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LIGHTEN THE LOAD

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Foreword

Musculoskeletal disorders (MSDs) are the most common of all reported work-related health problems in the European Union. Manual load handling, working in prolonged and/or awkward postures and repetitive movements are all risk factors for MSDs, as are non-biomechanical factors such as stress. Some of the most common work-related MSDs are lower back pain, neck pain, tendonitis of the forearm or shoulder, and carpal tunnel syndrome.

One in four European workers reported suffering from back pain in 2005, and a smaller number complained of muscular pains.

While they may be traditionally associated with manual workers, MSDs affect millions of Europeans across all employment sectors, with the highest rates found in agriculture and construction. They take a high toll on individual companies, individual workers and their families, and to society at large. MSDs not only result in high financial costs due to medical and social security expenses, compensation payments and lost productivity, but also result in personal suffering for many workers and their families.

The focus of the 2007 European Agency for Safety and Health at Work's campaign on MSDs in the workplace is therefore timely and relevant.

As the articles in this publication demonstrate, the extent of the problem varies considerably in individual countries across the EU, as does the level of commitment, activity and intervention.

The problem is a complex one, which must be fought not only at the policy level but at every appropriate level right down to the factory floor. The message is very much that all concerned, from the workers themselves to the legislators and decision-makers, are responsible for doing everything they can to recognise and combat the risk factors for MSDs in order to prevent them from happening in the first place.

These articles give many examples of good practice in mitigating MSDs in the workplace from Europe and further afield. These include simple practical measures such as providing lifting hoists to ensure that nurses do not have to lift patients manually, new diagnostic methods, and systematic, practical procedures for identifying and alleviating risk factors for MSDs in a variety of different work environments. Individual publicity campaigns from several countries are cited to provide examples of how education and information can help fight the problem.

These articles show that determination, knowledge and technology are in place to drastically reduce the incidence of these painful and often debilitating diseases. Hopefully, the momentum for change is so strong that within a generation the problem of work-related MSDs in Europe will be consigned to history.

Jukka Takala
Director, European Agency for Safety and Health at Work

For more information on the 'Lighten the load' campaign, see
http://ew2007.osha.europa.eu

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The impact of work changes on the resurgence of musculoskeletal problems

The fourth European working conditions survey (EWCS 2005) revealed that musculoskeletal disorders (MSDs) are the most common work-related health problems in the EU-27: 25 % of European workers complain of backache and 23 % of muscular pains.

In terms of exposure to physical risks a quarter or more of the time, 62 % of respondents are exposed to repetitive hand and arm movements; 45 % report working in painful or tiring positions; 35 % are required to handle heavy loads in their work. For certain risks, prevalence is higher amongst female workers, notably in education and health. For instance, 11 % of women say their job requires them to lift or move people a quarter or more of the time, compared to 6 % of men.

Yet, the survey provides a more nuanced picture in this respect and gives a useful insight into possible correlations between work intensity and work-related musculoskeletal problems. The way forward is the adoption of a global approach to well-being at work that takes into account organisational changes in the workplace as well as the emergence of new risks.

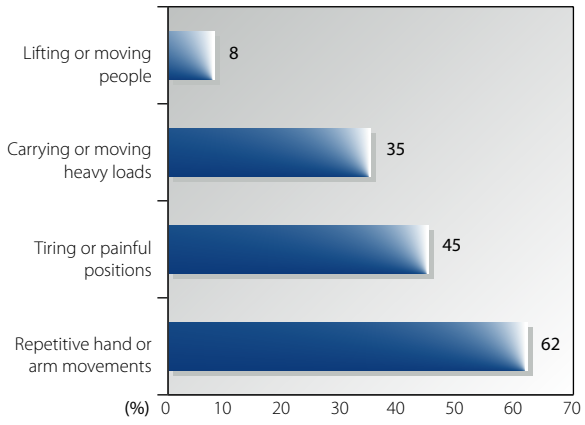
EWCS 2005: key findings on MSDs and associated risk factors

Through the European working conditions survey (EWCS), Eurofound provides harmonised and comparative data for the identification of issues and emerging trends in working conditions, including work-related health outcomes.

