ISSN 1392-2785 ENGINEERING ECONOMICS. 2008. No 5 (60)
WORK HUMANISM

Innovations at Workplace: Improvement of Ergonomics

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New physical overload factors (as working in the compulsory position or monotonously, where the strain of muscles is one-sided) have appeared for workers with the growth of information technology and logistics. The monotonous work is also a psychological hazardous factor, so the influence of work methods on workers' health might be multilateral. The work-world is changing, however the physical overload from lifting weights and manual material handling may not disappear in the near future, as the long supply chain necessary for globalized production means that goods are often produced in one country and consumed in another.

A calculation method (MODEL) for the assessment of the ergonomics of manual handling of loads is presented in the study. The results of the use of the method are given in manufacturing, for comparison in oldsters' care hospital, where the physical overload is rather high. Innovations have been introduced in the last years. Musculoskeletal disorders (MSDs) connected with monotonous work are medically examined for garment workers. In parallel, the questionnaire for assessment of mental strain of workers was used. There is no mental strain observed in garment workers, but it is rather high for medical personnel. The results show the possibilities to improve the work environment and workers' health through ergonomic analysis of workplace, good workplace design, education of special trained occupational hygienists and through them the education of blue-collar workers, the use of robot manipulators and roller conveyors, the increase of management interest and acceptance of ergonomics, the build-up of a bridge between planning and production departments.

Keywords: *innovation, work environment, risk assessment, ergonomics, garment workers, musculoskeletal disorders.*

Introduction

The working environment in the Baltic States (Woolfson et al., 2008) has changed considerably during the last ten years and is continuing to evolve as a result of the following trends much in line with broader European trends identified in the key EU strategy documents on OHS: new technologies, growing use of information and communication technology, growth in the service sector, more specific risks (ergonomics and personal contact with people, stress, violence); new forms of work, such as telework, self-employment, subcontracting, temporary employment; ageing workforce; increasing interest in autonomous work; changing management structures - organizations have become flatter, smaller and leaner; a growing number of SME's, in which health and safety knowledge and resources are often insufficient; increasing work pace and work load. The managers' role and competence as well as knowledge management and transfer in enterprises have become on the first place in the increase of competitiveness and productivity of the firm (Järvis, 2008; Kumpikaite, 2007; Girdauskiene, 2007).

The musculoskeletal disorders (MSDs) are the most common work-related health problemsin Europe, affecting millions of workers. Across the 27 Member States, 25% of workers complain of backache and 23% report muscular pains (European Agency, 2007). According to the European statistics, 62% of workers in the EU27 are exposed a quarter of time or more to repetitive hand and arm movements, 46% to painful or tiring positions and 35% to carrying or moving heavy loads. The European Agency on Work and Health organized the campaign "Lighten the Load" in 2007, which indicates that manual work is still widespread in European area. Particularly, female workers are at risk. Some authors (Drury, 2005; Kahn, 2003) argue, that there will be even more material handling as before, and at least some of it will be manual, and there will be continued time pressure on the workforce to be effective and efficient to produce high quality, low cost and on-schedule delivery. Besides, with the growth of information technology new overload factors have appeared as work in the compulsory position or monotonous work straining muscles is one-sided. The monotonous work may lead to increased worker fatigue due to continuous handling of loads, prolonged standing, repetitive movements of both hands and wrists, awkward postures. The human body responds to stress-factors through four systems – central nervous, automatic nervous, endocrine and immune – which are constantly interacting as a complex network. There are indications on combination of exposure workers to both MSDs and psychosocial risk factors (Reinert, 2007) – together these hazards affect the workers health to a greater extent. K. Johannisson (Stress, 2006) declares that stress as a term was known already in 1900; in 2000 they began to speak about burnout. The psychological and physical factors which affect human organism on workplaces are considered to be stress factors which affect the functional state of the central nervous system (Randmann, 2002; Tint et al., 2007). The main physiological stress-factor is poorly designed workplace (Engels, 1994; Gunning, 2000; Hollmann, 2001). Other physiological hazards include lifting loads, physical

exertion, fatigue, working long in the same posture, standing; poor support from colleagues and from the hierarchy (Reinert, 2007) etc. They all may affect the functional status of the nervous system.

The list of psychological stress-factors is a large: job content (lack of variety or short work cycles, meaningless work, under use of skills, high uncertainty) (Leka, 2003), work overload or underload, work pace (high levels of time pressure, machine pacing), work schedule (shift working, night shifts, unpredictable hours), control of work (low participation in decision making, lack of control over workload), inadequate equipment availability, organizational problems (poor communication, low levels of support of problem solving), interpersonal relationships, job insecurity, home-work interface (low support at home, conflicting demands of work and home) etc, but they can be derived also from physical or chemical factors such as inconvenient microclimate, excessive noise, insufficient lighting, dangerous chemicals.

Exposure to different types of hazards can cause different types of harm. For example, exposure to organic solvents may have a psychological effect on the person through their direct effects on the brain, through the unpleasantness of their smell and through fear that such exposure might be harmful (Levi, 1981). Physical hazards can affect health through psycho-physiological as well as physical-chemical pathways (Levi, 1984). Furthermore, significant interactions can occur both between hazards and in their effects on health.

Occupational stress (the mobilization due to alarm of the adoption possibilities of the organism reserves) develops three stages (Reinhold, 2006):

1) Hypersthenic stage (characterized with different subjective symptoms (mild asthenia, irritability, fatigue, pains in the muscles, paresthesis etc.)).

2) Hyposthenic syndrome (moderate asthenization, localized pain syndromes, different objective neurological symptoms etc.). The long-time exposure of the occupational stressor can cause the non-revisable changes in the organism – the development of the occupational disease.

