, back</td>
<td>Left shoulder, lumbar region, left hip</td>
<td>Yes</td>
</tr>
<tr>
<td>3</td>
<td>Forestry, farming</td>
<td>Back</td>
<td>Lumbar region, legs</td>
<td>No</td>
</tr>
<tr>
<td>4</td>
<td>Football</td>
<td>Knees</td>
<td>Knee, hip</td>
<td>Yes</td>
</tr>
</tbody>
</table>

General examination

The medical examination showed that four patients had symptoms from the heart and three patients had some neurological symptoms. Background data for the patients and reference populations are shown in appendix 1. The broca-index was estimated to indicate if any of the patients had overweight. With broca-index 1,1 as a limit (Hedberg and Lipping, 1981 acc. to Rössner) 33% of the patients were overweight, primarily men. The distribution of broca-index for the crane couplers compared to a reference group is illustrated in appendix 2.

Laboratory tests

The laboratory tests showed that two of 15 women and five of 29 men deviated from normal values, probably due to some medical illness. Thus for seven of the 46 patients the laboratory results indicated that the influence of some medical illness could not be excluded.
Clinical tests

A dominance of clinical findings was noted from the upper part of the body with a concentration on the right neck- and shoulder region. Table 2 illustrates the most common objective observations.

Table 2. The most common clinical findings related to muscles examined.

<table>
<thead>
<tr>
<th>Muscle</th>
<th>Number of Patients</th>
<th>Clinical observations: palpation pain/tendinitis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trapezius, upper, dx</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Biceps longus dx</td>
<td>13 (2 with tendinitis)</td>
<td></td>
</tr>
<tr>
<td>Extensor carpi radialis dx</td>
<td>11 (4 with lat epicondylit)</td>
<td></td>
</tr>
<tr>
<td>Flexor carpi radialis</td>
<td>2 (with tendinitis)</td>
<td></td>
</tr>
<tr>
<td>Levator scapulae dx</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Trapezius, upper, sin</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Supraspinatus dx</td>
<td>7 (1 with tendinitis)</td>
<td></td>
</tr>
<tr>
<td>Piriformis dx</td>
<td>1 (with tendinitis)</td>
<td></td>
</tr>
</tbody>
</table>

Palpation pain was noted in the right shoulder/neck-muscles, particularly in muscles active in forward elevation of the arm, flexion of the elbow and dorsal flexion of the wrist. Tendinitis were noted particularly in muscles active when coupling the chain on the yoke (supraspinatus, extensor carpi radialis dx) and when carrying chains and spacers (biceps longus dx) (table 2). Restricted movement in the joints was noted in nine patients. The restriction could be a result of static strain in the muscles or degenerative changes in the joints. All the patients with restricted movement also had notable clinical findings. Six patients had different signs of nerve root involvement, three of these together with other clinical findings. The signs of nerve root involvement observed were radiation of pain when compressing the nerve root, sensory disorder corresponding to dermatome, radiation of pain when stretching the nerve root and weakness of muscle corresponding to myotome.
The clinical observations shown in table 2 may have arisen as a reaction to local muscular strain. The reaction may have been immediate, delayed or prolonged (Hagberg, 1982).

Immediate symptoms such as mechanical failure or ischemic effects occur during or immediately after work. Delayed symptoms could be caused by ultrastructural ruptures, exudative peritendinitis, ischemic lesions or energy depletion and are most severe 2 to 5 days after work. Prolonged symptoms such as degenerative tendinitis, chronic myalgia or reactive tendinitis may last for months, even years (Hagberg, 1982).

The immediate reactions to muscular strain in crane coupling is probably due to ischemic effects. When a muscle contracts the intramuscular pressure increases with the contraction level. In an isometric contraction (as when carrying spacers) even as low as 20% of the maximal voluntary contraction (MVC), the circulation of the muscle is impaired (Edwards et al, 1972). The impaired circulation results in accumulation of metabolites. If the contraction and the impaired circulation persist the accumulation of metabolites will cause such a low pH that the normal function of the muscle enzymes is inhibited (Sahlin et al, 1978). The muscle ischemia results in an impaired muscle function such as reduction in strength, coordination and endurance as well as in discomfort and pain.

The most common type of delayed symptom related to muscular strain is muscle soreness occurring 1 to 3 days after performing sporting exercises or occupational tasks (Hagberg, 1982). Ultrastructural muscle ruptures may be a possible cause of muscular symptoms only in extremely heavy work not in crane coupling work. However, inflammations of tendons induced by repetitive contractions as in exudative or degenerative tendinitis are a very relevant contributing factor to the symptoms of crane couplers. One important factor is probably repetitive forward flexion of the arm, very common in crane coupling work.
Particularly exudative shoulder tendinitis is likely in occupational tasks involving highly repetitive arm movements (Hagberg, 1982).

Virus infections are reported to reduce muscular performance for a long time (Friman, 1978). Thus an infection may predispose a crane coupler exposed to local shoulder muscular strain to reactive tendinitis/myalgia due to reduction of muscular tolerance. The pathogenesis of neck and shoulder disorders induced by local strain is still poorly understood. Local strain may cause a variety of pathological processes producing symptoms.

3.4.4 Conclusions

In summary the present study showed that clinical findings dominated in the right neck- and shoulder-region. The symptoms could in individual cases be due to overstrain during leisure time (4 patients). Laboratory tests indicated an underlying medical illness in 7 patients. The other patients symptoms may very well be related to physical and psychosocial strain in the crane coupling work.
3.4.5 References

Brodin, H.:
Rörelseapparatens funktionsrubbningar.
Studentlitteratur, Lund, 1981.

Edwards, R. H. T., Hill, D. K., and McDonell, M.:

Engdahl, S.:
Antropometriska mått – vuxna svenskar.

Friman, G.:

Gard, G., Wiklund, H. and Winkel, J.:
Krankopplarnas arbetsmiljö – en enkätstudie.

Hagberg, M.:
Local muscular strain – symptoms and disorders.

Hedberg, G. & Jansson, E.:
Skelettmuskelfiberkomposition, kapacitet och intresse för olika fysiska aktiviteter bland elever i gymnasieskolan.
Universitetet och Lärarhögskolan i Umeå, Pedagogiska Rapporter nr 54, Umeå, 1976.
Hedberg, C. & Lipping, H.:
Yrkesförarnas hälsotillstånd - en enkätstudie.

Sahlin, K., Alvestrand, A., Brandt, R. and Hultman, E.:
Intracellular PH and bicarbonate concentration in human muscle during recovery from exercise.
Appendix 1. Mean (M), Standard deviations (SD) and Range (R) for the variables age, length of employment, height, weight and strength of hand grip of the patients examined and some reference populations.

<table>
<thead>
<tr>
<th></th>
<th>Group of Patients Hofors and Smedjebacken (n=46)</th>
<th>Industrial workers at SKF in Gothenburg (1)</th>
<th>Swedish upper secondary school students (&quot;norm group&quot;) (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Men (n=29)</td>
<td>Women (n=17)</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>38.8</td>
<td>25.4</td>
<td>16.1</td>
</tr>
<tr>
<td>SD</td>
<td>12.7</td>
<td>12.2</td>
<td>0.33</td>
</tr>
<tr>
<td>R</td>
<td>63.0</td>
<td>25-49</td>
<td>0.35</td>
</tr>
<tr>
<td></td>
<td>Men (n=85)</td>
<td>Women (n=77)</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>42.3</td>
<td>35.0</td>
<td>16.1</td>
</tr>
<tr>
<td>SD</td>
<td>12.2</td>
<td>5.0</td>
<td>0.35</td>
</tr>
<tr>
<td>R</td>
<td>61.0</td>
<td>25-49</td>
<td>0.35</td>
</tr>
<tr>
<td></td>
<td>Girls (n=205)</td>
<td>Boys (n=223)</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>174.5</td>
<td>151.4</td>
<td>166.4</td>
</tr>
<tr>
<td>SD</td>
<td>7.1</td>
<td>5.7</td>
<td>6.5</td>
</tr>
<tr>
<td>R</td>
<td>192.0</td>
<td>176</td>
<td>6.2</td>
</tr>
<tr>
<td></td>
<td>Weight (kg)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>77.2</td>
<td>56.8</td>
<td>62.7</td>
</tr>
<tr>
<td>SD</td>
<td>10.7</td>
<td>7.7</td>
<td>9.1</td>
</tr>
<tr>
<td>R</td>
<td>94.5</td>
<td>76.6</td>
<td>116</td>
</tr>
<tr>
<td></td>
<td>Strength of grip, right hand (kp/cm²)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>1.02</td>
<td>1.01</td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td>0.21</td>
<td>0.21</td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>0.60</td>
<td>0.60</td>
<td></td>
</tr>
</tbody>
</table>

(1) Engdahl, 1974
(2) Hedberg and Jansson, 1976
Appendix 2. Distribution of Broca index for crane couplers and reference group.

<table>
<thead>
<tr>
<th>Broca index</th>
<th>Crane couplers</th>
<th>Professional drivers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Men</td>
<td>Women</td>
</tr>
<tr>
<td>0.70 - 0.79</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>0.80 - 0.89</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>0.90 - 0.99</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>1.00 - 1.09</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>1.10 - 1.19</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>1.20 - 1.29</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>1.30 - 1.39</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.40 - 1.41</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>29</td>
<td>27</td>
</tr>
</tbody>
</table>
3.5 An Electromyographic study of work methods and equipment in crane coupling


3.5.1 Introduction

People working with preparing and coupling loads to the overhead cranes within the iron and steel industry are called crane couplers. There are about 25,000 of them in Sweden. According to a previous questionnaire study among 124 crane couplers (30% females) (Gard et al, 1982) their main work environment problems are physical strain and risk of accidents. Complaints of the locomotor system during the last year were indicated by 70% of the crane couplers; the right shoulder/neck region was indicated most frequently. Examination of 46 of these patients (37% females) (Gard et al, 1984) showed that clinical findings dominated from the same parts of the body. In addition, for the majority of the patients inflammatory rheumatic diseases and high physical strain during leisure time seemed not to be the main causes of the complaints.

Four significant variables were particularly important in relation to physical stress in crane coupling work according to the presentation of the work (page 13). The influence of these parameters slinging/pulling, fibre slings/chains, wooden/rail spacers and traditional coupling/radio control as well as performance rate seemed to be important to analyse in relation to physical stress.

The present investigation was undertaken to (1) determine if crane coupling implies too high physical strain on healthy female workers and (2) suggest ergonomic solutions to such problems if they occur.
3.5.2 Materials and methods

Subjects

Seven professional female crane couplers participated in the study. Prior to the experiments they were interviewed and subjected to a medical examination regarding musculoskeletal status and anthropometric data (Table 1).

Criteria for taking part were that they (1) displayed no musculoskeletal symptoms, (2) did not deviate too much from the normal Swedish female population with regard to height, weight and strength of the muscles to be examined and (3) were experienced crane couplers.

Workstation

The work was carried out in the cold-working shop as SKF in Hofors (Sweden). Two ordinary material stands (height 220 cm) were placed at a distance of 18 metres from one another (Fig. 1 page 51) which corresponded to a typical distance of product transportation. One of the material stands carried four loads of 4.3 metre long tubes. The subjects were instructed to move each of the loads separately to the second material stand. When this was full the loads were moved back again and so on during a 40-minute period. Globe temperature at the working area was about 21.5°C.

Experimental design

Five different work situations were studied. Four of them differed in one respect from the fifth, (Fig 2 page 51). In the reference treatment, the work was carried out in a way that was regarded as typical for SKF. The crane was run by a crane operator, iron chains and wooden spacers were used and the crane coupler coupled the load by slinging the chain round the load. In the remaining 4 situations the effects of pulling the chain,
rail spacers, fibre slings and radio control were investigated. Thus, it was possible to evaluate the effects of each of these parameters on the physical strain reactions. Each subject performed in all 5 work situations on the same day. Rest periods of 30 minutes were put in between the treatments, and the sequence of these was randomized. Four muscles were studied (Fig 3): m trapezius pars descendens dx and sin, m biceps brachii dx and m extensor carpi radialis brevis dx. These muscles were selected from film analyses of crane coupling work, where all relevant muscles were analysed according to postures, movement and possible load, since it was assumed that the physical load on these muscles might be the highest. Moreover, the most common symptoms experienced by crane couplers might have been due to overstrain in these muscles, (Gard et al, 1984).

Electromyography (EMG)

The muscular load was evaluated by vocational electromyography. The myoelectric activity was recorded telemetrically from the above mentioned 4 muscles (Fig 1).

The radio receivers (Medinic, 1C-600) were located in a room about 90 metres from the workstation. The radio system was modified with regard to transmitter frequencies, aerial, aerial amplifier, radio frequency filters at the amplified inputs etc, so good signal quality could be obtained even in the very difficult electrical environment of a steelworks. The signals were stored on a FM tape recorder (Racal Store 4). The details concerning instrumentation, calibration and analysis of the EMG-signals have previously been described by Jonsson (1982), Hagberg (1981) and Winkel (1985). A calibration between EMG and force was obtained for all 4 muscles by slowly increased isometric test contractions preceding the experiments (Winkel, 1985). A power function was used
to describe this relationship and only correlation coefficients $\geq 0.95$ were accepted. The amplitude probability distribution function (APDF) of the EMG signals during each work task was then converted to an APDF of the relative force of contraction ($\%$ MVC) (Hagberg, 1981; Jonsson, 1982). From this, the static and the peak contraction levels were obtained for the time studied. Analyses were based on the total working period (40 minutes). This was necessary because of the relatively long duration of each work cycle (about 2 minutes for each load and 8 minutes for all 4 loads in the material stand).

Other measurements

Heart rate (HR) was recorded every 5th minute during the work period by cardiometer 275 telemetry system (Cardionics AB). Simultaneously the overall level of rated perceived exertion (RPE) was assessed by the subjects on an numerical scale (Borg, 1970). Performance rate was determined by counting the number of loads moved during the work period. Before starting the experiments each subject was instructed to work at her own normal work rate. Immediately after each treatment the subjects were asked to rank the actual rate of performance according to the following scale: much slower, slightly slower, as usual, slightly faster or much faster than their normal work rate.

Statistics

Three-way analyses of variance (ANOVA) were used to test for differences in load levels between the right and left trapezius muscle (right/left x treatment x subject). The Minitab computer programme (Ryan et al, 1982) was used for the remaining statistical analyses. One-sample $t$-tests were used. All $p$-values presented are one-tailed according to the following hypotheses: The zero-hypothesis was that strain reactions and rate of work during the
reference work did not differ from those during the other four work situations.

- One counter-hypothesis was that the level of physical strain was greater and rate of work slower when the chain was pulled rather than slung round the load and when rail spacers rather than wooden spacers were used.

- Another counter-hypothesis was that the level of physical strain was lower and rate of work faster when fibre slings rather than chains were used.

- A third counter-hypothesis was that the level of physical strain and rate of work were reduced when the crane was operated by the crane coupler rather than a separate operator.

The zero-hypothesis was rejected if \( p < 0.05 \).

3.5.3 Results

Fig. 4 illustrates the mean values of RPE, heart rate and performance rate for the 5 treatments. Fig. 5 shows the muscular load levels obtained for the 4 muscles examined. The static load level (\( P: 0.10 \)) indicates that muscular strain (in % MVC) was lower than this level for 10% of the recording time. The peak load levels correspond to \( P: 0.90 \). The hatched bands across the bars in Fig. 5 indicate suggested threshold limit values for muscular strain of a duration of one hour or more (Jonsson, 1982). The bars marked by * in Fig. 4 and 5 indicate that these values differ significantly from the corresponding values obtained for the reference work. The peak load levels were significantly higher in the right trapezius muscle compared to the left one.
In 33 of the 35 experiments (7 subjects x 5 treatments) the subjects indicated that they had been able to work at their normal rate. In one case the opinion was "A little slower" and in another "A little faster".

3.5.4 Discussion

Job-related disorder

Crane coupling implies high static and peak load levels in the shoulder muscles (mm. trap. desc. dx and sin) in all five treatments, particularly on the right side. For the biceps muscle only the peak load levels are high. The extensor carpi radialis brevis muscle shows the lowest exposure to physical stress.

Thus, the results suggest that crane coupling work may cause harmful effects primarily in the shoulder/neck region (trap. desc. dx et. sin). Too high strain levels may also occur in the biceps muscle, particularly when pulling the chain round the load and when using rail spacers. Only the extensor carpi radialis brevis muscle showed an acceptable strain in all five treatments.