The first findings of EWCS 2005 showed that exposure to repetitive hand or arm movements had risen in the previous five years. The proportion of workers in Europe who reported being exposed to repetitive movements a quarter or more of the time increased from 57 % in 2000 to 62 % in 2005. The survey data confirm the relationship between levels of exposure to repetitive hand and arm movements, and muscular problems and backache. The percentage of workers who maintain tiring or painful positions and carry heavy loads remained relatively stable over the five years (45 % and 35 % respectively).

In general, women are less exposed than men, although hand or arm movements and work involving painful or tiring positions are experienced equally by both. For certain risks — jobs involving moving people — women are significantly more exposed than men with 11 % of them being exposed a quarter or more of the time compared with 6 % of men. This result reflects in part the gender segregation in specific sectors, notably the health and social sector.

Figure 1. Percentage of workers reporting exposure a quarter or more of the time (EU-27 — all workers)

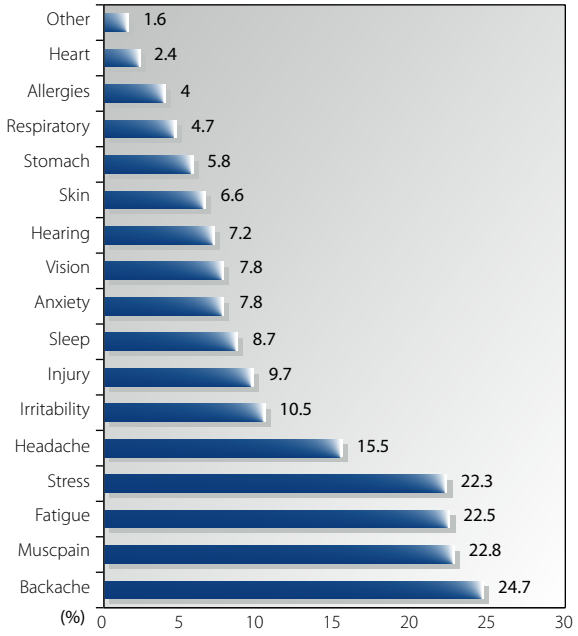


Most common work-related health symptoms

The survey also noted that the most common work-related health symptoms are backache (25 %) and muscular pains (23 %), followed by psychological symptoms of stress such as overall fatigue (22 %), headache (15 %), and irritability (10 %). In this respect, it is important to bear in mind that MSDs affect other aspects of workers' health because of the strong interrelations between nervous and muscular systems (see Giaccone, forthcoming). Stress and depression are closely related to job satisfaction and are often underlying factors which trigger secondary health problems such as musculoskeletal disorders and pain syndromes (see Boisard, 2002a).

Throughout Europe, work-related health outcomes of a musculoskeletal nature are by far the most widely reported and there is increasing evidence that stress and MSDs have significant correlations. Low-status work, i.e. low paid, unskilled, paced and repetitive work, where no training is required and there is poor control over the job, shows higher rates of resurgence of musculoskeletal problems. Also, social support is a very important factor when examining job strain with a view to predicting health outcomes (see Woods & Buckle, 2002). Although some care has to be taken in analysing the data, the exposure to other psychosocial risk factors — such as job insecurity and fear of the future — may also trigger musculoskeletal diseases (see Eurofound, 2005).

Figure 2. Impact of work on health (EU-27 — all workers)



Differences by countries, status, occupations and sectors

Broadly speaking, work-related health outcomes are more common in the central, eastern and southern countries of Europe. Looking at the detailed ranking of countries (Figure 3), Greece stands out with very high levels of reported health outcomes as do Estonia, Lithuania, Poland, Slovenia and Slovakia. There are some exceptions; for example, Sweden scores high levels of work-related health outcomes. At the other end of the scale, the United Kingdom, Germany, the Netherlands, Ireland and Austria report the lowest levels of impact of work on health.