3) Occupational disease.

The development of the occupational stress depends on the dose-response relationship: the length of time of the occupational stress, the specific character of the stressor and the functional state of the organism. The statistics of occupational diseases is the specific indicator which influences the existing hazards and risk factors on the worker in the work environment. However, the occupational diseases in Estonia (Figure 1) are usually diagnosed in the late stage of disease when the worker is already disabled and therefore, may not reflect all health disturbances adequately. The main part of these diseases is connected with musculoskeletal disorders (NLI, 2006), which are the most frequently mentioned problems in many surveys across the Europe (Jones, 1998 and 2006; Paoli, 2000). The problems caused by the mental stress at workplace are not considered to be induced by the work conditions in Estonia yet, although in European work-related health surveys occupational diseases caused by stress occupy the second place after musculoskeletal complaints (Jones, 2006, Paoli, 2000).

The basic aim of a risk assessment is to prevent accidents (Harms-Ringdahl, 2001). In Estonia, the registered occupational accidents rate has been increased compared to 1998 - a survey (European Foundation…, 2007) shows, that the standardized index of serious and fatal accidents at work in 2004 appears 35.4% higher than the average EU value (Figure 2). The reasons for this outcome have not been studied in depth as there is no support from the government for scientific studies in the field of work accidents; therefore at this time in Estonia understanding of their complex nature remains speculative. Estonia in one of the fewest countries in the European Union where the insurance law on work accidents and diseases has not been settled.

The research problem: physiological and psychological risk factors in the work environment.

The research object: the workers in manufacturing and their working conditions, particularly the risk of manual lifting of loads.

The research objective: to show that the working conditions of workers can be improved by the innovative ergonomic solutions at workplace.

The research methods: model for risk assessment of lifting loads manually; questionnaires, worked out for the purpose; medical examinations of workers.

The scientific novelty: use of model- method: the risk assessment based on the directives and experience of the European Union. The connections between the risk assess-ment at workplace and health complaints of workers are given.

Aims

The aim of the study was to analyse the risk level of lifting loads and manual material handling in Estonian medium-scale enterprises using a new method for risk assessment. As control group the oldsters' care hospital workers MSDs were investigated. The health status (medical examinations) and the co-influence of the physical and mental hazards (with the help of questionnaires) of garment workers in medium-scale enterprise were determined.

Materials and Methods

The workers, whose lifting load capacities and the health complaints caused by heavy loads were investigated, worked in the medium sized companies (the number of workers between 150 and 500) in manufacturing industry**:** I - garment, II - printing, III - wood processing, IV - plastic, V - rubber, VI - mechanical industries and in an oldsters' care hospital (VII).

It is well-known (Engels, 1994) that unlike large companies, small and medium sized enterprises mean more workers without the benefit of extensive services, such as on-site medical or ergonomics programs.

The activities in the investigated companies were as follows: the garment company (I) produces work clothes (the risk assessment carried out in 2002 and 2006), printing company (II) manufactures printed documents (newspapers, advertisements, magazines), the wood processing company (III) elements for furniture, the plastic company (IV) plastic tubes and other plastic parts to medical industry (the risk assessment carried out in 2000 and 2003), the rubber company (V) produces rubber seals and other rubber products mostly for car industry abroad and the mechanical company (VI) produces two-wheeled trailers for passenger cars (risk assessment carried out in 2000 and 2004).