This information has afterwards been used by the National Swedish Social Insurance Office in their decisions concerning crane couplers' suspected job-related disorders. According to Fig. 6 such decisions are taken in two steps. First, it is decided if the type of work may imply any harmful effects. The present data suggest that this is the case for crane couplers (see above). The next step is to determine if actual clinical symptoms have any connection to these effects. Interviews and medical examinations of crane couplers with musculoskeletal symptoms indicate that underlying medical diseases or too high strain due to leisure activities may only be a possible contributing factor to the symptoms in 9 out of 46 cases (Gard et al., 1984). The remaining patients all had clinical symptoms from the shoulder/neck region with a dominance in the right side. Location of complaints and
high physical strain therefore seem to agree. Based on this information the insurance office decided to accept complaints from the shoulder/neck region as occupational injuries for several of the patients. It should be emphasized that the present study does not suggest a relationship between lateral epicondylitis (4 of the 46 patients investigated by Gard et al, 1984) and crane coupling, as the load levels in the extensor carpi radialis muscle were low.

Ergonomic solutions

The study indicates that the investigated changes in equipment (fibreslings/chains, wooden/rail spacers) and methods (slinging/pulling, traditional crane coupling/radiocontrol) affect the peak muscular load levels but not the static load levels. The slinging of fibre slings rather than chains results in a modest but significant reduction in perceived exertion as well as strain in 3 of the 4 investigated muscles. It is presumed that these effects will be greater if the sling has to be lifted off the hook and put back again (pulled, see fig. 1b page 15) rather than slung around the load. Consequently the use of chains should be avoided as far as possible.

When using spacers made of rail rather than wood the heart rate increases significantly (classified as "high") in spite of reduced performance rate. In addition, the strain increases significantly in 3 of the 4 muscles. Light spacers which can be used when hot products are handled should therefore be developed.

When the chain must be lifted off the hook (pulling, see fig. 1b page 15) the performance rate decreases because of the extra time needed for this procedure. In spite of this, the strain in all investigated muscles increases and the HR is classified as "high". A comprehensive reduction in physical strain may therefore be obtained by replanning the layout in the steelworks so that slinging is always possible.
When working with radio control, production capacity is reduced to 2/3. However, performance per employed worker increases by about 35% as the crane drivers are no longer needed. Rationalisation often results in an increased strain but this does not apply to the present situation. The RPE-levels, the heart rate and the local muscular strain were all reduced. Our film analyses of crane coupling suggested that introduction of radio control does not imply any significant increase in load on other muscles.

3.5.5 Conclusions
* The first conclusion is that the level of physical strain on the neck/shoulder and right arm is high in all the five treatments studied and that crane coupling work may result in harmful effects particularly in the shoulder/neck region.

* The second conclusion is that working with radio control decreased the RPE, the HR and the local strain on all muscles recorded.

* As practical implications for ergonomic changes it may also be concluded that the level of physical strain in crane coupling can be reduced by using wooden or other light weight spacers, by rearranging the layout and reorganizing the work so that slinging always is possible and by using slings made of fibre or other light weight material.

The greatest reduction in strain may be achieved by combining the use of radio control with the use of lightweight spacers and slings which do not need to be lifted off the yoke during work. These changes will also result in considerable rationalization. A lightweight spacer used when handling hot material should be developed.
Acknowledgements

This investigation was supported by grants from the Swedish Work Environment fund. We wish to express our appreciation to the investigated crane couplers, to Hans Viklund, Lars Brundin and Karl-Axel Berg (research engineers), Thord Lewin (industrial physician), Ulrik Sundbäck (professor) and the reference group for the projekt for valuable assistance and advise.
3.5.6 References

Borg, G.:  

Christensen Hohwü, E.:  
1976 Occupational Safety and Health Series, No. 4, pp 9. Man at work - studies on the application of physiology to working conditions in a sub-tropical country.

Engdahl, S.:  

Gard, G., Lewin, T., and Winkel, J.:  

Gard, G., Wiklund, H., and Winkel, J.:  

Hagberg, M.:  

Hedberg, G. and Jansson, E.:  
Jonsson, B.:  
Measurement and evaluation of local muscular strain  
in the shoulder during constrained work.

Ryan, R.A., Joiner, B.L., and Ryan, B.F.:  
1982 'Minitab reference manual'. Statistics Department,  
Pennsylvania State University.

Winkel, J.:  
1985 'On foot swelling during prolonged sedentary work  
and the significance of leg activity'. Arbete och  
hälso 1985:35. National Board of Occupational  

Winkel, J., Ekblom, B., Hagberg, M., and Jonsson, B.:  
1983 'The working environment of cleaners. Evaluation of  
physical strain in mopping and swabbing as a basis  
for job redesign'. In: T.O. Kvålseth (Ed).  
Ergonomics of Workstation Design. Butterworth,  
London, Chapt. 4, pp 35-44.

Winkel, J., Ekblom, B & Tillberg, B.:  
1980. Physical work load on cabin attendants in civil  
University of Luleå, Sweden. (In Swedish).
LEGENDS TO FIGURES

Fig. 1. The experimental set-up.

Fig. 2. The experimental design. The reference experiment (centre) was compared with each of the remaining four situations. Thus the effect of pulling the chain (A), using rail spacers (B), fibre slings (C) and radio control (D) could be evaluated separately.

Fig. 3. Location of the 4 muscles investigated by EMG.

Fig. 4. Mean values of subjective ratings of perceived exertion (RPE) (top), heart rate (middle) and work rate (bottom) for the 5 treatments (n=7). Each of the shaded bars should be compared with the white reference bar to the left (cf Fig 3).
A heart rate of 125 min⁻¹ is indicated by a dotted line across the bars. According to Christensen (1976) a heart rate higher than this value may correspond to "heavy" physical work. For further details, see text.

Fig. 5. Mean levels of muscular strain in the 4 investigated muscles for the 5 treatments (n=7). Each of the shaded bars should be compared with the white reference bar to the left. For further details, see text.

Fig. 6. An illustration of an occupational injury decision in Sweden according to the rule of evidence 2:2, Swedish Industrial Injuries Act.
Table 1. Age, weight, height, grip strength and maximum isometric muscular strength on elevating the right shoulder (standing) of the investigated crane couplers and five healthy female reference populations.

<table>
<thead>
<tr>
<th>Crane couplers examined</th>
<th>University students (1)</th>
<th>Air (1) hostesses school students</th>
<th>Secondary cleaners (3)</th>
<th>Cleaners (4)</th>
<th>Industrial workers (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(N = 7) Mean (SD)</td>
<td>(N = 6) Mean (SD)</td>
<td>(N = 6) Mean (SD) (N = 205) Mean (SD)</td>
<td>(N = 6) Mean (SD)</td>
<td>(N = 77) Mean (SD)</td>
<td></td>
</tr>
<tr>
<td>Age, years</td>
<td>41 (6)</td>
<td>25 (7)</td>
<td>27 (2) 16.1 (0.3)</td>
<td>26 (8)</td>
<td>25 - 49</td>
</tr>
<tr>
<td>Weight, kg</td>
<td>68 (8)</td>
<td>56 (6)</td>
<td>61 (5) 57 (8)</td>
<td>69 (8)</td>
<td>65 - (9)</td>
</tr>
<tr>
<td>Height, cm</td>
<td>166 (7)</td>
<td>166 (4)</td>
<td>168 (3) 166 (6)</td>
<td>164 (5)</td>
<td>164 - (6)</td>
</tr>
<tr>
<td>Grip strength kPa</td>
<td>90.16 (16.66)</td>
<td>-</td>
<td>-</td>
<td>98.98 20.58</td>
<td>-</td>
</tr>
<tr>
<td>Elevation, right shoulder, N</td>
<td>497 (89)</td>
<td>458 (71)</td>
<td>520 (50)</td>
<td>579 (75)</td>
<td>-</td>
</tr>
</tbody>
</table>

1. Winkel et al, 1980  
2. Hedberg & Jansson, 1976  
3. Winkel et al, 1983  
4. Engdal, 1974
FIG. 4.
FIG. 5.
FIG. 6.
CONCLUDING DISCUSSION ON PHYSICAL STRAIN

4.1 What About Crane Coupling?

Decisions regarding occupational injuries have been dealt with in three studies. An important question before making these studies was, "Does the work of crane coupling have any harmful effects on the shoulder/neck region?".

A survey was first made to identify problems in the immediate working environment of crane couplers. A survey cannot prove any harmful effect or any causality, but it can show if there are any perceived problems in the working environment, and the relevance and severity of these problems. The questionnaire study showed that crane coupling is considered as a physically heavy work due to for example bad working postures and unsuitable working equipment. During the previous 12 months, 70% of the crane couplers experienced musculoskeletal symptoms from the body, particularly from the head, neck and shoulders. One possible explanation to this high percentage of musculoskeletal symptoms is that people who already have minor symptoms change their job voluntarily, or are transferred, to crane coupling. Of all crane couplers, 55% began the job because they wanted to leave, or had to leave, their previous work which could also have been physically demanding and a possible cause to the actual symptoms perceived. This explanation also makes it more understandable that the crane couplers had such a remarkably high percentage of symptoms in relation to the relatively short time of employment.

The number of symptoms is supposed to increase with increasing length of employment, but in fact 40% of the crane couplers were of the opinion that their actual job was the most important contributing factor to their symptoms. The medical study showed that clinical signs dominated from the neck and right shoulder. For the majority of the patients medical factors or physical strain
due to leisure activities could be excluded as possible contributing factors to the symptoms. The EMC-study of physical strain during crane coupling showed that the work can possibly have "harmful effects" on the region of the neck and shoulder. A high level of physical strain was found in the trapezius muscle on both the left and right side and in the right biceps muscle, especially when lifting iron material or when coupling above shoulder height.

For the majority of the patients in the medical study it is probably true that there are no important reasons against a relation between the injury and its harmful effect. Their symptoms from the trapezius and biceps muscles could, according to the practical rules for decision making in regard to occupational injury, be regarded as work-related symptoms or disorders. The medical evaluation also showed that lateral epicondylitis is common among crane couplers. The work is possibly not the direct cause of these symptoms, since the level of physical strain in the extensor carpi radialis brevis muscle was not high. However, the work could be one contributing factor among others. Hard work during leisure time, or strenuous activities such as tennis or badminton, could be other such factors.

As the shoulder muscular activity levels required to induce fatigue, and probably pain, change with the duration of exposure, the time of exposure as well as the work load are important parameters when discussing contributing factors to work-related muscular symptoms. The time of exposure in crane coupling varies, but when carrying or handling material the exposure to static work load in relevant muscles of the shoulder may probably be higher than the acceptable limit of 5% MVC. In crane coupling, working with the head in an extreme forward or backward flexed position, arms raised to an end position, and the back in a forward flexed and rotated position is common. To work with joints in extreme positions provokes fatigue and pain.
The work also involves handling of material held at a distance of 30 to 100 cm from the body which increases the biomechanical load. Local muscle fatigue, when putting on the sling, can possibly increase the risk of symptoms from the shoulder and neck. Frequent extension of the neck when operating the gantry can give rise to similar symptoms. A 25 to 100 metre walking distance between couplings, bad work postures, together with heavy exertions when frequently climbing over oily iron material can probably contribute to the symptoms from the hips and lower back.

What can be done to prevent the development of musculoskeletal symptoms in crane coupling? To reduce the level of physical strain it is necessary to avoid extreme working postures, to reduce burden weight, and to use ergonomic aids. This can be done in crane coupling by avoiding extreme extension of the neck and flexion of the right shoulder, by improving cooperation with the crane operator so that coupling can be done at a shorter distance from the floor. The weight of the slings being handled today varies between 5 and 14 kilo, and this weight can be reduced by using slings made of fibre material which can withstand high temperatures. The weight of the iron spacers used between the products (11-16 kg) could also be reduced by making them in another material tolerating hot temperatures. Work organisational changes (short pauses, workrotation etc.) could be another way to reduce the level of physical strain.
5. **PSYCHOSOCIAL STRAIN AND PSYCHOSOMATICS: A THEORETICAL FRAMEWORK**

5.1 **Psychosocial strain**

5.1.1 **Introduction**

There is a growing awareness that exclusion of psychosocial considerations distorts perspectives and interferes with patient care. There is a need to expand the dominant biomedical model of disease into a broader biopsychosocial medium (Engel, 1977), in which psychological stress has a key role, as Hamburg and Adams (1967) pointed out, "Nowhere are the needs and opportunities for progress in biobehavioral sciences clearer than in problems of health and behavior. Behavioral factors contribute to much of our burden of illness." Important questions are: How do physiological responses to the psychosocial environment affect the working individual? Which factors in the working environment activate physiological stress responses? When are these stress responses adaptive and health promoting and when are they maladaptive and potentially health damaging? A critical question is, "How does stress influence adaptional outcomes such as well-being, social functioning and somatic health?"

Stress research has been based on different psychological theories depending on the part of the stress process or the type of variables that is focused on. Wallius (1989) found in her comparative review of the coping process three main groups according to focus of interests, i.e. stimulus-based approaches, response-based approaches and interactional approaches and classified stress research according to these categories.

The theory of stress deals with three separate but independent levels of analysis, i.e. social, psychological and physiological (Lazarus, 1966). The most stressful transactions take place socially, at the individual
psychological level. The mind then perceives and evaluates the events with respect to their personal meaning and shape, the emotional reaction as well as the course of action (Lazarus, 1966).

5.1.2 Towards a Cognitive-phenomenological perspective

The past thirty years have witnessed some fundamental changes in the way stress is conceptualized (Coyne & Lazarus, 1980). The basic questions are no longer, "Under what conditions of stress does human performance deteriorate?" and, "Who are the people most vulnerable to such deterioration?". The limitations of simple drive and tension reduction and linear stimulus-response concepts have become apparent. Psychological stress can now be viewed as a general rubric for different related processes of person-environment transaction concerning emotions, motivations or cognitions in which demands tax or exceed the resources of the person (Coyne & Lazarus, 1980). Stress is not simply an environmental stimulus, a characteristic of a person, nor a response, but a balance between demands and the power to deal with them without unreasonable and destructive costs. This "cognitive-phenomenological" perspective emphasizes how a person can appraise what he or she experiences and use the information later on to shape the course of events. Such a perspective seems to be realistic, because the appraisal of an ongoing relationship with the environment, for one's wellbeing leads to behaviour consistent with the personality, as in real life. Stressful contact with the environment thus involves psychological mediation and feedback-loops which cannot be reduced solely to terms of stimulus and response. The nature of stress phenomena thus requires some comprehensive model within a transactional, process-orientated perspective (Coyne and Lazarus, 1980).
Until this model i developed, table 1 may be useful in illustrating system variables for the stress rubric.

<table>
<thead>
<tr>
<th>Causal Antecedents</th>
<th>Mediating Processes</th>
<th>Immediate Effects</th>
<th>Long-term Effects</th>
</tr>
</thead>
</table>

**Person Variables:**

Values, commitments and goals

General beliefs, e.g.,
- Self-esteem
- Mastery
- Sense of control
- Interpersonal trust

Existential beliefs
- Secondary appraisal changes

**Environment Variables:**

Coping (including use of social support)
- Quality of environmental outcome

Demands
- Resources, e.g., social support network
- Constraints
- Temporal aspects

**Table 1. System variables for the stress rubric (Lazarus et al. 1985).**

How people interact with their environment is an important research problem in many branches of psychology. The basic assumption is that environmental effects are mediated through the perception of actual situations (Bronfenbrenner, 1977).
How to explain that a given, or similar, environment is perceived differently by individuals? A situation might cause a stress reaction in one person but not in another. This implies some sort of evaluation of the information processing by the individual (Wallius, 1989). Such questions put the emphasis on individual differences and cognition, motivation and emotion.

In the cognitive-phenomenological approach; emotion, motivation and stress are seen as shaped by cognitive processes, by the way a person construes ongoing relationships with the environment (Lazarus & Launier, 1978). The way a person thinks, feels or acts is a product of the interaction of external situation characteristics and personal characteristics. The interest is on the process or dynamics of the situation, i.e., "What is actually happening in a stressful situation", and "How to change what is happening". The process of evaluation, "The cognitive appraisal" activity can be of two main kinds, primary and secondary. Primary appraisal refers to the process of evaluating the significance of a transaction for one's wellbeing. "Am I in trouble or not?". The appraisals come in three forms, irrelevant benign-positive or stressful. There are three subtypes of stressful appraisals, harm/loss, threat, or challenge. Harm/loss refers to damage already done, threat can be the same injury but also something that has not yet occurred. Challenge means an opportunity for growth, mastery or gain. These distinctions can be important not only in the process of stress and coping but also have different effects on morale and somatic health. One hypothesis about the causes of threat and challenge is that the former is more likely when a person assumes the environment to be hostile and dangerous, and he or she lacks the resources to master it, while challenge arises when the environmental demands are seen as difficult but not impossible to manage (Lazarus, 1966).
Second appraisal answers the question, "If I am in trouble what shall I then do about it?". A number of possible environmental factors probably contribute to appraisal, including the imminence of harm, its ambiguity, the power of environmental demands to do harm and the duration of the demands. Among person-centred determinants, the general and specific beliefs about oneself and the environment and the pattern and strength of values and commitments are particularly important (Lazarus, 1966).