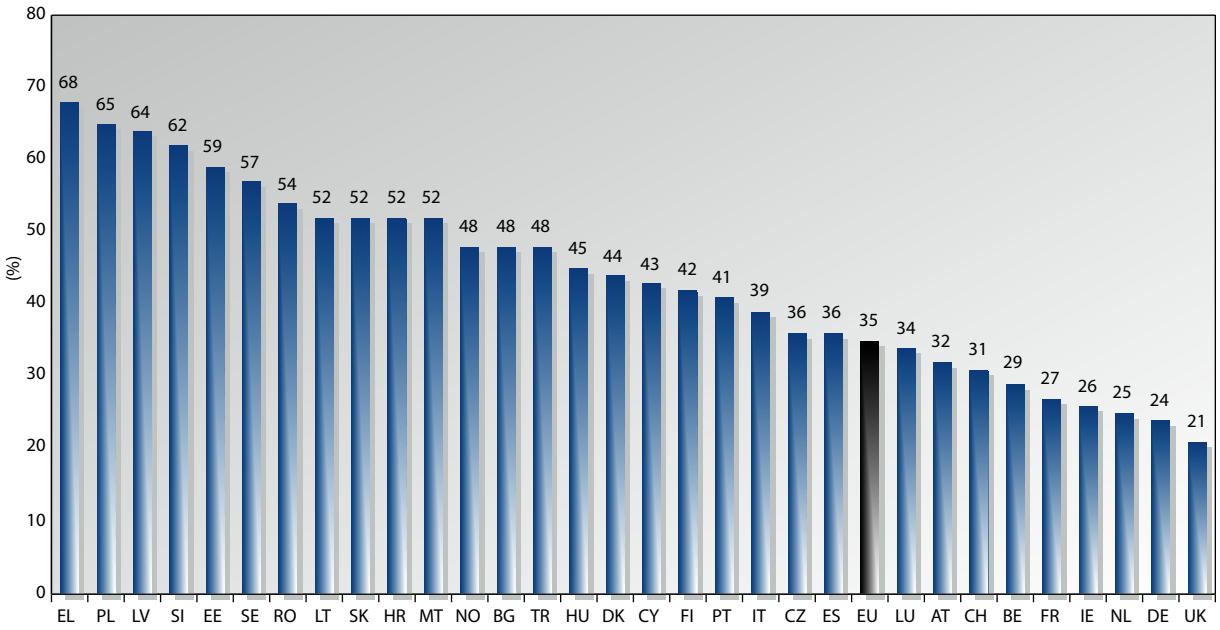
The differences according to economic status are not very strong but still quite significant and consistent with previous research. In general, the self-employed report higher levels of work-related health problems than employers or employees. In particular, the self-employed report higher levels of work-related health outcomes of a musculoskeletal nature — 29 % of self-employed people suffer from muscular pains (compared to 23 % of employees) and 28 % report backache (compared to 21 % of employees).

In terms of sectors, these problems continue to be reported mainly by workers in the agriculture and construction sectors. The incidence of MSDs also varies by occupation, although not so much as by sector. Craft and skilled workers have relatively high levels of physical strain, whereas professionals and managers report much lower levels of physical problems.

Correlations between work intensity and musculoskeletal problems

According to the EWCS 2005, work intensity is on the increase in Europe and the higher the work intensity, the higher the levels of physical and psychological strain in the workplace. The survey found that 60 % of workers work at very high speeds a quarter of the time

Figure 3. Percentage of workers who consider that their work affects their health (EU-27 — all workers)



or more (compared to 56 % five years ago, and 47 % 15 years ago) and that 62 % work to tight deadlines a quarter of the time or more (60 % five years ago, and 50 % 15 years ago). Another 12 % of the EU-27 workforce report that they rarely or never have enough time to get their work done. Work intensity levels are highest among high-skilled blue-collar workers.

Another form of work intensity is the level of interruptions, which might have a disruptive and negative impact. Overall, 14 % of workers in the EU-27 report that they are very often interrupted to perform an unforeseen task. However, half of the respondents explain that these interruptions are without adverse consequences.

The proportion of workers whose pace of work is dependent on automatic speed or movement of a machine declined slightly from 21 % in 1995 to 19 % in 2005. Over time, there has been a decline in industrial constraints resulting from automatic machinery, whereas the level of dependence on colleagues' pace of work, as well as fluctuations in demand, have increased.