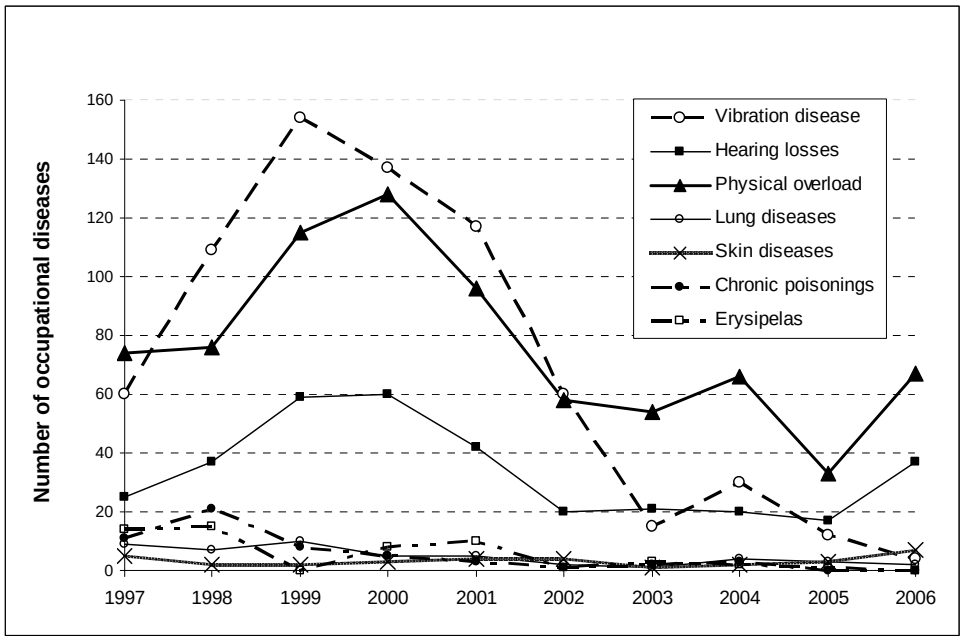

Figure 1. The occupational diseases in Estonia 1997-2006

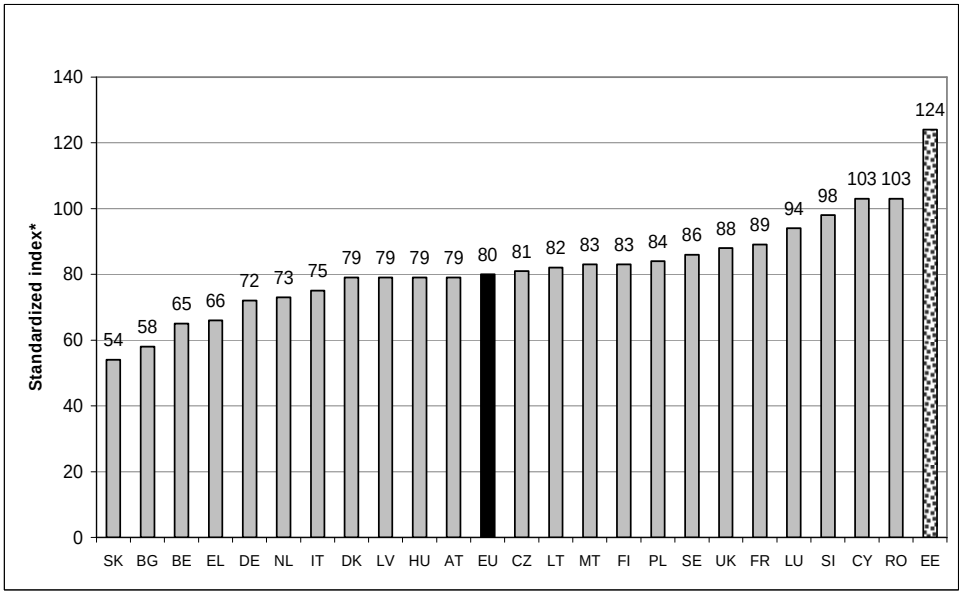

Figure 2: Serious and fatal accidents at work in EU, 2004 (1998 = 100)

**1998 is the reference year, and is indicated as the value of 100. Any data above 100 therefore represent an increase in the incidence of serious and fatal work accidents since 1998, while data below 100 represent a decline in the number of such accidents since that year. Data for IE, ES and PT are not available for 2004.*

The control group is described in the following way: medical personnel (VII) in hospitals (particularly taking care of aged patients) - need to cope with the heavy physical load and in many cases, often suffer from the diseases of musculoskeletal disorders.

In order to perform the risk assessment of lifting the loads in the workplace, the Regulation No 26 of the Estonian Ministry of Social Affairs of 27 February 2001 "Occupational Health and Safety Requirements for Manual Handling of loads" is used (MODEL).

The assessment in the MODEL is divided into the following parts:

- 1'- assessment on the weight of the load to be handled (Table 1);
- 2'- assessment on posture (Table 2);
- 3'- assessment on work environment conditions (Table 3);
- Calculation: (1'+2'+3') x D = Risk rate, where D is duration (Table 4).

On the dependence of Risk rate the Risk level is determined (Table 5).

Table 1.

Assessment on the weight of the load to be handled (1')

Weight of the load to be handled (men)	Weight of the load to be handled (women)	Assessment on weight (points)
< 10 kg	< 5 kg	1
10–20 kg	5–10 kg	2
20–30 kg	10–15 kg	4
30–40 kg	15–25 kg	8
≥ 40 kg	≥ 25 kg	10

Table 2.

Assessment on posture (2')

Illustrative figure	Assessment on posture (points)
 standing posture, the upper body is neither turned nor bent; the load is held against the body; standing posture or few steps are made	1, slight
 upper body is bent front up to 300^0 or bowed posture; the load could not be held against the body or it will be lifted above the shoulders; sitting or standing	2, moderate
 upper body is bent front up to 300 or bowed posture; the load could not be held against the body or it will be lifted above the shoulders; sitting or standing	4, high
 turned upper body bowed far front; the load could not be held against the body; standing on the unstable footing, kneeling or crouching	8, peak

Table 3.

Assessment on work environment conditions (3')

Ergonomic conditions of work environment	Assessment on conditions (points)
– sufficient space for work – the floor is even and not slippery; – good lighting	0
– insufficient space for work: work space less than 1.5 m^2, low ceiling etc. – unstable posture; slippery, uneven or slanting floor	1

Table 4.

Assessment on the duration (D) of handling work

Regularly repeated handling of loads	Summary time for holding or carrying the loads	Time assessment (points)
< 10 times in shift	< 30 min	1
10–40 times in shift	30 min – 1 hour	2
40–200 times in shift	1 hour – 3 hours	4
200–500 times in shift	3 hours – 5 hours	6
≥ 500 times in shift	≥ 5 hours	8

Table 5.

Determination of risk level

Risk rate	Risk level	Description of health risk and necessary action
< 10	1	Minor burden, minor health risk
10–25	2	– moderate burden – certain category of workers might be overburdened, whereas their work should be reorganized and the workplace ergonomically rearranged
25–50	3	– major burden – occurrence of potential physical overburden of also physically fit worker – changes in work organization and ergonomic rearrangement of workplace needed
≥ 50	4	– to complete the work up to making rearrangements – excessive burden – obvious physical overburden – changes in work organization and ergonomic rearrangement of workplace needed

Table 6.

Assessment of risk level of lifting loads in the investigated companies

Company	Weight 1’	Posture 2’	Conditions 3’	Sum 1’+2’+3’	Time	Risk rate/risklevel
I-sewers	2	2	1	5	4	20/2
II-printers	4	2	0	6	4	24/ 2
III-polishers	10	8	1	19	2	38/ 3
IV-pressers	2	2	1	5	2	10/ 1
V-wrappers	4	2	0	6	4	24/ 2
VI-compilers	10	8	1	19	2	38/ 3
VII-nurses	10	8	1	19	4	78/4

Computerized method

The calculations of risk level can be carried out with computer as follows.