5.1.3 Coping in stress situations

The control, buffering or inhibition of stress by the individual is called coping. Coping is a mediating process in conjunction with primary and secondary appraisal. Coping denotes all kinds of behaviour that an individual can perform in order to affect his or her own stress process. Coping can be actions, emotions, cognitive processing or restructuring, conscious as well as unconscious, and the outcome of coping may be either successful or unsuccessful. Coping in stress situations has two major functions for solving problems and for regulation of emotional stress. Firstly, to change the situation if we can by changing actions or the threatening environment and, secondly, to manage the somatic and subjective components of stress-related emotions themselves so that they do not undermine morale and social functioning. In a recent treatment of coping (Lazarus & Launier, 1978) four main coping modes were identified, i.e. information seeking, direct action, inhibition of action and intrapsychic processes. Effective coping often calls more for inhibition of impulses to act rather than the making of direct action. Mechanisms such as denial, reaction formation and projection, can function as intrapsychic processes minimizing emotional distress. To really assess coping you must describe what the person is doing and thinking in specific situations. A pattern-description of an individual's actions which could be compared with the actions of other individuals is a possible approach, developed originally by Lazarus (1966).
5.1.4 Coping and health

Health can be viewed as a product of effective coping. There is a growing consensus that the way a person copes with stress is an important modifier of the stress-disease relationship (Lazarus, 1981). Three types of processes tend to link behaviour to physical illness: (1) direct alterations in tissue function through the brain's influence on hormone production and other physiological responses to psychosocial stimuli, particularly stress; (2) health-impairing habits and lifestyles, such as excessive smoking, heavy drinking, lack of exercise, poor diet and poor hygienic practices; and (3) reactions to illness, including minimization of the significance of symptoms, delay in seeking medical care, and failure to comply with treatment and rehabilitation regimens (Nizetic et al, 1983). The variations in coping strategies employed for each kind of process linking behaviour with physical illness depend on a number of factors related to (1) an individual's life, i.e. the combination of variables that define the person who is confronted with a stressor (e.g. intelligence quotient, learning potential, value and belief system, self-esteem, sense of control, age and socioeconomic status); and (2) the current situation, i.e. factors that facilitate the coping response such as having friends who provide emotional support (Nizetic et al, 1983).

It has been hypothesized that coping might influence health outcomes through at least four pathways (Coyne & Holroyd, 1982). First by affecting the frequency, intensity and patterns of the physiological mobilization that predisposes to certain disorders but not to others. Life events of predictable as well as unpredictable nature constitutes an inevitable aspect of human experience and may produce stress that exceeds an individual's coping ability. This stress can be a factor in the onset of a wide variety of physical and psychosocial illnesses and can also increase the severity of existing symptoms.
The second pathway by which coping influences health is in the manifestation of physiological symptoms or illness behaviour (Coyne & Holroyd, 1982). Physiological symptoms may be learned or maintained because they serve coping functions. Thirdly, coping may contribute to disease because it involves changes in health behaviour that expose individuals to noxious agents such as alcohol, tobacco smoke or allergens. Stressful life events may increase tension, which then increases the probability that a person will use for example heavy smoking as coping strategy. When symptoms co-vary in a systematic manner with the occurrence of stressful events, there is a tendency to ignore the possibility that symptoms are triggered by changes in health behaviour” (Coyne & Holroyd, 1982).

The fourth pathway through which coping can influence health is the way a person copes with the threat of acute illness or the demands of chronic illness; this can be a significant factor in determining the course of the illness and the medical care received. Most people have characteristic attitudes towards the experience of illness probably shaped by past personal experience and knowledge. Specific coping strategies are directly related to the patient's understanding of an attitude towards illness or disability (Lipowski, 1970). For example, people who perceive illness as a challenge are likely to be inspired to react actively to it, seek advice in time, be cooperative and actively seek additional information specifically related to the illness. For other people who view illness as weakness and as a moral loss of control, the primary coping strategy is likely to be to deny or conceal the illness. Lipowski includes six other categories of meaning attributed to illness: (1) illness as enemy; (2) illness as punishment; (3) illness as relief; (4) illness as strategy; (5) illness as irreparable loss or damage; and (6) illness as value (Lipowski, 1970).
5.1.5 A Cybernetic model of Stress

Cummings & Cooper (1979) propose a cybernetic model of stress based on the work of Miller (1965). The model is problem-solving orientated. Cybernetics or systems control, is concerned with the use of information and feedback to control purposeful behaviour. The basic premise of the theory is that behaviour is directed at reducing deviations from a specific goal state and that these deviations direct the behaviour.

The stress concept is related to a drive toward homeostasis. When forces disrupt a variable beyond its range of stability the organism must react to restore its steady state. A stress is any force displacing a variable beyond its range of stability, which produces strain within the organism. Knowledge that stress is likely to occur constitutes a threat to the individual. The totality of strain within an individual represents its values, and the relative urgency of reducing the strain denotes the individual's hierarchy of values. The variables stress (independent), strain (mediating), and adjustment processes (dependent), are suitable in operationalizing the empirical components in this field. Four different phases of the stress cycle can be identified in a cybernetic model, i.e. detection of strain, choice of adjustment process, implementation of adjustment process, and effects of adjustment processes on the situation of stress or threat. Each of these phases includes a number of information-processing operations of importance to the perceived strain and the adjustment process (Wallius, 1989). This perspective has been widely used in biological, physical and social sciences to explain how systems adjust or adapt their actions to cope with disturbances from goal achievement. Much stress-research has often implicitly followed a cybernetic framework (Mc Grath, 1976).
5.1.6 The problem of confounded measures

Most models of stress irrespectively of their explicit assumptions conceptualize stress as a causal process, with interacting variables and sometimes feed back loops. In actual research these causal relations have been studied one by one due to two problems, i.e. methodological difficulties in analyzing causally interrelated variables and the problem of confounded measures involved in the analysis of chains of interrelated variables (Lazarus et al, 1985). The independent variable for example role conflict or quantitative overload and the measurements of the dependent variable for example work strain or distress are sometimes so close operationally that they appear to be simply two similar measures of a single concept (Lazarus et al, 1985). If it is true then nothing really important will be learned about the functional connection between stress as a condition of life and the health outcome. Instead of proposing a causal model Lazarus et al (1985), provide a set of system variables within a multiprocess system, with coping as a mediating process (Wallius, 1989). In this system there may be some variables confounded but this is a fusion in nature and not measurement error. This approach to stress gives special emphasis on the choice of design, measurement and analysis, so the problems of confounded measures are minimized.
5.1.7 References

Bronfenbrenner, U.

Coyne, J. C. & Lazarus, R. S.


Lipowski, Z.J. Physical illness, the individual and the coping process. Psychiatry in medicine, 1:91-102, 1970.


5.2 Psychosomatics

5.2.1 Introduction

The word psychosomatics is defined as "involving or depending on both the mind and the body as mutually dependent entities" (Svensson, 1983). The nature of psychosomatic disorders was first regarded as a punishment by the Lord for sins committed by the sick person (Jensen & Jensen, 1976). The meaning we today put into the term psychosomatic has gradually developed during the last century and is related to models for pathogenesis of disorders. The two major theoretical positions during this development regarding causal factors and disease is the legacy of Selye (1956), who equated stress and disease and of Alexander who emphasized the psychogenic aetiology of illness (Stein, 1986).

Selye focused on a non-specificity theory, in which agents such as infection, heat, cold or restraint produced a systemic reaction, a stereotype physiological response to any non-specific stimulus (Selye, 1956). Alexander postulated a specificity theory for certain disorders, and believed that certain emotional conflicts tend to affect certain internal organs; the aetiology varied from hereditary and organic factors to personal and family relationships. His hypothesis asserted that a nuclear conflict, the defences against it and the emotions engendered by it, tended to correlate with a specific "vegetative" response. Later on, such linear causality from emotions to disease has come to be regarded as inadequate to account for the development of most human morbidity.

Two different research traditions are the basis for the models developed in this field: the reductionistic and the holistic perspective (Engel, 1977). In the reductionistic tradition the researcher often tries to find somatic factors which may explain the pathogenesis of the illness. An illness is a mechanical breakdown, a matter of
"destroyed parts". Such a model assumes that if one does not know the cause of some disease then some chemical change is supposed to be the primary cause. According to the holistic tradition, psychosomatic disorders develop through a continuous cooperation between physical, psychological and social factors in the environment. Two concepts are of particular importance in this tradition, "organic change" and "signification". Organic change implies pathological changes in organs. Signification takes the existential being into account. A psychosomatic disorder may be understood in the meaning of the disorder. An understanding in holistic terms can lead to ideas for therapeutic procedures on two levels. One may include concrete steps, like trying to change family and work structures. At a deeper level one may ask, "What is the meaning of the disorder?". Treatment at this level can involve therapies in which insight is the final aim (Svensson, 1983).

5.2.2 Physiological responses to the psychosocial environment

Physiological responses to the psychosocial environment are always reflected its impact on the working individual (Frankenhaeuser, 1985). Even relatively minor changes in work environment are reflected in changes in blood pressure and heart rate as well as in adrenal medullary and adrenal cortical secretion. Two neuroendocrine systems are of primary interest in this process (Frankenhaeuser & Johansson, 1986). One is the sympathetic-adrenal medullary system with the secretion of the catecholamines adrenaline and noradrenaline; the other is the pituitary-adrenal cortical system with the secretion of cortisol. Both systems are controlled by the brain. This means that when a person perceives a stressful event in the environment, messages go to the adrenal cortex which secretes cortisol, and to the adrenal medulla which secretes the catecholamines adrenaline and noradrenaline. The adrenal hormones then act on most cells and tissues in the body. Situations of stimulus
under- and overload activate these systems (Frankenhäuser & Johansson, 1986). In highly mechanized and automated work with a low level of personal control over the work process conditions of over- and underload will trigger the adrenal medullary and adrenal cortical response. In the short term these neuroendocrine stress responses appear to be beneficial whereas in the long term they may lead to cardiovascular diseases.
5.2.3 References


6. STRESS AND QUALIFICATION AT ADMINISTRATIVE COMPUTER WORK

This chapter is based on

6.1 Introduction

The problem of changes in the attitude to working with computers during a forced or sudden computerization has been relatively little studied. There is also the question of how new users of computers will react to computerization psychologically and physiologically during a longer period. One pattern of reactions to computerization might be an initial period of increased work satisfaction and a reduction of social interaction (Grünbaum, 1982; Westlander and Söderman, 1985). Another pattern will emerge when an insufficient amount of time is provided for learning the new skills. Earlier studies show for example that the amount and type of computer work as well as the work organisation affects the experience of computerization.

Rigidly structured tasks with long periods of work at computer terminals and monotonous filing routines affect computer users in a negative way mentally and bodily (Johansson and Aronsson, 1984). The results also indicate that the higher a person's position at work, the more opportunities for using the computer as a tool according to her own needs, and the lower the position, the more risks that the computer will become a machine reducing social contracts and governing work strategies (Aronsson, 1984).

The computerization of certain tasks will of course change a person's experience of her work environment. Work can for example be perceived as more qualified but at the same time more charged with responsibility and mental work load.

The present study was designed to follow the computerization of economics and registry routines at the County Government Board in Luleå introduced in July 1986 during a longer period of time (about two years), partly to study the changing attitudes to computerization and partly to appraise the computerization from the point of view of work environment consequences.
Theoretical frame of reference

The strain experienced in a new situation (for example computerization of certain routines) can theoretically be expressed as the combined effect of new psycho-social stimuli and the unique position of the individual (Kagan and Levi, 1972). This strain can become a precursor to illness and possibly by various mechanisms lead to disease.

The way a person thinks, feels or acts is a product of an interaction between the properties of the situation and her own characteristics. Individual differences in for example attitudes, goals, self-confidence and experienced control of and reliance on the environment are factors which account for the variations in sensitivity to strain among different individuals (Lazarus et al, 1985). Work environments also differ with respect to demands for conformity and the availability of social support, causing differences in strain risks. Stress can be experienced as positive, i.e. as a challenge, or negative (distress), i.e. as a threat (Frankenhaeuser and Johansson, 1986). People often feel threatened when a change is experienced as strange and dangerous and there seems to be no possibility of coping with it, challenges are felt when a situation seems trying but not impossible to manage (Lazarus, 1966). Studies have shown that the lower the degree of control experienced at work, the larger the risk of distress and feelings of helplessness (Frankenhaeuser, 1985). Furthermore it is essential to distinguish between psychological and physiological stress. Increased demands at work are reflected in psychological as well as physiological stress (Frankenhaeuser, 1985). Any psychosocial change in the work environment can activate the neuro-endocrine system and trigger off those physiological and psychological reactions (increased wear and fear) which prepare the individual for fighting or escaping in a given situation. Over- and understimulation can often, in jobs with a low degree of personal control, create
situations where excessive or insufficient strain will trigger off adrenaline and cortisol excretion from the cortex via the sympathetic nervous system (Frankenhaeuser and Johansson, 1986). On a short view these physiological reactions are positive in that they increase or preparedness for effectively managing situations. On a long view they can cause cardio-vascular conditions (Henry and Stevens, 1977). In the construction of psychosomatic theories illness is often defined as deviations from a dynamic balance of physiological, psychological and social factors which reinforce each other (Carlsson and Jern, 1982). According to these theories there are no somatic diseases without emotional or social correlates and no mental illness without somatic symptoms. The effects of computerization over a longer period of time can therefore be studied partly from the point of view of psychological and partly from physiological reactions.

A model intergrating earlier knowledge, called the vitamin model (Fig 1) (Warr, 1987) has been developed in order to clarify through what processes different working conditions affect mental health. According to it mental health is influenced by the surrounding environment the same way that vitamins affect physical health: Vitamins are beneficial to physical health up to a certain level. Beyond that point the effect can be negative. Differences in age, gender, socioeconomic status, attitudes and abilities are other essential factors influencing the way a person is affected by a certain environment. The most important significance of personal characteristics according to the vitamin model is that they modify the effect of the environment on mental health. According to the vitamin model mental health is associated with five aspects; affective wellbeing, competence, autonomy, aspiration and integrative functioning.

Supplementing the model with somatic parameters is relevant in considering health consequences of the work environment. In order to be able to explain the occurrence
of body symptoms, physiological stress reactions etc, a psychosomatic vitamin model is proposed, including psychosomatic and physiologic reactions to the environment (and as part of the person characteristics). A psychosomatic vitamin model might have a wider range of application than Warr's vitamin model.

Figure 1. The psychosomatic vitamin model (Warr, 1987, modified by Gard and Brenner, 1989).

Research problem

One of the basic research question of the present investigation is how computerization affects working conditions and mental and psychosomatic health. Another question deals with how the actual change in environment (computerization) affects the mental or cognitive representation of the environment.
6.2 Method

Design

A study of work environment and health effects of the computerization of the economics and registry routines at the County Government Board in Luleå was made during a period of one and a half year in 1986 and 1988. The investigation included repeated questionnaires and parallel physiological measurements, and repeated GRID interviews. All 42 computer users at the economics and registry unit participated, all of them women.

Measurements

Procedure of measurement. On two occasions questionnaires were answered by all employees at the County board. The first questionnaire was sent out in June 1986 i.e. just before the computerization. The questionnaire included questions about the re-organization and computerization, experience of and attitudes to computers, present tasks, beliefs about how their future tasks would appear, health and well-being, etc. The purpose of his questionnaire was mainly to investigate if the computer users in any way differed from other employees at the County Government Board before the computerization and re-organization.

In November 1987 9 e about one and a half year later a shorter questionnaire was addressed to all employees. The purpose was to investigate whether the computerization and reorganization had involved the same kind of changes for the computer users as for the other employees at the County Government Board.

On five occasions spread out over slightly more than a year the computer users were exposed to questionnaires and physiological tests i.e. delivered blood samples and had their blood pressure measured. The blood samples were analyzed with respect to serum cortisol (stress
hormone). At each test occasion the computer users answered a short questionnaire about work contents, job satisfaction, and different symptoms of strain.