Previous research in the foundation (see Boisard, 2003) provides indicators on pace of work, illustrating to what extent market constraints (i.e. external demands of customers) are associated with industrial constraints (i.e. production targets, speed of machines, transfer of products). It is argued that workers' pace of work is dependent on both industrial and market constraints and these two types of constraints tend to overlap. As a result, the two-fold effects are likely to worsen the working conditions of employees and have a considerable negative impact on psychological and physical health.

Use of computers, machine technologies and new technologies

Based on the findings of previous research in Eurofound (see Dhondt et al., 2002) there is a strong correlation between the use of different technologies and work-related health outcomes. In particular, the use of machine technology is correlated with more musculoskeletal health problems. Workers using machine technology also tend to be less satisfied with their working conditions and more exposed to stress symptoms. Conversely, workers using new technologies are more likely to have more training, sport, cultural or leisure activities or other social activities outside their jobs.

According to the first findings of EWCS 2005, the use of computers is clearly increasing: 27 % of workers use computers for their work all or most of the time and another 20 % use them between a quarter and three-quarters of the time. There is a clear upward trend over 15 years compared with the results of the first EWCS survey in 1991 when 14 % of workers used computers all or most of the time and 18 % reported using computers between a quarter and three-quarters of the time.

According to the 2005 survey, it is mostly white collar workers who use computers. In terms of gender, computer use is higher for women than men, and highest among women aged 30–49. Regarding the use of new technologies, 17 % of workers indicate that they use email and Internet all the time in their work, whereas another 17 % use it between a quarter and three-quarters of the time.

At the same time, the number of workers using only machine technologies or no technology at all is diminishing. By way of confirmation, workers are increasingly less exposed to vibrations from hand tools, machinery, automatic speed of a machine or moving of a product and interruptions by machines.

Effects of work schedules and working hours on health and well-being

The survey shows that there is a clear relationship between work-related health outcomes and working hours and work schedules. In particular, night work and long working hours (defined in this case as working more than 45 hours per week) are strongly correlated to physical work-related health outcomes.

Also the proportion of working time spent standing or walking has a negative effect on health and well-being. On average, 73 % of workers say that they do their work standing or walking at least a quarter of the time whereas 43 % report doing so all or nearly all of the time.

A high proportion of workers (93 %) who have to stand or walk in their main paid job all or almost all of the time are found in the hotel and restaurants sector.

Unclear relationship between impact of work on health and health-related leave

Due to the diversity of regulatory systems on health-related absence in different countries it is difficult to compare results, and not possible to identify a straightforward relationship between the levels of reported impact of work on health and the levels of health-related leave.

Interestingly, the countries with higher levels of reported work-related health outcomes are not at all the countries where there is more health-related absence. For instance, Greece, which has by far the highest level of reported impact of work on health, has one of the lowest proportions of workers taking health-related absence. This clearly demonstrates the complex and multidimensional nature of health-related absenteeism.

The way forward: organisational changes

In the light of the survey findings, there seems to be a sound correlation between workers' health and well-being on the one hand and quality of work and economic prosperity on the other hand. Although weekly working hours are decreasing, the pace of work is increasing. Nearly half of the respondents complained of working in painful or tiring positions, while over half were working at very high speeds (60 %) and to tight deadlines (62 %). It is no wonder that the level of work-related stress is remarkably high in the EU-27 (22 %). For these reasons, there is a need to implement prevention strategies and programmes to combat staff health problems. These strategies must place the worker at the centre of organisational changes and redesign of the workplace.

Survey methodology

The European working conditions survey is carried out every five years by the European Foundation for the Improvement of Living and Working Conditions, a tripartite European agency based in Dublin. Previous editions of the survey were conducted in 1990/91, 1995/96, and 2000. In 2001/2, the survey was extended to cover the 10 new Member States, plus Bulgaria, Romania and Turkey. The fourth wave of the survey was carried out in 2005 in the EU-25, in the acceding countries (Romania, Bulgaria) and candidate countries (Turkey and Croatia), as well as in Switzerland and Norway.

The survey questionnaire has expanded from 20 questions in the first edition to nearly 100 questions and sub-questions in 2005, thus becoming a complex and rich monitoring tool. Although the total number of questions has increased steadily since the first wave, the core variables of the questionnaire have been maintained, so that trends and changes in working conditions in the EU in the last 15 years can be examined. The questionnaire is developed by the Eurofound team in close cooperation with an expert questionnaire development group comprising representatives of the European Social Partners, other EU bodies (EU Commission, Eurostat, the European Agency for Safety and Health at Work, Bilbao), international organisations (OECD, ILO), national statistical institutes and leading European experts in the field.