First example

A male worker has to lift the loads 30-40 kg (Table 1, rate ‘8’) above his shoulders (Table 2, rate ‘4’) 6 hours per day (Table 4, rate ‘4’). The lifting has to be performed in uneven posture (Table 3, conditions not OK, rate ‘1’).

The risk level$_1$ = (8+4+1) x 4= 52,
risk level **4 => Critical Limit**

Mass: **8**

Sex: **xMale ☐ Female**

Position Load: **☐ Slight ☐ ModeratexHigh ☐ Peak**

Condition: **OK xNot OK**

Times Executed: **4**

OK

4 => Critical Limit

Second example

A male worker has to lift the loads 30-40 kg (Table 1, rate ‘8’) above his shoulders (Table 2, rate ‘4’) less that 30 minutes a day (Table 4, rate ‘1’) in good working conditions (sufficient space, good lighting, Table 3, conditions OK, rate ‘0’).

The risk level$_2$ = (8+4+0) x 1 =12,
risk level **2 =>Normal**

Mass: **8**

Sex: **xMale ☐ Female**

Position Load: **☐ Slight ☐ Moderate xHigh ☐ Peak**

Condition: **xOK ☐ Not OK**

Times Executed: **1**

OK

2 => Norm

Investigations of the Estonian medical researchers of MSDs

The national investigations in post-socialist countries in occupational health and safety are very needed as the field is very sensitive and connected with people’s health. Several investigations have been carried out in the field of MSDs in Estonia during last years (Kahn, 2003; NLI, 2005; Vain, 2008; Übner, 2002). Hereby, a short review of the results of these investigations is presented.

Occupational physical overload diseases, the diseases of upper limbs, neck and shoulder region among them, have occupied the leading position in the structure of Estonian occupational diseases during the last years (NLI, 2006). In addition to rise of such incidences, there is a worrisome tendency to diagnose these diseases too late – in the phase when the individual’s work ability has decreased vastly and is incapable to perform his present work with required quality or pace. One essential reason for late diagnosis is inadequate risk assessment of workplaces, which do not give enough qualitative information to occupational health physicians for early diagnoses of occupational physical overload disease. In the investigation (Kahn et al., 2003) of patients (N=428) from different occupations (sewers, cleaners, workers in wood and food processing industry) regarded with suspicion of occupational physical overload disease, the main group belonged to the age group 40-49 (34.3%) and 50-59 (54.4%). The primary reasons for developing the physical overload disease in different activities and work conditions were:

- lifting of loads, compulsory positions and cold climate (53.3% of respondents);
- intensive work in compulsory position (22.7%);
- lifting of loads, compulsory positions and chemical hazards (10.5%);
- lifting of loads, compulsory positions, noise and vibration (4.4%);
- lifting of loads, compulsory positions, emotional strain, disturbance of the vacation regime and cold climate (4.2%);
- lifting of loads, cold climate and noise (2.3%);
- compulsory positions and overstrain of eyes (1.2%);
- other (1.4% of all occupational physical overload diseases).

According to the investigation of Übner (2002) the sick-leaves of medical personnel working in oldsters' caring hospitals is high and depends highly on the medical worker's age (while people in the age group 18-24 years take sick-leaves on the average for 37 days a year, then people from age group 55-64 take sick-leaves on the average already for 95 days a year).

The forgoing stadium to the decrease of blood circulation in muscles is stiffening. This stadium is the warning stadium for the developing of a MSD. A.Vain (2008) from Tartu University (Estonia) has worked out and designed a myometre (Myoton) that enables to measure the following parameters:

- frequency of self-oscillation of the muscle that indicates the condition of blood circulation in the muscle;
- the velocity of muscle's attenuation that characterize the elasticity of the muscles;
- rigidity of the muscles that characterize the property of muscles to stand up against the power of changing the shape of the muscle.

This equipment has been successfully used for investigations of 1796 workers. The result is that if the tonicity of the muscle increases then the resistance to the blood circulation also increases.

The use of MODEL in enterprises and for the control - group

The results of the investigation of lifting the loads in different institutions show (Table 6) that the risk appears to be the highest (level 4) in oldsters' care hospital.

Several cross-sectional studies by other authors (Engels, 1994 and 1998; Hollmann, 2001; Niedhammer, 1994) demonstrate the association between lifting loads and musculoskeletal diseases in the nursing profession. It is believed that physical overload affects the development and maintenance of many health problems, but it remains largely unclear exactly how the different factors interact and precisely which factors trigger which disorder (Niedhammer, 1994). Therefore, lifting of patients is not recommended to do alone but work in pairs (male and female persons). The research (Übner, 2002) in Estonia shows that the physical load of medical workers can be considerably reduced with the help of new ideas for improvement of workplace ergonomics.

The attention should be paid to the following issues while nursing elderly patients with movement disabilities:

- wards should be designed ergonomically (size, layout, walking distances);
- beds used in wards should be electrically adjustable;
- toilets should be larger and the toilet pots established higher;
- duration and light should be purchased;
- proper working movements: all the employees who are engaged in lifting the patients should have an appropriate training.

The highest risk level in manufacturing was registered in wood processing (III) and mechanical industry (VI). The results indicate that the most overwhelming physical activities are not performed manually, but operated by various mechanisms which may produce the appearance of other risk factors such as the overload of some muscles caused by monotonous work. Therefore, it is essential to carry out the assessment of operator's workload.