On two occasions (corresponding to the first and third physiological test and questionnaire) each of the computer users was interviewed in detail, the first time in connection with the computerization and at a second time about nine months later. The interviews were concerned with those factors and phenomena at work considered more or less distressing or stimulating. The interviews were carried out through the GRID technique, based on G. Kelly’s personal construct theory (Fransella & Bannister, 1977). Through this method each person can put together her unique experience of work contents (called elements) with her attitude to it using her own concepts (constructs). One person’s experience and evaluation of her working conditions on different occasions (in this case before and after computerization) or the different attitudes of different persons to similar working conditions (in this case computerization) can then be compared.

Scale construction. Questionnaire results from the last measurement of computer users and non-users were factor analyzed (Factor, SPSS-X) as a foundation for scale construction.

A factor analysis of the questions related to the working conditions gave four factors, namely responsibility, qualification, job satisfaction, and work-load/strain. The responsibility factor included questions of attention and responsibility at work. The qualification factor included questions of independence, qualification and meaning of work. The job satisfaction factor included questions about contacts with fellow-workers and superiors. The work-load/ strain factor contained questions on mental and physical strain and work-load.
An analysis of body symptoms gave the factors nervous symptoms, sleep symptoms, heart symptoms, fatigue symptoms, stomach symptoms and musculo-skeletal symptoms (symptoms from skeleton, joints and/or muscles).

With the factor analysis as a foundation, scales for all factors were calculated, the reliability within each scale being checked with Cronbach's alpha (Reliability, SPSS-X).

GRID interviews. The two GRID interviews resulted in two matrixes (GRIDs) for each person giving a quantitative relationship between each element (work factor) and each construct (concept through which the elements were evaluated). Three constructs were, if necessary, added to those provided by the interviewee, namely opportunity for control, non-distress (stimulation) and importance (salience). Each GRID was aggregated on these three constructs, giving a mean value on these for each person and each occasion.

Physiological measures. At five occasions blood samples were taken and analyzed for serum cortisol and other stress-related measures. Blood pressure was assessed at the same time (not reported here). The samples were taken in the morning before breakfast, and at the same time at each occasion.

6.3 Results

Work experience and the prevalence of symptoms
The working conditions before the computerization were considered satisfying and the mental health was satisfactory for both computer users to be, an the others. No significant differences existed between the two groups after controlling for gender and age. The working conditions were still satisfying and the mental health satisfactory after one year of computerization. Working with economics and registry tasks at at
computer at the County Government Board in Luleå was above all seen as responsible (79%) and independent (77%), demanding much attention (70%). Work contents as a whole were positively experienced, as meaningful (51%), interesting (51%) and exciting (32%). Nor was computer work experienced as physically strenuous by a majority (59%), but as varied (70%). On the other hand work was experienced as terribly busy by 47% of the secretaries and only 39% did not feel mental strain. The work was seen as demanding (44%) and qualified (47%). The results also show that the computer users felt most at ease with their work-fellows (83%) and superiors (70%). They were also satisfied with their responsibility at work (58%), the demands for skill (47%) and the work intensity (57%). The attitude to computers was very positive throughout (67%).

The computer users had few body symptoms but were above all troubled by headache, mental fatigue, general fatigue and muscular tension. In Brenner et.al. (1989) the questionnaire results are presented more in detail.

In this paper the emphasis is put on the main trend.

Change in working experiences and stress

Repeated questionnaires. The results from variance analyses of repeated measures (Reliability, SPSS-X) on questions given on five different occasions show a significant change concerning experienced work qualification. Work was experienced as more qualified at the three last measurements. The computer users considered at all five measurements that their work was qualified to some extent. At none of the five measurements was physical and mental strain at work experienced as particularly trying. Nervous symptoms almost never occurred at any of the five measurements. Sleep symptoms were rare or very rare, heart symptoms very rare. Fatigue symptoms appeared now and then, though comparatively rarely. Stomach symptoms and musculoskeletal symptoms appeared very rarely and rarely respectively at the five measurements.
Opportunity for control, degree of non-stress, and salience according to the GRID interviews. There was no significant change in opportunity for control or perceived stress between the two GRID interviews. However, the content (elements) of the GRIDs changed, dealing more with computer disturbances.

Cortisol level. The level of cortisol increased significantly (analysis of variance for repeated measures, \( p < .01 \)) from the two first occasions to the last three ones (approximately 50%). This change is too drastic to be ascribed to chance or to sources other than the computerization.

Correlation analyses

Pre-computerization measurements. A high level of experienced work qualification was significantly positively correlated with a high level of job satisfaction. Heavy strain at work had a significant positive correlation with a high frequency of sleep and heart symptoms. All psychosomatic scales were strongly correlated with one another. The correlations between nervous symptoms and the stomach and fatigue symptoms respectively were especially high. (table 1)

Table 1

Significant correlations (5% level) between conditions at work and psychosomatic health before computerization. (n=36)

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<th>variable</th>
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<td>.32</td>
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<td>sleep sympt.</td>
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<td>heart symptoms</td>
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Post-computerization measurements. A high level of experienced work qualification showed a positive correlation with an experienced heavy strain at work and a high frequency of nervous, sleep, heart and fatigue symptoms. High job satisfaction was negatively correlated with a low frequency of heart and stomach symptoms. (table 2). In addition, the participants evaluated the change that had taken place during the computerization (retrospectively). (table 3).

Table 2

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Table 3

Significant rank correlations (5% level) between evaluated change during the computerization. (n=33)

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<td>7. heart symp.</td>
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<td>8. fatigue symp.</td>
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<td>11. skin symp.</td>
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Note. The variables were measured by single questions asking about change for the better or worse in each aspect of work and health on a five degree scale (with no change as midpoint).

GRID measures. The correlations between opportunity for control and non-stress on element level covaried with degree of importance to work conditions ascribed to an element. The higher salience, the higher the correlation between control and non-stress. (figure 2). Since the correlations between control and non-stress were significant also on an aggregated level, an index was formed by the product of control and non-stress.
Figure 2. Correlations between opportunity for control and degree of non-stress dependent on degree of salience.

GRID measures related to change in cortisol level. There were negative, significant correlations between control and non-stress at occasion 1 and occasion 3 and change in level of cortisol from occasion 1 to occasion 3 (r = -.32, p < .01 and r = -.38, p < .01, respectively). The highest correlations were obtained for those with initial non-extreme cortisol values (cortisol level < 500) at occasion 1 (r = -.45, n=23, for occasion 2).
6.4 Conclusion

The results of a two year study of computerization of administrative work indicated that work after computerization was seen as very positive for example as to the experience of responsibility, job satisfaction, and qualification at work. The attitude to computers was very positive throughout. Health too remained good in the group as a whole: psychosomatic symptoms of various kinds seldom occurred. However, after the computerization perceived qualification presented significant correlations with a high frequency of nervous, sleep, heart and fatigue symptoms. Physiological stress increased too, the cortisol value increasing by 50% during the computerization period.

Thus the results give a picture of satisfying working conditions, good mental health - and drastically increased physiological stress. An analysis of stimulation and control, as measured by GRID interviews, relative the increase in physiological stress indicated that those with at the same time relatively lower opportunities of control and experiencing relatively more strain (less positive simulation), and a relatively low initial level of physiologic stress had a relatively larger increase in physiologic stress during the computerization. At least two interpretations are possible. Either, one could conclude that there has been a healthy mobilization, rather than a negative increase in stress, or that there is a dissociation between (good) mental health and physiologic stress. There is some evidence against the first interpretation, e.g. the positive correlation between simultaneous low control and distress and physiologic stress, especially for those with low staring values with regard to physiologic stress. Furthermore, in our opinion it is not to be taken for granted that a clear association should exist between measures of psychological and physiological stress. These measures are probably related in a nonlinear way, and modified by both person and situation characteristics.
The strong inter-individual variation in stress reactions to the same objective environment is an argument for obtaining precise measures of the perceived environment. The GRID technique might be an instrument that serves this purpose. The possibility that the relationships between mental and somatic reactions are nonlinear, speaks for a multidimensional approach to work and health, mental or psychosomatic, where one considers mental and body reactions to working conditions simultaneously.
6.5 References

Aronsson, G. Omstrukturering och kvalifikationskrav vid datorisering. Rapporter från Psykologiska institutionen vid Stockholms universitet, 1984, 42.


7. PHYSICAL AND PSYCHOSOCIAL OCCUPATIONAL STRAIN AMONG PATIENTS APPLYING FOR PRIMARY HEALTH CARE

This chapter is based on Gard, G. Physical, psychosocial and organisational strain in work: Studies within primary health care. Submitted to Scandinavian Journal of Caring Sciences, 1990.

Acknowledgements

I am grateful to Dr. Lars Olof Persson, University of Gothenburg for help with formulating the coping questions and to Dr. Lars Ake Idahl and Dr. Carl W Sandberg for constructive criticism and comments to the manuscripts.
7.1 **Introduction**

In most industrialized countries musculoskeletal complaints are one of the most common categories of illnesses. In Sweden, disorders of the musculoskeletal system are the prime grounds for sick leave and disability pensions (Wickström, 1982; Westerling and Jonsson, 1980; Riksförsäkringsverket, 1985). The underlying causes are regarded as multifactorial. It is likely that many of these complaints are caused or enhanced by workrelated physical and psychosocial strain. Although the processes of mechanisation and automation in working life may have reduced the level of physical strain on individuals this level may still be high due to awkward working postures, repetitive working movements and heavy materials handling (Hagberg, 1984; Westgard and Aarås, 1984; Maeda, 1977). Psychosocial strain have increasingly been cited as contributing factors to musculoskeletal complaints (Maeda, 1977; Coyne & Lazarus, 1980; Esbjörnsson, 1984). Good agreement has been found between musculoskeletal disorders and for example factors as lack of personal control, high concentration and a high level of responsibility in work (Magora, 1973).

The number of work injuries due to physical and/or psychosocial strain in work has also increased since the 1970’s particularly injuries due to psychosocial factors (SCB, 1988). More than 50 percent of all registered work injuries in Sweden may have been caused by physical and/or psychosocial strain in work (SCB, 1988). Contributing factors to this frequency may be an increased knowledge and awareness of the importance of physical and psychosocial risk factors as well as an actual worsening of the working conditions.
The aims of this study were twofold:

(1) to describe how patients applying for primary health care perceive physical and psychosocial strain as working environment problems.

(2) to study if patients with and without musculoskeletal disorders differ in their perception of psychosocial stress, opportunity for control of the job situation and how they cope with stress situations in work.
7.2 Theoretical frame of reference

The psychosomatic vitamin model (figure 1) (Warr, 1987) has been developed to clarify how different working conditions affect psychosomatic health. According to this model psychosomatic health is influenced by the surrounding environment in the same way that vitamins affect physical health. Vitamins are beneficial to physical health up to a certain level. Beyond that point the effect can be negative. The most significant aspect of personal characteristics, according to the vitamin model, is that they modify the effect of the environment on psychosomatic health. Environmental conditions actively influencing psychosomatic health are opportunity for control and skill use, the prevalence of externally generated goals, variety, environmental clarity, availability of money, physical security, opportunity for interpersonal contact and a valued social position. Opportunity for control is introduced first among the assumed foundations of mental health for an explicit reason. If the remaining eight environmental features have substantial impact upon mental health it may be that it is through influencing the level of those that a person can most directly affect his or her mental health. Opportunity for control may thus be important in determining the level of other features as well as contributing to mental health in its own right. The results from study 1 are interpreted within the limits of this vitamin model. The focus is on the factors opportunity for control and opportunity for skill use.

The control, buffering or inhibition of stress by the individual is called coping. Coping denotes all kinds of behaviors that an individual can perform in order to affect his or her own stress process. Coping in stress situations has two major functions for solving problems and for regulation of emotional stress. Firstly to change the situation by changing actions or the threatening environment and secondly to manage the somatic and subjective components of stress related emotions themselves. In a recent treatment of coping four main coping
modes were identified i.e. information seeking, direct action, inhibition of action and intrapsychic processes (Lazarus & Launier, 1987). These four coping modes are used when evaluating the results from study 2.

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<td><strong>ENVIRONMENTAL CONDITIONS</strong></td>
<td><strong>ENDURING PERSONAL CHARACTERISTICS</strong></td>
<td><strong>CURRENT MENTAL HEALTH</strong></td>
<td><strong>CURRENT PSYCHOSOMATIC HEALTH</strong></td>
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<td>1. Opportunity for control</td>
<td>A. Baseline mental health</td>
<td>Nervous symptoms</td>
<td>Start of mental health condition</td>
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<td>Affective well-being</td>
<td>2. Opportunity for skill use</td>
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<td>Sleep symptoms</td>
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<td>Competence</td>
<td>3. Externally generated goals</td>
<td>B. Demographic features</td>
<td>Heart symptoms</td>
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<td>Autonomy</td>
<td>4. Variety</td>
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<td>Fatigue symptoms</td>
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<tr>
<td>Integrated functioning</td>
<td>5. Environmental clarity</td>
<td>C. Values</td>
<td>Stomach symptoms</td>
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<tr>
<td>B. Demographic features</td>
<td>6. Availability of money</td>
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<td>Musculoskeletal symptoms</td>
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<td>Age</td>
<td>7. Physical security</td>
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<td>Sex</td>
<td>8. Opportunity for interpersonal contact</td>
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<td>Ethnic group</td>
<td>9. Valued social position</td>
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<td>C. Values</td>
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<td>D. Abilities</td>
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<td>Modifiers</td>
<td>ENVIRONMENTAL CONDITIONS</td>
<td>which may interact with</td>
<td>CURRENT MENTAL HEALTH</td>
<td>CURRENT PSYCHOSOMATIC HEALTH</td>
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<td>Recent health changes</td>
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<td>Integrated functioning</td>
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**Figure 1. The psychosomatic vitamin model (Warr, 1987, modified by Gard and Brenner, 1989).**
7.3 Method

Subjects

Patients applying for medical care at three primary health care centres participated in the first part of this study. The three centres were randomly selected. A total of 525 patients between 20-65 years participated, 175 patients from each primary health care centre. All visits to the physician, patients with acute as well as chronic illnesses, during two weeks in March 1984 were included in the study.

The second part of the study included 30 patients (aged 20-65) with and 30 patients (aged 20-65) without musculoskeletal disorders (controls), working as secretaries, industrial workers or teachers. The patients received physical therapy at a randomly selected primary health care centre during 2 weeks in October 1989. The controls were patients without musculoskeletal disorders, working in the same positions, receiving dental care at the same primary health care centre during the same period of time.

Questionnaire

The questionnaire used in the first part of this study was primarily based on questions used in the survey of living conditions of the Swedish population (SCB, 1979). Additional questions were made to answer more specific questions according to the hypothesis. The questionnaire was validated in a pilot study before the main study. The questions concerned physical strain (i.e. working posture, physical exertion) and psychosocial strain (i.e. perceived stress, opportunity for control of work planning, work rate and skill development) (appendix 2). Patients were asked to complete the questionnaire while waiting to see the physician and guidance was given in completing it by the receptionist.
The questionnaires used in the second part of this study were based on questions concerning psychosocial strain in work i.e. perceived stress, opportunity for control of work organisation and coping strategies (appendix 3). Valid coping questions have been received from the Institution of psychology, University of Gothenburg (Dr Lars Olof Persson, personal communication). The questionnaires were validated in a pilot study at the actual primary health care centre. Patients were asked to complete the questionnaire while waiting for the physical therapist or the dentist and guidance was given in completing it by the receptionist.

**Statistical analyses**

Statistical analysis in the first part of the study was performed by using chi-square tests (SPSS-X). Comparisons between the three primary care centres were made and no significant effects according to background factors (age, sex) were obtained. Since no differences were found the results from the three primary care centres were summated and used as one group. Due to language and/or medical reasons 11 of the patients did not answer the questionnaire. The total dropout was 2.1 percent. The question about "work" was an open question. The answers were summated in five groups: industry-farming-forestry, service, nursing, education and administrative work. Partial dropout i.e. unanswered or incorrectly answered questions were indicated to each question separately. That the total dropout was so low and can be due to the fact that the procedure was accepted as a primary health care routine.

Statistical analyses in the second part of the study was performed by using chi-square test (Epi info).
7.4 Results

Perceived physical and psychosocial strain among patients applying for primary health care

The patients in the first study perceived to a great extent physical and psychosocial strain as working environment problems. A risky or strenuous working posture was a problem according to 50% of the patients, heavy physical exertion with daily lifting and handling of materials was another physical strain problem (34%). A majority (61%) perceived their work rate as tiring, strenuous or dangerous almost every day. One fourth of the patients perceived often or always a high level of psychosocial stress in work. Low opportunity for control of work organisation was noticed, 42% of the patients perceived for example that they had no or a very low influence on the planning of the work or the work rate. One fourth of the patients had the possibility to decide when to take pauses and breaks in work. A high perceived level of physical strain was associated with a high perceived level of psychosocial strain. Patients working in strenuous working postures tended to have a more forced and hectic work rate (Chi-2 (9, N=369) = 72.85, p < 0.001), lower opportunity for control of work planning (Chi-2 (6, N=319) = 27.84, p < 0.001) and more limited possibilities for skill development in work (Chi-2 (6, N=359) = 24.62, p < 0.001), than the others. The same tendency was noted for patients with heavy exertion and lifting in work. They perceived a more forced and hectic work rate (Chi-2 (9, N=394) = 42.44, p < 0.001) lower personal control of the planning of their work (Chi-2 (6, N=346) = 18.87, p < 0.05) and more limited possibilities for skill development in work (Chi-2 (6, N=388) = 28.72, p < 0.001) than other patients. Low personal control of the work rate was associated with a low opportunity for control of planning of the work (Chi-2 (4, N=318) = 135.43, p < 0.001) and of the possibilities for skill development in work (Chi-2 (4, N=328) = 24.44, p 0.001).
The patients worked within different areas; industry-farming-forestry (32%), service (27%), nursing (19%), education (14%) and administration (8%). Secretaries, industrial workers and teachers were the most frequent positions. Distribution in relation to sex and occupation showed that male industrial workers and female secretaries were the largest groups in considering their working posture as uncomfortable, stressful or dangerous. Male industrial workers were the largest groups in regarding their work as physically strenuous. Male industrial workers and female secretaries were also the largest groups of patients who perceived their work rate as tiring, strenuous or dangerous. These occupational groups were also of the opinion that they more often experienced psychosocial stress in work compared to the others. Men worked mostly within industry-farming-forestry (44%) or service (36%) women within nursing (30%) or industry-farming-forestry (24%) (Chi-2 (4,N=389) = 57.87, p < 0.001). Patients working within nursing, industry-forming-forestry or service work perceived both the working posture (Chi-2 (12,N=346) = 44.41, p <0.001) and the physical exertion (Chi-2 (12,N=376) = 75.89, p < 0.001) in work more strenuous, risky or heavy than patients within other working areas. They were also of the opinion that they to a lesser extent than the others had possibilities for skill development in work (Chi-2 (8,N=360) = 31.59, p < 0.001). The problem of opportunity for control of the work organisation was also particularly noticed within the industry-farming-forestry, nursing- and service sector. For example perceived on average over 60% of the patients that they had a low or no influence at all on the planning of their work.
Comparison of factors related to psychosocial stress between care patients with or without musculoskeletal disorders

The results from the second part of the study showed no significant differences between patients with musculoskeletal disorders (physical therapy patients) and the dental group (controls) in regard to the level of psychosocial stress and opportunity for control of the work situation. People with a high perceived level of stress in work did not have musculoskeletal disorders to a greater extent than the other group. When comparing how to cope with stress situations effectively a significant difference was found between the groups. Patients with musculoskeletal disorders differed in coping strategy compared to the other group. For example they were of the opinion that they acted less seriously in stress situations and could handle them in an easier way (Chi-2 (4,N=60) = 9.96, p < 0.05) that they trusted their own ability to solve new and difficult situations (Chi-2 (3,N=60) = 9.21, p < 0.05). They also more often than the others made and used their own plans of action when handling stress situations (Chi-2 (4,N=60) = 13.23, p < 0.05). They also more often thought of other things to get a distance to a stress problem (Chi-2 (3,N=60) = 12.29, p < 0.05). No significant differences between the groups were found in their need to use stimulation and social support from others as a coping strategy.
7.5 Discussion

The results showed that the patients perceived physical as well as psychosocial strain to be important working environment problems. This was true for all patients but particularly for patients working with industry-farming-forestry-, nursing- and servicework. Male industrial workers and female secretaries were the largest groups perceiving their work as physically and psychosocially strenuous. Kvarnström has found ergonomic factors characteristic for occupations with a high risk for developing musculoskeletal disorders (Kvarnström, 1983). Jobs in the highest risk zone were those characterized by small workpieces, small working area, short work cycle, no variation of postures or movements, high level of static strain and high demands on attention and work rate. These factors are still common within traditional industrial, service and administrative work. The character of the work often determines the localisation of musculoskeletal symptoms. Back disorders are highly frequent within heavy manufacturing industry while neck- and shoulder disorders are frequent both within manufacturing industry and within administrative work (Wickström, 1982).

The present study showed that patients with a high level of physical strain in work also to a great extent perceived a forced work rate, high psychosocial stress, low opportunity for control of workplanning and more limited possibilities for skill development in work. According to the psychosomatic vitamin model (figure 1) an individual's environmental conditions and current psychosomatic health influence each other in a recycling process. Environmental conditions as opportunity for control and skill use influence current mental and psychosomatic health. Although the amount of control and skill use exercised by a particular individual is partly determined by his or her motivation relative to a given situation it is clear that working environments vary in the extent to which they provide opportunities for decision-making,
influence and skill use. Jobs differ considerably in the
costume they provide for workers to choose their
objectives, to schedule their tasks, and to determine the
ways in which work should be undertaken (Warr, 1987).
Working environments also differ in their acquisition of
new skills, sometimes requiring people to remain at low
levels of skilled performance despite their potential for
extending into more complex activity. A low opportunity
for control of work organization may according to the
vitamin model influence all 5 aspects of psychosomatic
health: affective wellbeing, competence, autonomy,
aspiration and integrative functioning (Warr, 1987). The
present results indicated that patients with a low oppor­
tunity for control of planning of work also perceived a
low opportunity for skill development in work. Both
these aspects may influence psychosomatic health
negatively according to the vitamin model. A high level
of perceived stress was associated with a low opportunity
of control of work planning and work rate and limited
possibilities for skill development. Other studies have
shown that the lower the opportunity for control in work
the higher the risk for negative stress (distress) and
feelings of helplessness (Frankenhaeuser, 1985). A
combination of high demands and low opportunity for
control increases the risk for fatigue and depression as
well as cardiovascular symptoms in work (Henry &
Stevens, 1977). In the present study on average over
60% of all patients within the industry-farming-forestry,-
nursing- and service sector were of the opinion that
they had a low or no opportunity for control of the
planning of their work. Karasek and coworkers (Karasek
et.al., 1981) have shown that high psychosocial demands
imply problems for an individual when there is low
opportunities for skill use in work or when the external
control of work content are high. High agreement have
been shown between for example qualitative and quantita­
tive overload, high psychosocial demands and musculo-
skeletal disorders (Dehlin & Berg, 1977; Wölfors, 1985).
The second part of the present study showed no differences between patients with musculoskeletal disorders and the other group (controls) in regard to the level of psychosocial strain and perceived control of the work situation. However patients with musculoskeletal disorders tried to cope more appropriately with stress situations in work than the others. As described in the theoretical frame of reference (page 93) coping in stress situations has two major functions for solving problems and for regulation of emotional stress. Firstly to change the situation by changing actions or the threatening environment and secondly to manage the somatic and subjective components of stress related emotions themselves. Patients with musculoskeletal disorders were of the opinion that they acted less seriously in stress situations and could handle them in an easier way. They also trusted their own ability to solve new and difficult situations, often by using their own plans of action. Direct action is one adaptive coping strategy to prevent the deleterious effects of stress, diminish distress (negative stress) and facilitate eustress (positive stress). Other possible coping modes may be seeking of new information, inhibition of action and intrapsychic processes (page 93). Direct action seem to be the preferred method in the present study. The patients tried primarily to change stress situations by acting less seriously and by making and using their own plans of action.

In conclusion the first part of the study indicated that patients applying for primary health care perceived physical as well as psychosocial strain as important working environment problems. The second part of the study indicated that patients with musculoskeletal disorders tried to cope more appropriately with stress situations in work than patients without musculoskeletal disorders.
Intervention studies may be done to reduce the level of physical and psychosocial occupational strain. Work environmental improvements have often been done by studies intervening against physical factors and work organisation. Many studies focus on work station design, by improving for example the duration of pauses. Studies have shown that individual variations in work technique are large, even among individuals who perform exactly the same work tasks (Kilbom, et al, 1986). Training in work technique can be used to prevent musculoskeletal disorders. The work technique is often established at the outset of vocational training and it is not surprising that the long-term effects have been small (Linton and Kamvendo, 1988). Parenmark et al, (1988) used EMG-biofeedback in the first weeks of vocational training for assembly work, which reduced the number of days for shoulder and neck sickleave by 50 per cent. Intervention studies aiming at influence the characteristics of individuals may for example concern ergonomic risk factors and life style together with improvements of work stations and physiotherapy. It may also be important to do intervention studies against psychosocial risk factors at work. The success or failure of an intervention depends on the effectiveness of the intervention technique i.e. whether the intervention does lead to the expected change in posture, work method, work organisation or psychosocial climate and whether this change in work content is sufficient to influence the development of a musculoskeletal disorder (end-point effects) (Kilbom, 1988). For a full effects of intervention studies both these steps should be assessed.
7.6 References


8. CONCLUDING DISCUSSION ON PSYCHOSOCIAL STRAIN AND PSYCHOSOMATICS

8.1 Stress and computerisation
The study of the effects of computerisation (chapter 6) showed that the working conditions after computerisation at the County Government Board were judged to be very satisfactory. The attitude to computers was very positive throughout and psychosomatic symptoms of various kinds seldom occurred. Correlation analyses showed that there were significant positive correlations between experienced qualification, mental work load and job satisfaction. Significant correlations were also obtained between experienced high level of work qualification and high frequency of nervous, sleep, heart and fatigue symptoms.

In the Berlin report (Çakir et al., 1978) perceived fatigue among visual display terminal (VDT) operators with more simplified tasks appeared to be subjectively expressed in terms of job content complaints, whereas for those whose tasks were more cognitively complex, such fatigue was manifested in physical symptoms. The Berlin study also revealed that amount of time spent working at the VDT screen was correlated with items relating to job satisfaction and physical stress. Increased VDT working time was related to higher levels of boredom, fatigue, monotony, perceived job satisfaction and extent to which work organisation is specified in detail, as well as to physical stress factors. The Ohio study (Dainoff et al., 1981) concluded that comments concerning physical and mental stress were associated with two different clusters of effects. Those variables which correlated with VDT working time also showed significant correlations with physical/mental stress. At the same time the stress variable showed lower but significant correlations with job pressure and fatigue. In the Ohio study it appears that job demands yielded effects on self-labelled reports of stress which were different from and independent of
factors associated with long hours at the computer. Job demands can have very large impacts on the expression of those physical symptoms typically associated with visual and/or postural problems. Work activities characterized as repetitive, oversimplified, lower in status, lower in sense of control tend to have the worst of it along physical, as well as job satisfaction dimensions. The present study indicated that perceived qualification in work after the computerization presented significant correlations with a high frequency of nervous, sleep, heart and fatigue symptoms. A situation of increasing demands on skill development and skill use in a position may increase perceived as well as physiologic stress due to an initial discrepancy between task requirements and the resources an individual has available in order to pursue task goals. As mentioned in chapter 5 psychological stress comprises different related, processes of person-environment transaction concerning emotions, motivations and cognitions in which demands tax or exceed the resources of a person. In such a cognitive-phenomenological approach the interest is on a person's continuing transactions with the environment, on the coping as well as on the primary and secondary appraisal process (table 1 page 60). The appraisal activity is the process of cognitive evaluation (chapter 5). Coping is the process by which an individual controls buffers or inhibits stress.

Various coping strategies may be used by a computer user to reduce this discrepancy between task requirements and his/her own resources. Active coping strategies may be to "try harder" or to acquire new skills, aiming at increasing the supply of cognitive resources. Indirect coping "cognitive reappraisal" by reducing the effective level of demands for example by adopting lower or different personal targets or negotiating a reduction in organisational requirements may also be used to reduce this discrepancy. To manage environmental demands at source "indirect cognitive control", by for example
matching the work flow or task sequence to current
cognitive resources is another indirect coping strategy
(Hockey, 1986). All these coping modes are effective in
the sense that they solve a stress problem but they are
associated with different cost/benefit patterns. When
trying harder or acquiring new skills, performance levels
are sustained, though at the cost of increased effort and
physiological activation. When using cognitive reappraisal
the stability of an individual’s psychological state is
preserved at the expense of reduced personal effective­ness
(Hockey, 1986). Indirect cognitive control may
permit effective performance through more efficient
planning and organisation of the work, a preferred mode
when task environment permits. Low levels of decision­
making and planning are most apparent then the user is
engaged in repetitive computer work for most of the
working day. Machine-centered dialogue structures where
the computer users cannot chose their own task strategies often reduce the demand on planning. Instead
computer work may increase the need for individual planning and decision-making by giving the user greater
amounts of information and communication facilities, requiring the user to organise work into larger task
chunks.
An investigation at the Scandia Insurance Company com­plex (Johansson and Aronsson, 1980) also dealt with the
way office work is being affected by computerization. A
conclusion from this study is that technological factors beyond the worker's control are now having direct impacts on their work output. Seventy per cent of the
VDT work group indicated that their work rates were too
dependent on technical equipment, the percentages decreased with the amount of time spent on the terminal.
Adrenalin levels measured throughout the workday, were
seen to be higher in the mornings for the VDT-operators.
Feelings of fatigue, effort and a sense of being rushed were greater for VDT-operators in the morning. Inter­views with the participant indicated that this was likely
due to the fact that VDT-operators worked very fast
during the morning as a precaution in case the computer
broke down. If the system remained functional, they could then relax during the afternoons. Individuals are always able to exercise choice in their strategy for resolving stress states. But in fact performance is often protected against disruption by external stressors or high workload though the effort involved in this may be observed as costs in other systems (Hockey, 1986). Failure of continued effort to maintain performance may result in a switch to indirect coping (reappraisal) or to the development of a chronic stress state associated with a long-term impairment of both job motivation and mental health. This failure of direct coping may be attributable to either excessive workload or inadequate individual resources (Hockey, 1986).

The process of computerisation (developing and using new skills) in the present study may be interpreted as a way to increase work qualification according to the psychological action theory (Hacker, 1976). Mental regulation of work actions occurs on three levels. Each level has action programmes of its own, which vary according to the goals of the task. The plans at the level of intellectual regulation, which develop through intellectual analysis form the highest level of cognitive action. Frequently repeated actions are pushed down to lower levels, and the intellectual level is ready for new challenges of the environment. The regulation at the conceptual-perceptual level is based on action schemata and images initiated by signals. The control at the sensorimotor (automated) level occurs often unconsciously as if by itself (Hacker, 1976). The level of control depends on the degree of familiarity with the environment. The process of computerisation (developing and using new skills) increases work qualification and satisfies the highest level of cognitive action as, according to Hacker (1976), it requires intellectual analysis. This may increase the perceived level of physical and psychosocial strain as well as physiological stress during an initial period, although the attitude to computers is very positive. When the new skills have
been acquired and frequently repeated, the actions are pushed down to lower levels of control, which may imply a reduction of the level of psychosocial and physiological strain. An optimal balance between these different levels of cognitive action is important for the opportunities for growth and mastery in working life. Quantifying an optimal balance between these different levels of cognitive action may, however, be difficult.

The results in the present study of computerization at the County Government Board give a picture of satisfying working conditions, good mental health and increased physiological stress. The results from the grid interviews indicated that employees perceiving at the same time relatively lower opportunity for control, less positive stimulation and a relatively low level of physiologic stress had a relatively larger increase in physiologic stress during the computerization.

Other studies have also shown significant correlations between computer work and physiologic symptoms (Gardell, 1976). It is an important task to try to identify the factors in a work environment which activate physiological responses and to determine when stress responses are adaptive and health promoting and when they are potentially health damaging. Two stress dimensions are specially relevant when doing this: effort and distress (chapter 5). Effort is a pleasurable experience concerned with interest and engagement, while distress is a negative experience associated with boredom and dissatisfaction. A state of active effort is accompanied by increased catecholamine secretion, while a passive state of distress is accompanied by increased cortisol secretion (chapter 5). The present study showed that the working conditions after computerisation were judged to be very satisfactory, with positive correlations between high level of qualification and job satisfaction, indicating interest and engagement in work (effort). Unfortunately only the level of serumcortisol was measured in this study, as an indication of aspects of distress in the computer work.
Negative experiences associated with dissatisfaction in the computer work may be momentary high mental workload. In future studies it is important to measure both these stress dimensions (effort and distress) in relation to working conditions. Earlier studies (Elias et al., 1980) have shown that computer users whose work were characterized by repetition, oversimplified task structures and fewer degrees of freedom (low personal control) also had more musculoskeletal symptoms than those involved in more flexible, less stereotyped computer operations. The latter were also significantly less likely to report job dissatisfaction than the former (28 versus 70 per cent).