Work-related musculoskeletal disorders of the upper extremities are still one of the main causes of occupational overload diseases (NLI, 2006). Back pain and muscle pain (neck and shoulders) are often reported, too, possibly due to working in painful positions, carrying of heavy loads, and intensification of work. Possible disorders like carpal tunnel syndrome, epicondylitis, rotator cuff syndrome, myalgia, etc. result from the physical activities, which cause the strain of the locomotor system.

The possibilities for rehabilitation from the physical overload disease are: massage, hydropathical estab-lishment, swimming, water gymnastics, specific motive care. If the working capacity worsens, the radical treatment with medicines is needed together with physical care methods. The special medical treatment is individual in each case depending on the severity of the deficiency.

Ergonomic risk factors increase the threat of injury to the worker's musculoskeletal system. Unlike 50 years ago, when traumatic injuries were dominant, nowadays disabilities of the lower back and upper extremities, associated with overexertion and overuse, constitute the majority of all work injuries.

The case studies I-VI included an independent interview with the safety personnel of the company where the accidents investigation took place. In some of the factories (I, II & VI), management has been interested, motivated as well as effective improving the working conditions within last 2 years. The main types of accidents in the companies (I, II, III, VI) were slips, pinching of fingers and back injuries. The employees with whom the accidents occurred were rather experienced workers (half of them had worked in the factory for 10-20 years). The workers (in VI) were complaining on back injuries caused by lifting tasks while the injuries (in VI) were typically caused by sharp pieces of sheet metal.

It should be emphasized, that in each company, where the risk assessment is carried out regularly, the number of accidents shows a decreasing trend.

In most companies, the housekeeping was functioning at a good level. The storage of materials was well organized and the walking and working surfaces were mainly clean and free. Some manual handling tasks were observed in the companies, but a large part of products was transported using trucks or hoists.

Job hazard analysis which is a detailed examination of a job health and accident hazards was performed in investigated companies as well. In most cases, truck driving was seen as a special and potentially hazardous task. Training for specialized operations was given in all companies. In most cases, new employees were trained by senior workers.

Safety communication between top managers, other supervisors and the employees is still in a low level in Estonian enterprises. The same trend was noticed in investigated companies as well - workers' involvement in safety management was insufficient, except in one company (II), where workers' representatives participate actively in the meetings of work environment councils and have fruitful discussions on the improvement possibilities

of workers' health conditions at workplaces. In another example (V), communication between workers and management barely existed; the interest from the side of the management was more obvious due to the Labour Inspectorate checkups while most workers weren't concerned about their health or working conditions.

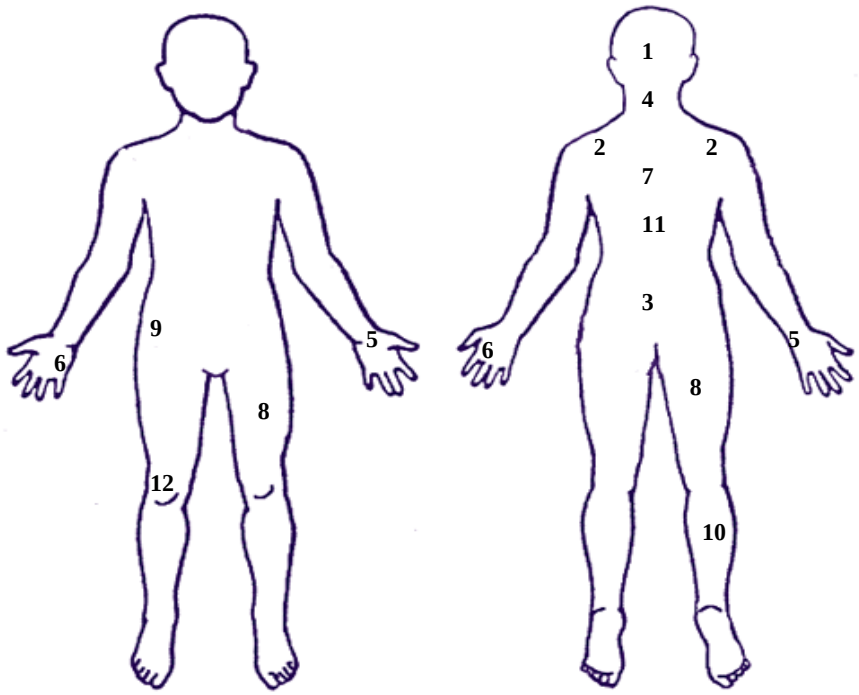

Figure 3. The painful points in the body:

1- Headache and head fatigue
2- Shoulder pains
3- Lower back pains
4- Pain in neck area
5- Carpal channel syndrome (moderate stadium), pain in wrist
6- Fatigue and the disturbances of sensitiveness in hands
7- Back pain in breastbone region
8- Pain in thing muscle
9- Pain in hips
10- Pain in leg muscle
11- Back pain
12- Pain in knees

The periodical medical examinations of workers are very important as they give the possibility to diagnose the diseases in the early stage and the worker's health can be totally recovered. The medical side of the current work was carried out by the Medical Centre "Work and Health Co." in a small Estonian town, where the job market is tight and the women need to satisfy with the jobs available – many of them are offered in the textile and garment area.

MSDs can affect the body's muscles, joints, tendons, ligaments, bones and nerves (European Agency 2007). Concerning body parts, MSDs affect the back, neck, shoulders and upper limbs, less often lower limbs are influenced. Health problems range from discomfort, minor aches and pains to more serious medical conditions requiring absence from work and even medical treatment in more chronic cases. Unfortunately, treatment and recovery are not always possible – which may result to permanent disability and loss of employment.