Frankenhaeuser and Johansson (1986) found, in a complex laboratory task as well as in a field study of process control, that jobs which allow the operator to respond actively to changing demands were associated with increased effort and excretion of catecholamines, and with reduced cortisol levels. In jobs where the controllability was low, however, a more passive coping pattern was evident. This was accompanied by increases in feelings of both distress and effort, and raised levels of both catecholamines and cortisol. It now seems likely that elevated levels of corticosteroids, characteristic of passive coping, rather than catecholamine activity, are functionally involved in the aetiology of stress-related illnesses (Antoni, 1987).

So the key question is how to achieve and work in a state of effort without distress. Personal control over the worksituation is an important modulating factor in this regard (Frankenhaeuser and Johansson, 1986). Personal control may act as a buffer and change the neuroendocrine balance so effort without distress may be possible.
8.2 From theory to practice – implications for rehabilitation and prevention

8.2.1 Preventive activities

There is a growing demand for stress-management and wellness programmes in workplace settings. These programmes may aim at approaches to single risk factors such as reducing hypertension by relaxation training or biofeedback or by trying to reduce general levels of stress in organizations. Industrial and management organizations are also beginning to be aware of the price they pay for stress and to measure it in financial terms. Loss of effectiveness and errors as well as employee sickness and/or replacements, job dissatisfaction and retraining of workers lower the productivity. As we all know, stress is part of everyday life. It is the effects of distress (negative stress) that causes the problems both in the short and the long term. The actual level of distress is unique to each individual (table 1).

Table 2: Clinical effects of distress (O'Neill, 1988)

<table>
<thead>
<tr>
<th>Muscular</th>
<th>Digestive</th>
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<tr>
<td>Increased tension and spasm</td>
<td>Heartburn</td>
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<td>Stiff neck</td>
<td>Nausea</td>
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<tr>
<td>Tense shoulder girdle</td>
<td>Loss of appetite</td>
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<td>Tension headache</td>
<td>Constipation</td>
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<td>Low Back pain</td>
<td>Diarrhoea</td>
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<td>Peptic ulcer</td>
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<td>Cardiovascular</td>
<td>Mucous colitis</td>
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<tr>
<td>Chronic hypertension</td>
<td>Mental</td>
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<tr>
<td>Increased pulse rate</td>
<td>Anxiety</td>
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<tr>
<td>Palpitation</td>
<td>Depression</td>
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<tr>
<td>Angina pectoris</td>
<td>Nervous breakdown</td>
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<td>Heart attack</td>
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<td>Stroke</td>
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<tr>
<td>Respiratory</td>
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<td>Shallow breathing</td>
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<td>Asthma</td>
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As physiotherapists, we are concerned with rehabilitation programmes for most of the conditions listed in table 1. More counselling and education activities are needed, for example, within primary health care to help people to make decisions regarding lifestyle vis à vis stress levels before the development of stress-related symptoms and disorders. The very cornerstone of health promotion is advertising. To focus on the interplay of mind and body, how health and mental health affect each other is important. Also important is that individuals take more power and responsibility for their own health and mental health. Life-style behaviors that are conducive to health and well-being should be promoted.

Figure 1 presents a framework for examining health, preventive stress management and a medical model for development of most chronic illnesses (Quick & Quick, 1984). The important sequence here is the development from a demanding or stressful situation through stress-responses to distressful consequences or health problems. The source of stress is a demand of some sort. All demands increase an individuals vulnerability to health problems. Preventive activities directed to actual stressors (primary prevention) to stress responses (secondary prevention) and/or to symptoms (tertiary prevention) may prevent the development from stress to illness. It is important that physical therapists work on all these levels of intervention in their activities.

On the level of primary and secondary prevention the physical therapist has an important role in individual and general counselling and education. It is critical for a patients understanding of contributing factors to actual problems to explain the high agreement between different demands within a person or in a working environment and/or different stress responses and the development of distress and stress-related illness. The aim may be to increase people's awareness of the origin to actual problems and to decrease psychosocial loading by actually changing the environment and/or their own behavior. This can be done by identifying actual stressors and
discussing with patients what to do to reduce their effect in practical situations. Relaxation therapy, regular physical training, body awareness therapy and/or work-hardening training may also be used to reduce the effect of stressors. A usual course in primary prevention is first to identify risk factors and then to initiate measures to eradicate them. The problem is that we have a very restricted knowledge concerning risk factors. We have suggestions that prevention may be oriented towards modifying everyday behavior at work or at home and to promote health (Linton, 1987). Learning factors may often be involved in the development of a stress response in an everyday situation. The workplace or family may reinforce a stressful behavior. More appropriate behavior should be reinforced and reinforcers for potential stress behaviors should be eliminated (Linton, 1987). Physical therapists may promote non-stressful behavior in their primary and secondary prevention.

**Figure 1.** The stages of preventive management (Quick & Quick, 1984)
On the level of tertiary prevention when symptoms have developed, the physical therapist may concentrate on early rehabilitation, activation and return to work. A clinical examination followed by information about contributing factors to actual illness and skills in selfcare and prevention is necessary. Since a risk person statistically has little chance of returning to work after about three months of being sick-listed (Chöler et al, 1985), early rehabilitation and activation is important for patients with stress-related illnesses. Early detection of and intervention in environmental and emotional stressfactors though a contract and mutually agreed - on goals is also important.

8.2.2 Personal and/or organisational strategies

When trying to identify and prevent stress-related illness the physical therapist must try to focus on both changing the personal conditions and the environmental conditions that caused or influenced the experience of stress. The causes and effects of job stress may be found both within a person and the person's work environment. There are several possible personal and organizational strategies for handling job stress (Neuman & Behr, 1979). Some of them can be used by the physical therapists in individual counselling and/or general education. One general strategy aims at changing a person's psychological condition by, for example, meditation, psychological withdrawal from a situation, better planning ahead and/or readjustments of personal life style. Another type of strategy aim at changing a persons physical condition, for example by more proper diet and/or regular exercise. Strategies for changing a persons behavior for example by learning to relax and receiving social support and strategies for really changing an individual's work environment may also be used by the physical therapist. Organizational strategies for handling job stress are aimed primarily at changing some aspect of a work
Organization - policies, processes, structures, programmes, roles, tasks etc. (Neuman & Behr, 1979). They can be used by physical therapists during work analyses when trying to maximize the fit between a person and a working environment. One organizational strategy to handle job stress is to try to change organizational conditions, for example the organizational structure, the reward system, the selection, placement, training and development programmes, the policy relating to job rotation etc. Another organizational strategy aim at changing role characteristics for example, by redefining a person's role, reduce role overload by redistributing the work and institutionalize procedures for reducing stress when it occurs. A third strategy focuses on changing task/job characteristics, for example by designing jobs in the light of workers abilities and preferences, and develop training programmes that give employees the skills necessary to meet changing job demands and to allow individuals to participate in decisions concerning their work.

The role of the physiotherapist is extended through education and prevention of stress-related illness. Skills and techniques used in the clinical context of rehabilitation may not be enough, practice may benefit from a wider ergonomic perspective. Ergonomics emphase "fitting the job to the man", and encourages us to take a look at the broader aspects of rehabilitation and prevention relating to working environments. Ergonomics starts with a worker and his individual limitations and capacities as the centre of concern, and then looks at all the factors which may impinge on him and interact with him to affect his efficiency and well-being. The whole work organisation is regarded as an interactive sum of its parts, and these parts are considered to be the worker, his interface with equipment at work (the workstation), the immediate environment around him (the work-place) and the organisational and social environment generally surrounding this (Girling & Birnbaum, 1988).
The use of such an ergonomic system approach as a basis for assessment of need and implementation of prevention programmes may be a framework helping physiotherapists in the challenge of training for prevention of musculoskeletal disorders in the occupational setting.

8.2.3 Recommendations for future research

How can rehabilitation and prevention of stress-related illnesses be improved by future research? Rehabilitation may be improved by both better training of the physical therapists and more relevant education and training of patients. Studies are needed to better understand the process that physical therapists pursue when confronted with psychosocial problems in their patients. For example the following questions needs attention: What kinds of physical therapy facilitate recognition of psychosocial problems in patients? What patient cues alert the physical therapist to psychosocial issues? How can the patient-physical therapist relationship be used for therapeutic purposes in this regard?

As psychosocial health skills improve, clear patient-physical therapist communication is essential for detecting stress-related problems. To consider and assess approaches to patient education which may encourage patients to relate appropriate stress-related illnesses to physical therapists is important within physical therapy for the future. Research to clarify the nature of psychosocial and psychosomatic illness for example in primary health care may need to be system-oriented and derived from two perspectives: (a) an epidemiological approach to identify previously unclassified syndromes that combines somatic and psychological features (a proposal for such research can be found in a recent World Health Organisation report (WHO, 1981)) and (b) examination of clinical practices relevant to such syndromes, possibly making use of the classification being field-tested by WHO.
(Lipkin and Kupka, 1982). Epidemiologic research on the course of disorders, combined with research on clinical practice will contribute to a determination of conditions for which intervention is appropriate.
8.3 References


Johansson, G., & Aronsson, G. Stress Reactions in Computerized Administrative Work (Supplement 50), (Department of Psychology, University of Stockholm), 1980.


O'Neill, E. Change is the key to stress. Physiotherapy, 1988, 74, 9.

9. CONCLUSIONS

The questionnaire study showed that the level of physical strain in crane coupling work was perceived as high. Unsuitable monotonous postures and movements, heavy lifting and long walking distances were common reasons for regarding crane coupling as a physically strenuous work.

The medical study showed that clinical findings were more prevalent in the right neck and shoulder region. The symptoms could in individual cases be due to background medical illness or overstrain during leisure time. For the other patients it is possibly true that their symptoms were related to physical and psychosocial strain in the crane coupling work.

The electromyographic study showed that the level of physical strain on the neck/shoulder and right arm was high in all the five treatments studied. Crane coupling work may result in harmful effects particularly in the neck/shoulder region. Working with radio control decreased the ratings of perceived exertion (RPE) the heart rate (HR) and the local strain on all muscles recorded.

As practical implications for ergonomic changes it may also be concluded that the level of physical strain in crane coupling can be reduced by using wooden or other light weight spacers, by rearranging the layout so that slinging always is possible and by using slings made of fibre or other light weight material. The greatest reduction in strain may be achieved by combining the use of radio control with the use of light-weight spacers and slings which do not need to be lifted off the yoke during work. These changes will also result in considerable rationalization. A light weight spacer used when handling hot material should be developed.

The study of computerization of administrative work indicated that work after computerization was seen as
very positive for example as to the experience of responsibility, job satisfaction, and qualification at work. The attitude to computers was very positive throughout. Health too remained good in the group as a whole; psychosomatic symptoms of various kinds seldom occurred. However, after the computerization perceived qualification presented significant correlations with a high frequency of nervous, sleep, heart and fatigue symptoms. Physiological stress increased too, the cortisol value increasing by 50 per cent during the computerization period.

The primary health care study indicated that patients applying for primary health care perceived physical as well as psychosocial strain as important working environment problems. Patients with musculoskeletal disorders tried to cope more appropriately with stress situations in work than patients without musculoskeletal disorders.
APPENDIX

FRÅGEFORMULÄR: QUESTIONNAIRES:

1. Krankopplare
   (studie 1)
   Crane couplers
   (studie 1)

2. Primärvårdspatienter
   (studie 5)
   Primary health care patients
   (study 5)

3. Patienter med besvär från rörelseorganen samt kontrollgrupp
   (studie 5)
   Patients with musculoskeletal disorders and controls
   (study 5)
Anvisningar för ifyllandet av frågeformuläret


Frågorna är mest av den typen att Du skall ringa in den sifferkombination som motsvarar ditt valda alternativ till svar. Siffrorna är det kodnummer som vi senare skall använda för databearbetning av svaren.

Ex. Inom vilka områden och hur lång tid har Du tidigare förvärvsarbetat innan Du anställdes som krankopplare?

<table>
<thead>
<tr>
<th>Område</th>
<th>0-1 år</th>
<th>2-5 år</th>
<th>6-10 år</th>
<th>10-20 år</th>
<th>Over 20 år</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hantverk</td>
<td>(29:1)</td>
<td>29:2</td>
<td>29:3</td>
<td>29:4</td>
<td>29:5</td>
</tr>
<tr>
<td>Skogs-/lantbruk</td>
<td>30:1</td>
<td>30:2</td>
<td>30:3</td>
<td>30:4</td>
<td>30:5</td>
</tr>
<tr>
<td>Handel</td>
<td>31:1</td>
<td>31:2</td>
<td>31:3</td>
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</tr>
<tr>
<td>Transport</td>
<td>32:1</td>
<td>32:2</td>
<td>32:3</td>
<td>32:4</td>
<td>32:5</td>
</tr>
<tr>
<td>Kontor</td>
<td>(33:1)</td>
<td>33:2</td>
<td>33:3</td>
<td>33:4</td>
<td>33:5</td>
</tr>
<tr>
<td>Vårdarbete</td>
<td>34:1</td>
<td>34:2</td>
<td>34:3</td>
<td>34:4</td>
<td>34:5</td>
</tr>
<tr>
<td>Husligt arbete</td>
<td>35:1</td>
<td>35:2</td>
<td>35:3</td>
<td>35:4</td>
<td>35:5</td>
</tr>
<tr>
<td>Egen företagare</td>
<td>36:1</td>
<td>36:2</td>
<td>36:3</td>
<td>36:4</td>
<td>36:5</td>
</tr>
<tr>
<td>Annat ex.</td>
<td>37:1</td>
<td>37:2</td>
<td>37:3</td>
<td>37:4</td>
<td>37:5</td>
</tr>
</tbody>
</table>

På några frågor vill vi att Du själv skriver svaren (på den streckade raden). Du får gärna skriva utförliga kommentarer också (räcker inte raderna skriv på baksidan). Om det finns frågor som inte alls berör dig svarar du genom att ringa in alternativet "Gäller ej mig".

Ex. Är Du nöjd med radiostyrningen?

Ja         72:1
Nej        72:2
Gäller ej mig (arbetar ej med radiostyrning) (72:3)
Om Nej varför inte nöjd ___________________________ 72:4

OBS! Det är viktigt att Du svarar på samtliga frågor.
Vi börjar frågeformuläret med några frågor kring personliga förhållanden.

1. Kön.
   - Man 4:1
   - Kvinna 4:2

2. Hur gammal är du?
   - Yngre än 25 år 5:1
   - 25-34 år 5:2
   - 35-44 år 5:3
   - 45-54 år 5:4
   - 55 år eller äldre 5:5

3. Hur mycket väger du?
   - Mindre än 55 kg 6:1
   - 55-64 kg 6:2
   - 65-74 kg 6:3
   - 75-84 kg 6:4
   - 85-94 kg 6:5
   - 95 kg eller mer 6:6

4. Hur lång är du?
   - Mindre än 155 cm 7:1
   - 155-164 cm 7:2
   - 165-169 cm 7:3
   - 170-174 cm 7:4
   - 175-179 cm 7:5
   - 180-184 cm 7:6
   - 185 cm eller mer 7:7

5. Hur många personer ingår i ditt hushåll? (Dig själv medräknad)
   - 1 person 8:1
   - 2 personer 8:2
   - 3 personer 8:3
   - 4 personer 8:4
   - 5 personer 8:5
   - 6 personer eller fler 8:6
6. Är Du ensam i ditt hushåll som förvärvasarbetar?

Ja 9:1
Nej 9:2

7. Hur lång är Din genomsnittliga restid till arbetet?

Mindre än 14 minuter 10:1
15-29 minuter 10:2
30-59 minuter 10:3
Mer än 60 minuter 10:4

8. Hur tar du dig i regel till arbetet?

<table>
<thead>
<tr>
<th></th>
<th>Sommarhalvåret</th>
<th>Vinterhalvåret</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dagtid</td>
<td>Nattid</td>
</tr>
<tr>
<td>Går</td>
<td>11:1</td>
<td>11:2</td>
</tr>
<tr>
<td>Cyklar</td>
<td>12:1</td>
<td>12:2</td>
</tr>
<tr>
<td>Åker med allmänna</td>
<td>13:1</td>
<td>13:2</td>
</tr>
<tr>
<td>kommunikationer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Åker moped/scoter</td>
<td>14:1</td>
<td>14:2</td>
</tr>
<tr>
<td>motorcykel/bil</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

9. I vilken utsträckning är Du fysiskt aktiv på din fritid?

Inte alls eller endast obetydligt 15:1
Motionerar regelbundet 1-2 ggr/vecka 15:2
Motionerar regelbundet mer än 2 ggr/vecka 15:3

10. Anser Du att regelbunden motion är en förutsättning för att klara av ditt jobb?

Ja 16:1
Nej 16:2

11. Ägnar Du dig regelbundet åt något av följande? Ange det du ägnar mest tid åt.