The investigated group of textile workers (mainly sewers, also pressers, transport workers, embroiderers, mechanics) have been influenced by long-lasting manual handling of loads. In many cases, the disorders of musculoskeletal and neural system are felt already after one year experience of work. The relations between the height and weight of the workers were investigated. The study indicates that thin female persons are more susceptible to the musculoskeletal disorders, radiculitis and backache and lower back diseases than overweighed women.

There were 230 participants (16 men and 214 women) in the study. The middle age of investigated group was 36.2 years. Only 36 healthy persons (16% of all examined) were identified in the sewers' group.

The control-group consisted of 33 persons (7 men, 26 women) of management personnel (quality managers, sail agents, technologists, project managers, storekeepers etc.). In control-group, 72.7% of workers had no musculoskeletal disorders and were recognized healthy in this respect. Some employers among management (12%) had worked as blue-collar workers (sewers) in the past. The middle age of the control group was 36.8 years.

The main complaints (Figure 3) were:

Sewers' group: shoulder pains (27%), lower back pains (46%), pain in neck area (21%), headache and fatigue of the head (15%), carpal channel syndrome - moderate stadium (18%), back pain in the pectoral region (8%), the fatigue of hands and the disturbances in the sensitiveness (16%), pain in hip (2%), pain in the leg muscle (7%), knew pains (6%), pain in thigh muscle (2%), back pain (8%).

The control-group: upper limb pains (3%), lower limb pains (12%), pain in the neck (3%), headache and fatigue of the head (3%), knee pains (3%), no carpal channel syndrome.

Assessment of psychological risk factors

Mental stress is the second common health symptom reported by the European workers (Paoli, 1994). Stress and features of work organization like pace of work, time pressure and repetitive work were found to be correlated (Cox, 1993). For example, where conditions like working at high speed and too tight deadlines were present, the number of reporting stress doubled (Paoli, 2000). 28% of the European workers think that stress influences their health and workability (Teichmann, 2002). 38% of Estonian workers were under the stress in 2002 (Ministry of Social Affairs, 2002).

As medical doctors and nurses are one of the workers group who are under great work stress (Teichmann, 2002; Aaviksoo et al., 2005). The investigations in medical institutions show the connections between the physical and mental risk factors.

The questionnaire compiled in the present study focused on clarifying the factors in the work environment what disturb workers mentally. The questions consisted of the following area: nature of job (contact with patients, clients, public; exposure to noise, vibration, monotonous work, extreme heat/cold), work organization (work pace, working alone, working without breaks, inadequate training for the work etc), degree of control over job and work environment (poorly designed work stations, insufficient ventilation, inappropriate lighting levels etc). The results were got from the area where physical and mental hazards get together. The number of respondents in garment industry was 256; and 356 in Estonian hospitals. Because the data are gathered by means of questionnaire, it is obvious that all variables must be interpreted as perceived work-related discomfort or as subjective health complaints.

The results indicate that in garment industry over 40% of workers are troubled by compulsory position and perceive it as a very high health risk. Monotonous work is perceived as a very high health risk by 30% of workers and as a high health risk by nearly 20% of workers. High physical load appears not to be a factor which concerns workers, as only 4% of workers consider it as a very high risk while over 40% of workers see it as a minimal risk or no risk at all. Mental strain as a health risk factor is perceived differently by workers – 18% of workers perceive it as a very high or a high risk factor, over 40% as a medium risk factor and 42% as a minimal risk or no risk factor. The main stress factors workers reported were monotonous work, high work intensity, repetitive movements, noisy environment and unpleasant or insufficient relationships between manager and workers.

The investigation of nurses in Estonian hospitals showed that 28% of respondents had medium stress from the problem that they had no sufficient time for communication with patents and 22% of respondents were troubled by the fact that they had not sufficient time for consulting the patients and their relatives as much as they considered necessary to do this. The physical overload of nurses has decreased during 2005-2007 as the new lifting equipment has been taken into use. 42% of nurses considered the physically hard work as a moderate risk factor for their health. The nurses are generally satisfied with the work environment, but not with the salary, the last is the main reason for leaving the country for looking better job possibilities abroad.

On the base of investigations the connections between physical and mental occupational hazards and the stages of developing of occupational physical overload diseases the following scheme was developed (Figure 4: 1st risk level- acceptable risk; 2nd risk level- tolerable risk; 3rd risk level- medium risk; 4th risk level: high risk).

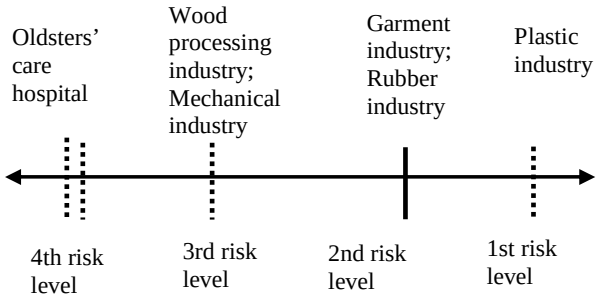

Figure 4. Determination of health risk levels at workplace

Conclusions

Preventing physiological and psychological stress at workplace needs a lot of cooperation between workers and the management. Besides, both managers and workers should to be acknowledge that stress factors at work may cause a large variety of health complaints and absenteeism, and to prevent these, the primary causes have minimized. The spread of information in the organization and the positive attitude for safety among workers, and also management, is extremely important.

In investigated companies, occupational stress can be decreased by using more suitable types of work organization, working tools and techniques, ergonomically designed work places, open discussions between the workers and the management. In order to save workers' health, recommendations were given for healthier work arrangements, working postures and movements.