Skötsel av småbarn 17:1
Trädgårdsskötsel/snöskottning od. 17:2
Underhålls- och reparationsarbeten (hus,bil od.) 17:3
Stickning,virkning,klädsömnad od. 17:4
Annat t ex ..........................: 17:5
Ingenting speciellt 17:6
12. När började du din nuvarande anställning/som krankopplare?
   för mindre än 1 år sedan 18:1
   för 1-3 år sedan 18:2
   för 4-10 år sedan 18:3
   för mer än 10 år sedan 18:4

13. Vilka arbetsuppgifter utöver krankoppling har du i ditt nuvarande arbete:

14. Arbetar du med radiostyrning? Hur lång tid har du gjort det?
   Mindre än 1 år 20:1
   1 - 3 år 20:2
   4 - 10 år 20:3
   mer än 10 år 20:4
   arbetar inte med radiostyrning 20:5

15. Du som arbetar med radiostyrning har du tidigare arbetat som vanlig krankopplare? I så fall hur länge?
   Mindre än 1 år 21:1
   1 - 3 år 21:2
   4 - 10 år 21:3
   mer än 10 år 21:4
   Nej 21:5

16. Vad var huvudorsaken till att du började som krankopplare?
   Jag sökte just det arbetet då jag anställdes 22:1
   Jag placerades i det arbetet då jag anställdes 22:2
   Jag sökte förflytning eftersom jag inte trivdes med mitt gamla arbete 22:3
   Jag sökte förflytning för att få byta arbetsuppgifter 22:4
   Jag orkade inte med mitt tidigare arbete och ville byta arbetsuppgifter 22:5
   Jag tillfrågades av arbetsledningen om jag ville byta arbete 22:6
   Jag omplacerades 22:7
   Annan anledning 22:8
17. Är du anställd på
   Heltid
   Deltid

18. Arbetar du
   Femskift
   Fyrskift
   Treskift
   Tvåskift
dagtid

19. Har du under senaste året gått över från heltid till deltid?
   Ja, p g a studier
   Ja, p g a vård av småbarn
   Ja, p g a att arbetet är så tungt att jag inte orkar arbeta heltid
   Ja, p g a annan orsak
   Nej, jag har försökt men kan ej få deltid
   Nej, arbetar heltid

20. Vilken löneform har du?
   Rakt ackord
   Blandackord
   Bonus eller premielön
   Månadslön/tidlön

21. Är du anställd vid
   SKF Steel Hofors
   Smedjebacken/Boxholms Stål AB

22. Inom vilka områden och hur lång tid har Du tidigare förvärvsarbetat innan Du anställdes som krankopplare?

<table>
<thead>
<tr>
<th></th>
<th>0-1 år</th>
<th>2-5 år</th>
<th>6-10 år</th>
<th>10-20 år</th>
<th>Över 20 år</th>
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<td>37:4</td>
<td>37:5</td>
</tr>
</tbody>
</table>
NÅGRA FRÅGOR KRING DIN UTBILDNING

23. Vilken skol- eller yrkesutbildning har du? (Markera endast den högsta utbildningen)
   - Folkskola 39:1
   - Grundskola 39:2
   - Realskola, folkhögskola eller motsvarande 39:3
   - Yrkesskola, fackskola eller motsvarande 39:4
   - Gymnasium eller motsvarande 39:5
   - Universitets- eller högskoleutbildning 39:6
   - Särskild yrkesutbildning, nämligen: 39:7

24. Hur lång sammanlagd utbildning (teoretisk+praktisk) har du fått för ditt krankopplararbete?
   - Ingen alls 40:1
   - Mindre än 1 dag 40:2
   - Ungefär 1 dag 40:3
   - 2-3 dagar 40:4
   - 4 dagar-1 vecka 40:5
   - Mer än 1 vecka 40:6

   - Nej, utbildningen är tillräckling 41:1
   - Ja, mer information om säkerhets- och skyddsfrågor 41:2
   - Ja, mer information om arbetsteknik 41:3
   - Ja, mer information om signalsystemet 41:4
   - Ja, mer information om kranens funktion och arbetsätt 41:5
   - Ja, mer information om lyftdon (kättingar, ok m m) 41:6
   - Ja, mer information om ____________________________ 41:7

26. Har du fått tillräckligt med kunskaper om säkerhets- och skyddsfrågor för att känna dig säker i ditt arbete?
   - Ja 42:1
   - Nej 42:2

27. Det är vanligt att alla får någon form av praktisk handledning o dyl. när man kommer ny. Anser du att du fick tillräcklig praktisk handledning innan du lämnades ensam i ditt nuvarande arbete?
   - Ja 43:1
   - Nej, längre tid hade behövts 43:2
**FRÅGOR KRING BESVÄR OCH SJUKDOMAR**


28. Har du under de senaste 12 månaderna haft några av nedanstående besvär?

<table>
<thead>
<tr>
<th>Har besvär i form av</th>
<th>Anser du att ditt nuv. arbete kan ha medverkat till/orsakat besvären</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obehag, trötthet o dyl.</td>
<td>Anser du att ditt nuv. arbete kan ha medverkat till/orsakat besvären</td>
</tr>
<tr>
<td>Domning, smärta o dyl.</td>
<td>Anser du att ditt nuv. arbete kan ha medverkat till/orsakat besvären</td>
</tr>
</tbody>
</table>

![Diagram of human body parts]

Huvudet | 44:1 | 44:2 | 44:3
Hacket | 45:1 | 45:2 | 45:3
"Mellan skulderbladen" | 46:1 | 46:2 | 46:3
Ländryggen | 47:1 | 47:2 | 47:3
Höger axel/skuldra | 48:1 | 48:2 | 48:3
Vänster axel/skuldra | 49:1 | 49:2 | 49:3
Höger överarm | 50:1 | 50:2 | 50:3
Höger armbåge | 51:1 | 51:2 | 51:3
Höger underarm | 52:1 | 52:2 | 52:3
Höger handled | 53:1 | 53:2 | 53:3
Höger hand, fingrar | 54:1 | 54:2 | 54:3
Vänster överarm | 55:1 | 55:2 | 55:3
Vänster armbåge | 56:1 | 56:2 | 56:3
Vänster underarm | 57:1 | 57:2 | 57:3
Vänster handled | 58:1 | 58:2 | 58:3
Vänster hand, fingrar | 59:1 | 59:2 | 59:3
Höger höft | 60:1 | 60:2 | 60:3
Vänster höft | 61:1 | 61:2 | 61:3
Höger lår | 62:1 | 62:2 | 62:3
Höger knä | 63:1 | 63:2 | 63:3
Höger underben | 64:1 | 64:2 | 64:3
Höger fotled, fot | 65:1 | 65:2 | 65:3
Vänster lår | 66:1 | 66:2 | 66:3
Vänster knä | 67:1 | 67:2 | 67:3
Vänster underben | 68:1 | 68:2 | 68:3
Vänster fotled, fot | 69:1 | 69:2 | 69:3

(70)

**OBS!** Du har väl inte glömt att ringa in alla JA-svar.
29. Du som anser att ditt nuvarande arbete kan ha medverkat till/orsakat dina besvär. Vilket/vilka arbetsmoment tror du kan ha orsakat besvären?

30. Har Du varit sjukskriven de senaste 12 månaderna för några av de besvär som du angett i fråga 28? I så fall hur länge?

Ja, kortare tid än 1 vecka 72:1
Ja, mellan 1 vecka - 1 månad 72:2
Ja, mellan 1 - 3 månader 72:3
Ja, mer än 3 månader 72:4
Nej, har ej varit sjukskriven 72:5
Gäller ej mig (har inga besvär) 72:6

31. För att tolka dina besvär behöver vi veta hur de förändras efter kortare eller längre tid. Svara därför på följande frågor, (även du som inte har några besvär)

Hur förändras dina besvär mot slutet av en arbetsdag?

Är oförändrade 73:1
Ökar i styrka 73:2
Minskar i styrka 73:3
Frågan gäller ej mig, har inga besvär 73:4

32. Hur förändras dina besvär mot slutet av en arbetsvecka?

Är oförändrade 74:1
Ökar i styrka 74:2
Minskar i styrka 74:3
Frågan gäller ej mig, har inga besvär 74:4

33. Hur förändras dina besvär efter en längre ledighet/semester?

Är oförändrade 75:1
Ökar i styrka 75:2
Minskar/upphör i styrka 75:3
Frågan gäller ej mig, har inga besvär 75:4

34. Anser du att kroppsslig/fysisk belastning i ditt ev. förra arbete kan ha medverkat till/orsakat dina besvär eller sjukdomar de senaste åren?

Ja 76:1
Nej 76:2
Gäller ej mig, har inga besvär 76:3
35. Kan dina fritidsaktiviteter på något sätt ha medverkat till/orsakat dina besvär?
   Ja 77:1
   Nej 77:2
   Gäller ej mig, har inga besvär 77:3

36. Har du ändrat dina fritidsaktiviteter på något sätt p.g.a några sjukdomar eller besvär?
   Ja, i någon mån 78:1
   Ja, betydligt 78:2
   Nej, inte alls 78:3
   Gäller ej mig, har inga besvär 78:4

FRÅGOR KRING FYSISK BELASTNING
Här följer några frågor kring hur tungt eller fysiskt krävande du upplever ditt arbete.


   Ja, p.g.a. ofta upprepade rörelser åt samma håll 4:1
   Ja, p.g.a. olämpliga arbetsställningar (ex. krokig,vriden,böjd rygg) 5:1
   Ja, p.g.a. olämpliga arbetsmetoder eller tekniker 6:1
   Ja, p.g.a. olämplig utrustning (tunga eller svårhanterliga lyftredskap, mellanlägg od.) 7:1
   Ja, p.g.a. olämpliga lokaler/trånga utrymmen 8:1
   Ja, p.g.a. för högt arbetstempo 9:1
   Ja, p.g.a. tunga eller olämpliga lyft (från ex.vis för låg eller för hög höjd) 10:1
   Ja, p.g.a. hala eller ojämna golv 11:1
   Ja, p.g.a. långa gångsträckor 12:1
   Ja, p.g.a. att arbetet som helhet är för tungt 13:1
   Ja, p.g.a. andra faktorer nämligen ____________________________ 14:1
   ____________________________ 15:1

   Nej, arbetet är inte speciellt tungt eller belastande för kroppen 16:1
38. Anser du att det går att göra ditt arbete mindre fysiskt tungt? Om Ja ge gärna förslag på hur,
   Nej
   Ja, genom att ___________________________________________ 17:2

39. Händser det att du är så trött efter dagens arbete att du har svårt att ta dig för med något t ex motionera, träffa vänner o s v?
   Ja, mycket ofta 18:1
   Ja, ganska ofta 18:2
   Ja, ibland 18:3
   Nej, sällan 18:4
   Nej, aldrig 18:5

40. Anser du att arbetet som krankopplare som helhet har blivit fysiskt lättare de senaste 5 åren?
   Ja  19:1
   Nej  19:2
   Vet ej, har arbetat för kort tid  19:3

41. Är Du besvärad av följande i ditt arbete?

<table>
<thead>
<tr>
<th></th>
<th>Ja i hög grad</th>
<th>Ja i någon mån</th>
<th>Varken ja el. nej</th>
<th>Nej inte alls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Damm</td>
<td>20:1</td>
<td>20:2</td>
<td>20:3</td>
<td>30:4</td>
</tr>
<tr>
<td>Svetsrökö</td>
<td>21:1</td>
<td>21:2</td>
<td>21:3</td>
<td>21:4</td>
</tr>
<tr>
<td>Syror el. frätande ämnen</td>
<td>23:1</td>
<td>23:2</td>
<td>23:3</td>
<td>23:4</td>
</tr>
<tr>
<td>Lösningsmedel</td>
<td>24:1</td>
<td>24:2</td>
<td>24:3</td>
<td>24:4</td>
</tr>
<tr>
<td>Oljedimma</td>
<td>25:1</td>
<td>25:2</td>
<td>25:3</td>
<td>25:4</td>
</tr>
<tr>
<td>Buller</td>
<td>26:1</td>
<td>26:2</td>
<td>26:3</td>
<td>26:4</td>
</tr>
<tr>
<td>Vibrationer</td>
<td>27:1</td>
<td>27:2</td>
<td>27:3</td>
<td>27:4</td>
</tr>
<tr>
<td>Dålig belysning</td>
<td>28:1</td>
<td>28:2</td>
<td>28:3</td>
<td>28:4</td>
</tr>
<tr>
<td>Temperaturväxlingar</td>
<td>29:1</td>
<td>29:2</td>
<td>29:3</td>
<td>29:4</td>
</tr>
<tr>
<td>Värmestrålning(fr matr.)</td>
<td>30:1</td>
<td>30:2</td>
<td>30:3</td>
<td>30:4</td>
</tr>
<tr>
<td>Luftfuktighet</td>
<td>31:1</td>
<td>31:2</td>
<td>31:3</td>
<td>31:4</td>
</tr>
<tr>
<td>Drag</td>
<td>32:1</td>
<td>32:2</td>
<td>32:3</td>
<td>32:4</td>
</tr>
<tr>
<td>Kyla</td>
<td>33:1</td>
<td>33:2</td>
<td>33:3</td>
<td>33:4</td>
</tr>
</tbody>
</table>
FRAGOR OM TILLBUD OCH OLYCKSFALL

42. Anser du att ditt arbete som krankopplare är riskfyllt?
   Ja, i hög grad 34:1
   Ja, i någon mån 34:2
   Tveksam 34:3
   Nej, absolut inte 34:4

43. Måste du ta större risker än vad du anser vara nödvändigt i arbetet?
   Ja, i hög grad 35:1
   Ja, i någon mån 35:2
   Tveksam 35:3
   Nej, absolut inte 35:4

44. Skyddsutrustning finns att tillgå på ditt arbete. Många gånger används den dock inte av olika skäl. Vilken skyddsutrustning har du tillgång till? Använder du den?

<table>
<thead>
<tr>
<th></th>
<th>Finns ej</th>
<th>Finns används ibland</th>
<th>Används ibland</th>
<th>Används oftast el. alltid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hörselskydd</td>
<td>36:1</td>
<td>36:2</td>
<td>36:3</td>
<td>36:4</td>
</tr>
<tr>
<td>Hjälm</td>
<td>37:1</td>
<td>37:2</td>
<td>37:3</td>
<td>37:4</td>
</tr>
<tr>
<td>Visir</td>
<td>38:1</td>
<td>38:2</td>
<td>38:3</td>
<td>38:4</td>
</tr>
<tr>
<td>Skyddsglasögon</td>
<td>39:1</td>
<td>39:2</td>
<td>39:3</td>
<td>39:4</td>
</tr>
<tr>
<td>Skyddshandskar</td>
<td>40:1</td>
<td>40:2</td>
<td>40:3</td>
<td>40:4</td>
</tr>
<tr>
<td>Skyddsskor/stövlar</td>
<td>41:1</td>
<td>41:2</td>
<td>41:3</td>
<td>41:4</td>
</tr>
<tr>
<td>Skyddskläder</td>
<td>42:1</td>
<td>42:2</td>
<td>42:3</td>
<td>42:4</td>
</tr>
<tr>
<td>Annat, vad?</td>
<td>43:1</td>
<td>43:2</td>
<td>43:3</td>
<td>43:4</td>
</tr>
</tbody>
</table>

45. Skyddsföreskrifter, anvisningar o.dyl. finns numera för de flesta arbeten. Känner Du till vilka interna skyddsföreskrifter som gäller för krankopplingsarbete?
   Ja absolut 44:1
   Ja i någon mån 44:2
   Tveksam 44:3
   Nej inte alls 44:4
46. Anser du att ackordlöneformen ökar risken för olycksfall i arbetet?  
Ja 45:1  
Nej 45:2  
Vet ej 45:3  

47. I praktiken används olika sätt att kommunicera kranförare och krankopplare emellan. Ett sätt är att använda det signalschema som finns. Använder du det?  
Ja, alltid 46:1  
Ja, ibland 46:2  
Nej, aldrig 46:3  

48. Anser du att olycksfallsriskerna kan minskas genom att alla krankopplare använder signalschemat?  
Ja 47:1  
Nej 47:2  

49. Anser du att radiostyrning av traverskran påverkar riskerna för olycksfall/tillbud?  
Ja, riskerna ökar 48:1  
Ja, riskerna minskar 48:2  
Nej 48:3  

Korsade, vridna eller knutna kättingar 49:1  
Slitna, nötta eller skadade stroppar/kättingar 49:2  
Överbelastade stroppar/kättingar 49:3  
Blockerade transportvägar 49:4  
Trång upplagsplats 49:5  
Olämplig stapling i materialställ och liknande 49:6  
För höga upplagsfickor 49:7  
Last som glider, förskjuts eller pendlar 49:8  
Annat t. ex. 49:9
51. Hur många olycksfall med minst 1 dags sjukskrivning har Du råkat ut för det senaste året respektive sammanlagt i ditt arbete som krankopplare? (Räkna inte med olycksfall till och från arbetet)

<table>
<thead>
<tr>
<th></th>
<th>inget o-fall</th>
<th>1 o-fall</th>
<th>2 o-fall</th>
<th>3 eller flera</th>
</tr>
</thead>
<tbody>
<tr>
<td>Senaste året</td>
<td>50:1</td>
<td>50:2</td>
<td>50:3</td>
<td>50:4</td>
</tr>
<tr>
<td>Sammanlagt</td>
<td>51:1</td>
<td>51:2</td>
<td>51:3</td>
<td>51:4</td>
</tr>
</tbody>
</table>

52. Har du råkat ut för något olycksfall i samband med tillfälligt inhop i någon annan krankopplares arbete?
- Ja 52:1
- Nej 52:2

53. Olycksfallstillbud eller lindrigare småskador (klämda fingrar o dyl) inträffar säkert i de flesta jobb, Hur ofta har du råkat ut för det i ditt krankopplararbete senaste året?
- Praktiskt taget aldrig 53:1
- Någon enstaka gång 53:2
- I genomsnitt 1 ggr/månad 53:3
- I genomsnitt 1 ggr/vecka 53:4
- Dagligen 53:5

54. Brukar olycksfallstillbud och småskador på ditt arbete rapporteras till arbetsledning eller skyddsorganisation?
- Ja, alltid 54:1
- Ja, ibland 54:2
- Nej, sällan 54:3
- Nej, aldrig 54:4

55. Kan du minnas något/några tillfällen under de senaste åren då du varit tvungen att stanna hemma från jobbet p.g.a. någon skada som inte anmälts som arbetsolycksfall?
- Ja 55:1
- Nej 55:2
FRÅGOR OM olika MANÖVRERINGSSÄTT

56. Du som arbetar med krankoppling kör du även traverskran? Vilken kran kör du mest?

Traverskran med förarhytt 56:1
Hängkabelstyrd traverskran 56:2
Radiostyrd traverskran 56:3
Annan typ av traverskran nämligen 56:4
Nej kör ej traverskran 56:5

57. Har Du tidigare kört någon annan typ av traverskran? Vilken kran körde du då mest?

Traverskran med förarhytt 57:1
Hängkabelstyrd traverskran 57:2
Radiostyrd traverskran 57:3
Annan typ av traverskran nämligen 57:4
Nej har ej kört någon kran tidigare 57:5

58. Om Du jämför de olika manövreringsätten vilket föredrar du?

Traverskran med förarhytt 58:1
Kabelstyrd traverskran 58:2
Radiostyrd traverskran 58:3
Annan typ nämligen 58:4
Vet ej 58:5

59. Finns det något som man speciellt kan förbättra på den typ av traverskran som du kör/betjänar?

Nej 59:1
Ja 59:2
Ge gärna förslag på förbättringar 59:3

60. Anser Du att transport med hjälp av traverskran är det bästa sättet att transporterera material i lokalen?

Ja 60:1
Nej 60:2
Ge gärna förslag på andra transportsätt 60:3
Följande frågor handlar om radiostyrning. Du som ej arbetar med radiostyrning ringa in svarsalternativet "Gäller ej mig".

61. Är du nöjd med radiostyrningen?
   Ja 61:1
   Nej 61:2
   Gäller ej mig 61:3
   Om nej varför inte 61:4

62. Är manövreringslådans utformning bra?
   Ja 62:1
   Nej 62:2
   Gäller ej mig 62:3
   Om nej vad kan förbättras 62:4

63. Är utformning och funktion av manövreringslådans reglage bra?
   Ja 63:1
   Nej 63:2
   Gäller ej mig 63:3
   Om nej vad kan förbättras 63:4

64. Stör manövreringslådans utformning och placering din arbets- teknik/arbetsställning el. dyl,?
   Ja 64:1
   Nej 64:2
   Gäller ej mig 64:3

FRÅGOR OM LYFTREDSKAP

65. Vilken typ av lyftredskap använder du mest?
   Kättingar 65:1
   Stållinestroppar 65:2
   Fiberstroppar 65:3
   Plåthandske 65:4
   Annat lyftredskap, nämligen 65:5
66. Vilket lyftredskap tycker du är svårast att använda? (Ringa in endast ett alternativ)

Kättingar 66:1
Stållinestroppar 66:2
Fiberstroppar 66:3
Plåthandske 66:4
Annan lyftredskap, nämligen ____________________________ 66:5

Ge gärna exempel på vad som gör redskapet svårt att använda.

____________________________________________________

____________________________________________________

____________________________________________________

PSYKO-SOCIALA FRAGOR (Arbetstrivsel)

67. Hur anser du att samarbetet mellan krankopplare och traversförare fungerar?

Mycket dåligt 67:1
ganska dåligt 67:2
varken bra eller dåligt 67:3
ganska bra 67:4
mycket bra 67:5
Jag både kopplar och kör traversen själv 67:6

68. Har något av följande medfört samarbetsproblem mellan dig och traversförare/krankopplare? Samarbetsproblem kan bero på många orsaker, ange den viktigaste.

Det är så bullrigt att man måste gestikutera och skrika för att göra sig förstådd 68:1
Det är så dammigt och rökigt att sikten är dålig 68:2
Överenskomna signaler används inte eller används felaktigt 68:3
Sikten är skymd av materialhögar, maskiner m.m. 68:4
Traversföraren/krankopplaren är ouppmärksam 68:5
Dålig belysning 68:6
Litar ej på min kranförare/krankopplare 68:7
Annan orsak ____________________________ 68:8
Nej inga samarbetsproblem förekommer 68:9
Tag ställning till följande påståenden genom att ringa in ett svarsalternativ på varje.

<table>
<thead>
<tr>
<th>Stämmer absolut</th>
<th>Stämmer i stort sett</th>
<th>Stämmer knappast</th>
<th>Stämmer absolut inte</th>
<th>Kan ej svara</th>
</tr>
</thead>
<tbody>
<tr>
<td>70. Mitt arbete är ansvarskravande</td>
<td>70:1</td>
<td>70:2</td>
<td>70:3</td>
<td>70:4</td>
</tr>
<tr>
<td>72. Mitt arbete ger bra kontakt med mina arbetskamrater</td>
<td>72:1</td>
<td>72:2</td>
<td>72:3</td>
<td>72:4</td>
</tr>
<tr>
<td>73. Den fysiska arbetsmiljön är bra</td>
<td>73:1</td>
<td>73:2</td>
<td>73:3</td>
<td>73:4</td>
</tr>
<tr>
<td>74. Mitt arbete ger mig möjligheter att själv bestämma hur jag ska lägga upp det</td>
<td>74:1</td>
<td>74:2</td>
<td>74:3</td>
<td>74:4</td>
</tr>
<tr>
<td>75. Mitt arbete ställer stora krav på uppmärksamhet</td>
<td>75:1</td>
<td>75:2</td>
<td>75:3</td>
<td>75:4</td>
</tr>
<tr>
<td>76. Mitt arbete är okvalificerat</td>
<td>76:1</td>
<td>76:2</td>
<td>76:3</td>
<td>76:4</td>
</tr>
<tr>
<td>77. Mitt arbete är tungt och slitsamt</td>
<td>77:1</td>
<td>77:2</td>
<td>77:3</td>
<td>77:4</td>
</tr>
<tr>
<td>78. Mitt arbete är jäktigt och psykiskt påfrestande</td>
<td>78:1</td>
<td>78:2</td>
<td>78:3</td>
<td>78:4</td>
</tr>
<tr>
<td>79. Mitt arbete innebär ständigt ombyte av arbetskamrater</td>
<td>79:1</td>
<td>79:2</td>
<td>79:3</td>
<td>79:4</td>
</tr>
<tr>
<td>80. Min utrustning (verktyg o dyl.) är dålig eller olämplig.</td>
<td>4:1</td>
<td>4:2</td>
<td>4:3</td>
<td>4:4</td>
</tr>
<tr>
<td>81. Jag måste ofta anpassa mig till mina medarbetares arbetssätt och arbetstakt</td>
<td>5:1</td>
<td>5:2</td>
<td>5:3</td>
<td>5:4</td>
</tr>
<tr>
<td>82. Min närmaste arbetsgivare planerar och organiserar så att arbetet flyter (uppgifter, material etc)</td>
<td>6:1</td>
<td>6:2</td>
<td>6:3</td>
<td>6:4</td>
</tr>
<tr>
<td>83. Jag blev väl omhändertagen och väl insatt i arbetet när jag kom som ny krankopplare.</td>
<td>7:1</td>
<td>7:2</td>
<td>7:3</td>
<td>7:4</td>
</tr>
</tbody>
</table>
FRÅGEFORMULÄR

Detta frågeformulär delas ut till alla personer i åldern 20 - 65 år som söker läkare vid Mjölkuddens vårdcentral, Timmermansgatan eller Örnäsets vårdcentral under veckorna 7 - 9 1984. Syftet är att samla in information om för vilka besvär människor i dag söker hjälp på en vårdcentral, om besvären anses ha samband med arbetet och förväntningarna på den behandling som ges.

Kunskaperna skall användas för att förbättra vårdcentralens möjligheter att hjälpa Dig framöver. De skall också användas i sjukgymnastutbildningen i Boden bland annat som underlag för projektarbeten i ergonomi och därmed insatser i arbetslivet.

Uppgifterna kommer att databearbetas, allt fullständigt anonymt.

Ett stort TACK för att du ställer upp och besvarar dessa frågor.

Gunvor Gard
Leg sjukgymnast
Lärare vid Vårdförsökskolan i Boden

Kön: Man ☐
     Kvinnan ☐

Alder: 20 - 29 år ☐
       30 - 39 år ☐
       40 - 49 år ☐
       50 - 59 år ☐
       60 - 65 år ☐

Vad har du för arbete? ___________________________

Hur vill Du beskriva arbetsställningen i Ditt arbete? Sätt ett kryss i en ruta, den som bäst stämmer med Din uppfattning.

Bekväm ☐ Obekväm ☐ Päfrestande ☐ Riskabel ☐

Symmetrisk och avspänd ställning utan större belastning
Ensidig arbetsställning
Tungarbetad arbetsplats
Starkt fixerad eller vriden ställning
Hur vill Du beskriva den kroppsansträngning Du är utsatt för i ditt arbete? 
Sätt ett kryss i en ruta den som bäst stämmer med din uppfattning.

- Inget eller obetydligt kroppsarbete
- Lätt kroppsarbete en hel del spring i arbetet
- Medeltungt kroppsarbete lyft och hantering dagligen. (ej över 15 kg)
- Tunat kroppsarbete, tunga lyft och tung hantering dagligen. (över 15 kg)

Hur upplever Du Din arbetstakt? 
Sätt ett kryss i en ruta, den som bäst stämmer med din uppfattning.

- Lätt
- Tröttande
- Påfrestande
- Farlig

ofta utschasad vid arbetets slut

Vilken grad av inflytande anser Du att Du har över följande frågor?

- Planering av ditt arbete
- Ditt eget arbetstempo
- Förläggning av Dina raster

Inget inflytande alls Visst inflytande Stort inflytande Frågan ej aktuell Vet ej

- Planering av ditt arbete
- Ditt eget arbetstempo
- Förläggning av Dina raster

Är ditt arbete sådant att Du har möjlighet att lära Dig nya saker i arbetet?

- Ja i hög grad
- Ja i någon mån
- Nej inte alls
- Vet ej
1. För vilka besvär får Du sjukgymnastisk behandling?

2. Vad har Du för typ av arbete?

3. Anser Du att ditt nuvarande eller tidigare arbete kan ha medverkat till eller orsakat Dina besvär? Ja [ ] Nej [ ]

4. Om ja, vilka arbetsmoment eller förhållanden i arbetet kan ha orsakat besvären?

5. Tycker Du att ditt arbete är: (Ringa in ett av alternativen 1-5)
   - Stressigt
   - Enformigt
   - Kvalificerat
   - Intressant
   - Självständigt
   - Svårt
   - Fysiskt påfrestande
   - Psykiskt påfrestande
   - Kunskapskrävande

6. Om Du tycker att ditt arbete är stressigt, vad beror stressen på?

7. Hur brukar Du fungera i stresssituationer?
   Ringa in det svarsalternativ som bäst beskriver hur Du brukar fungera
   ++ = om Du definitivt brukar reagera så som påståendet beskriver
   + = om Du i viss mån brukar reagera så som påståendet beskriver
   - = om Du knappast brukar reagera så som påståendet beskriver
   -- = om Du definitivt inte brukar reagera så som påståendet beskriver
   
   Jag försöker att se så lättsamt som möjligt på situationen - vägrar att ta den på allvar ++ + --
   Jag brukar utforma en handlingsplan och försöker följa den ++ + --
   Jag betraktar stresssituationer som utmaningar som är till för att lösas ++ + --
   Jag litar på min förmåga att lösa nya och svåra situationer ++ + --
   Jag söker stöd och uppmuntran från min omgivning ++ + --
   Jag försöker tänka på andra saker för att få distans ++ + --
Vilken grad av inflytande anser Du att Du har över (sätt ett kryss på aktuell rad)

<table>
<thead>
<tr>
<th>Planeringen av ditt arbete</th>
<th>Inget inflytande</th>
<th>Visst inflytande</th>
<th>Stort inflytande</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hur Du utför ditt arbete</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ditt arbetstempo</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>När Du tar rast i arbetet</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Är Ditt arbete sådant att Du (sätt ett kryss på aktuell rad)

<table>
<thead>
<tr>
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Anser Du att sjukgymnasten på något sätt kan hjälpa Dig att bättre hantera förhållanden i Din psykosociala arbetsmiljö, t.ex. att bemästra stress

<table>
<thead>
<tr>
<th></th>
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<tr>
<td>Om ja - på vilket/vilka sätt?</td>
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Övriga kommentarer till frågorna

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För vilka besvär besöker Du folktandvården idag? ..............................................

Har Du idag besvär från rörelseorganen (skelett, leder eller muskler i kroppen)?
   Ja    Nej    Om ja, vilken typ av besvär? ..............................................

Vad har Du för arbete? ..............................................................

Tycker Du att ditt arbete är (Ringa in ett av alternativen 1 - 5)

Stressigt         Ja mycket  1  2  3  4  5 Nej inte alls
Enformigt         1  2  3  4  5
Kvalificerat      1  2  3  4  5
Intressant        1  2  3  4  5
Självständigt     1  2  3  4  5
Svårt             1  2  3  4  5
Fysiskt påfrestande  1  2  3  4  5
Psykiskt påfrestande  1  2  3  4  5
Kunskapskrävande  1  2  3  4  5

Hur brukar Du fungera i stresssituationer? Ringa in det svarsalternativ som bäst beskriver hur Du brukar fungera

++ om Du definitivt brukar reagera så som påståendet beskriver
+ om Du i viss mån brukar reagera så som påståendet beskriver
- om Du knappast brukar reagera så som påståendet beskriver
-- om Du definitivt inte brukar reagera så som påståendet beskriver

Jag försöker att se så lättsamt som möjligt på en situation och vägrar att ta den på allvar        ++ + - --
Jag brukar utforma en handlingsplan och försöker följa den         ++ + - --
Jag betraktar stresssituationer som utmaningar som är till för att lösas         ++ + - --
Jag litar på min förmåga att lösa nya och svåra situationer         ++ + - --
Jag söker stöd och uppmuntran från min omgivning         ++ + - --
Jag försöker tänka på andra saker för att få distans         ++ + - --
Vilken grad av inflytande anser Du att Du har över (sätt ett kryss på aktuell rad)

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<tr>
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<th>Visst inflytande</th>
<th>Stort inflytande</th>
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<tr>
<td>Planeringen av Ditt arbete</td>
<td>-----</td>
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<tr>
<td>Hur Du utför Ditt arbete</td>
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<tr>
<td>Ditt arbetstempo</td>
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<tr>
<td>När Du tar rast i arbetet</td>
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Är Ditt arbete sådant att Du (sätt ett kryss på aktuell rad)

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