Different prevention methods have been worked out to prevent the accidents and occupational diseases like continuous training of workers on all levels, internal surveillance, personal protective equipment, improvement of workrooms and workplaces, prevent eyes over-extension in the work with computers.

Every workplace is different, which means employers must carry out an assessment of the risks at the workplace concerned so that solutions are developed for specific problems. However, some solutions can work across industry sectors in organisations of different size.

The modifications that we can carry out at workplaces for improvement of workers' work conditions could be divided into three groups:

1. Technical interventions: redesign of physical environment or working aids and tools, introduction or lifting and transfer aids, the rearrangement of placement of tools, providing the opportunity to use a sit/ stand stool, as well as an anti-vibration mat to reduce the fatigue caused by a permanent standing working posture, use robot manipulators, roller conveyors and conveyor belts for heavy physical work.

2. Organizational and administrative interventions: work modification, job rotation, building a bridge between planning and production departments, increasing management's interest and acceptance of ergonomics, relieving physical strain on workers without reducing productivity, avoiding unnecessary lifting, carrying and repetitive work.

3. Behavioural modification: train the ergonomic experts who can train and educate workers for manual handling techniques, promote physical activity, raise workers' awareness of health and safety issues at work, persuade the workers that the company values them highly.

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Naujovių įvedimas darbo vietose: pasiekimai ergonomikoje

Santrauka

Nauji fizinio perkrovimo veiksniai (pavyzdžiui, vienoda būtina padėtis dirbant arba monotoniškas darbas kai įtempiami tik vieni raumenys) išryškėjo plėtojantis informacinėms technologijoms ir logistikai. Monotoniškas darbas yra psichologiškai pavojingas veiksnys, todėl ir darbo metodų įtaka darbuotojų sveikatai yra daugiareikšmė. Darbo aplinka keičiasi, tačiau fizinis persitempimas keliant svorį arba atliekant darbą rankomis greitai nepasikeis, nes prekių srautas, kuris reikalingas globaliajai gamybai, dažnai gaminamas vienoje šalyje, o vartojamas kitoje.

Šiame straipsnyje pateikiama rankinio darbo krūvio ergonomikos apskaičiavimo metodika. Šio metodo panaudojimo rezultatai gamyboje lyginami su darbu senelių slaugos ligoninėje, kur fizinis perkrovimas yra ypač didelis. Pastaraisiais metais buvo šioje srityje buvo įdiegta daug naujovių. Medicinos požiūriu tiriami aprangos pramonės darbuotojų raumenų ir kaulų pažeidimai, susiję su monotonišku darbu. Buvo parengta anketa darbuotojų protinei įtampai įvertinti. Tarp aprangos pramonės darbuotojų protinės įtampos požymių nepastebėta, tačiau šis rodiklis yra gana didelis tarp medicinos darbuotojų. Tyrimo rezultatai rodo, kad yra daug galimybių pagerinti darbo aplinką ir darbuotojų sveikatos būklę: atlikti ergonominę darbo vietos analizę, gerai ją suprojektuoti ir parengti darbo higienos specialistus, sukonstruoti robotus, įrengti konvejerius ir išugdyti vadovų susidomėjimą ergonomikos pasiekimais bei sustiprinti bendradarbiavimą tarp planavimo ir gamybos padalinių.

Tiriamoji problema: fiziologiniai ir psichologiniai rizikos veiksniai darbo aplinkoje.

Tyrimo objektas: darbuotojų darbo sąlygos, ypač kreivių kėlimo rankomis rizika.

Tyrimo tikslas: įrodyti, kad darbuotojų darbo sąlygas galima pagerinti taikant ergonomikos sprendimus darbo vietose.

Tyrimo metodai: modelis, skirtas krūvių kėlimo rankomis rizikai įvertinti, tam tikslui parengta anketa, medicininė darbuotojų patikra. Mokslinė darbo naujovė: specialaus modelio – metodo panaudojimas, rizikos veiksnių įvertinimas, paremtas Europos Sąjungos direktyvomis ir patyrimu. Parengtos išvados apie rizikos veiksnių įvertinimą darbo vietoje ir darbuotojų nusiskundimus.

Darbo aplinka Pabaltijo šalyse per pastaruosius dešimt metų gerokai pasikeitė. Ji ir toliau gerėja laikantis Europos Sąjungos strateginių krypčių, kuriant naujas technologijas, plečiant informacines sistemas, gerinant aptarnaujančių sričių darbą, mažinant darbo rizikos veiksnių įtaką, įtampą darbe, kuriant naujas darbo formas: televizijos taikymą darbe, laikino įdarbinimo galimybių panaudojimą, vyresnių žmonių įdarbinimą, vadovavimo struktūros pasikeitimų taikymą (organizacijos tapo mažesnės). Taigi padaugėjo smulkių ir vidutinių įmonių. Šiose įmonėse dažnai sunku užtikrinti pakankamą darbo ir sveikatos apsauga, o darbo sparta ir apimtis nuolat didėja. Vadovų vaidmuo ir kompetencija nukreipta didinti firmos gamybą ir našumą.

Darbo įtampos didėjimas priklauso nuo daugelio veiksnių ir santykių darbe bei nuo tos įtampos trukmės. Profesinių ligų statistika rodo, kad egzistuoja daugybė rizikos veiksnių darbo aplinkoje. Estijoje profesinės ligos diagnozuojamos gana pavėluotai, dažniausiai tik tada, kai darbuotojas jau tampa neįgalus, todėl sunku tiksliai nustatyti ligų atsiradimo laikotarpį. Daugiausia šių ligų susijusios su raumenų ir kaulų pažeidimais, kurie dažnai yra minimi ir visos Europos duomenų suvestinėse. Estijoje susirgimai, kuriuos sukėlė protinė įtampa darbo vietoje, dažnai nėra laikomi negalavimais, kurių priežastis yra netinkama darbo vieta, nors Europos suvestinėse tokios ligos yra antros po raumenų ir kaulų pažeidimų.

Buvusiose socialistinėse šalyse labai trūksta darbo saugos ir sveikatingumo darbo vietose tyrimų, nes ši sritis yra labai jautri ir susijusi su kiekvieno žmogaus sveikata. Pastaraisiais metais Estijoje atlikti kai kurie tyrimai. Šiame straipsnyje pateikiama tam tikra tokių tyrinėjimų apžvalga.

Profesinės ligos, kilusios dėl fizinio krūvio yra viršutinių galūnių, kaklo ir pečių srities skausmai. Šie pakitimai pastaraisiais metais yra pirmieji tarp profesinių susirgimų Estijoje. Šie negalavimai daugėja dėl to, kad susirgimai yra paprastai diagnozuojami per vėlai, t. y. kai sumažėja žmogaus pajėgumai reikiamai atlikti darbą. Svarbiausia tokios vėlyvos diagnozės priežastis yra nepakankamas dėmesys darbo vietų projektavimui ir su tuo susijusių rizikos veiksnių įvertinimui. Kvalifikuota informacija apie problemas, susijusias su netinkamomis darbo vietomis, dažnai nepasiekia gydytojų, kurie galėtų laiku diagnozuoti profesinius susirgimus.

Estijos įmonėse dažnai pasigendama tinkamo pasikeitimo informacija tarp aukštesnio ir žemesnio lygio vadovaujančių asmenų apie darbo vietų organizavimo trūkumus. Tai buvo pastebėta atliekant ir šiuos tyrimus: darbuotojai nepakankamai įtraukiami į darbo saugos problemų sprendimą, išskyrus vieną kompaniją, kurioje darbuotojų atstovai aktyviai dalyvauja šiame procese. Šie atstovai dalyvauja pasitarimuose, susijusiuose su darbo aplinkos tarnybų darbu, ir gali diskutuoti apie darbo sąlygų pagerinimą, darbo vietų pertvarkymą ir t. t. Visai kitaip yra kitoje kompanijoje: bendravimo tarp darbuotojų ir valdžios atstovų beveik nėra, o tai, kad nerodomas dėmesys darbuotojams, išryškėja tik darbo inspekcijos patikrinimų metu.

Protinis stresas yra antrasis dažnai pasitaikantis susirgimas tarp Europos darbuotojų. Streso buvimas ir darbo organizavimo trūkumai yra tarp savęs glaudžiai susiję. Pavyzdžiui, tose įmonėse, kur didelė darbo sparta ir labai griežti darbo užduočių atlikimo terminai, stresų atvejai padvigubėja. 28 % Europos dirbančiųjų galvoja, kad įtampa veikia jų darbingumą. Nustatyta, kad 2002 m. 38 % Estijos dirbančiųjų jautė įtampą.

Išvados: Norint išvengti psichologinės ir fiziologinės įtampos darbo vietoje, būtinas glaudus dirbančiųjų ir vadovų bendradarbiavimas. Be to, ir vadovai ir dirbantieji turi suprasti, kad darbo įtampa gali sukelti rimtų sveikatos sutrikimų, dėl kurių gali reikėti pasitraukti iš darbo. Todėl būtina mažinti streso darbe priežastis. Svarbu, kad tiek vadovai, tiek dirbantieji keistų savo požiūrį į šią problemą.

Kompanijose, kuriuose buvo atlikti tyrimai, profesine įtampa gali būti sumažinta taikant tinkamus darbo organizavimo metodus, naudojant priderintus darbo įrankius, įrengiant ergonomiškai teisingai suplanuotas darbo vietas ir nuolat aptariant iškilusias problemas su darbuotojais. Tam, kad darbuotojų sveikata būtų apsaugota, tyrėjai pateikė rekomendacijas kaip planuoti, darbo vietas, kad galima būtų apsaugoti darbuotojus nuo profesinių sveikatos sutrikimų. Pasiūlyti metodai padėtų išvengti nelaimingų atsitikimų ir profesinių susirgimų, o darbo kambarių ir darbo vietų tobulinimas parodytų ir rūpinimąsi žmogumi.

Kiekviena darbo vieta yra skirtinga, tačiau darbdaviai turi įvertinti kiekvienos iš jų rizikos faktorius ir imtis priemonių, jeigu atsiranda problemų. Pakeitimai darbo vietose skirstomi į tris grupes:

1. Techninės priemonės: aplinkos pokyčiai, susiję su naujų įrankių ir įrengimų panaudojimu, specialių perkėlimo ir pakėlimo priemonių robotų konvejerių bei kitos technikos taikymu.
2. Organizacinės ir administracinės priemonės: darbo pobūdžio keitimas, rotacija, bendradarbiavimo tarp planavimo ir galimybių skyrių stiprinimas, vadovų atsakomybės didinimas siekiant sumažinti dirbančiųjų darbo įtampą nesumažinant gamybos tempų.
3. Elgsenos pakeitimai: parengiant ergonomikos specialistus, kurie mokytų darbuotojus saugiai dirbti su įvairiomis priemonėmis ir saugoti savo sveikatą. Tai padėtų išsaugoti darbuotojų darbingumą ir pasididžiavimą, kad kompanija vertina juos ir jų darbą.

Raktažodžiai: *naujovės, darbo aplinka, rizikos įvertinimas, ergonomika, aprangos pramonės dirbantieji, raumenų ir kaulų pažeidimai.*

The article has been reviewed.

Received in February, 2008; accepted in December, 2008.