The EWCS sample is representative of people in employment (according to the Eurostat definition: broadly, employees and the self-employed) in the countries covered for the respective periods. In each country, the EWCS sample followed a multi-stage, stratified and clustered design with a random walk procedure for the selection of the respondents at the last stage. All interviews were conducted face to face in the respondent's own household.

Future research

On the basis of the first results of the 2005 survey complemented by contributions from 28 EWCO national correspondents, Eurofound is in the process of finalising a comparative analytical report on MSDs based on qualitative and quantitative data. In the first place, this study will investigate the relationship between health and organisational factors in the workplace. Secondly, emphasis will be laid on institutional settings and policy context, and finally the relationship between MSD trends and their socio-economic impact at national, international and EU level will be assessed.

The report will also provide a wealth of information and figures on sick days caused by MSDs according to parts of the body affected and causal agent, and their trends over the past 10 years, disaggregated by labour contracts, occupation, and age. Other dimensions that will be explored are pace of work (speed or repetitiveness, tight deadlines), autonomy (possible opportunities for breaks, work methods), use of computers and other ICT devices, and scope of discussion over work organisation and/or organisational changes.

Additionally, based on secondary analysis of the fourth survey, the foundation will prepare in-depth analytical reports on the relationships between working conditions and other environmental aspects that adversely affect workers' health and well-being.

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Implementing Germany's Load-handling decree

Musculoskeletal diseases (MSDs) are one of the biggest health problems faced by employees in Europe. Studies show that over 40 million EU workers in all sectors of the economy are affected and that 40–50 % of all work-related health problems are due to MSDs (EU Commission, 2004). They cost EU employers billions of euros and weaken Europe's competitiveness. The total cost for the economy and society is estimated at 0.5–2 % of GDP every year. The three most relevant risk factors for MSDs are lifting and carrying heavy loads, repetitive movements and poor posture at work. Activities of this kind are still widespread, despite continuous changes in the working environment within the EU.

Legislation

To improve this situation, the European Commission, on the basis of the EC framework directive on safety at work, passed Directive 90/269/EEC on the minimum health and safety requirements for the manual handling of loads. The German Bundestag implemented this directive in German law on 4 December 1996 as the *Verordnung über Sicherheit und Gesundheitsschutz bei der manuellen Handhabung von Lasten* (Decree on health and safety on the manual handling of loads, or the 'Load-handling decree', *Lastenhandhabungsverordnung — LasthandhabV*, for short). Together with the *Arbeitsschutzgesetz* (Occupational Health and Safety Act, *ArbSchG*) of 7 August 1996, this provides Germany with legally binding rules on the health and safety of those employed to handle loads manually.

The legal provisions impose considerable requirements on employers and their OSH officials. Paragraphs 2 and 3 of *LasthandhabV* in particular specify that appropriate support must be implemented in practice. The main points are:

- the assessment of working conditions (Paragraph 5 *ArbSchG*, Paragraph 2 *LasthanhabV*);
- the need to take into account the physical aptitude of workers when assigning tasks (Paragraph 3 *LasthandhabV*);
- the binding nature of these provisions for all enterprises (legal obligation).

Whereas large companies with their in-house doctors and health and safety managers have no difficulty in meeting these requirements, small- and medium-sized enterprises (SMEs) generally find it more difficult. Hence it was considered important to come up with a way of assessing working conditions and staff deployment that took due account of personnel and economic practicalities. The idea was not only to help employers to meet their legal obligations but to provide genuine assistance in discharging the duty of care and providing targeted prevention.

Assessing MSD risk factors

The initial intent was to come up with an assessment tool based on existing methods, many of which are described in the specialist literature (see Steinberg et al., 1998). However, most of these methods of assessment are very complex and many were developed for specific applications. They are therefore difficult to apply in the health and safety work of a company doctor. Differences in methods, working methods of variable quality, inadequate user training and varying limits to their applicability only added to the problems of applying them. There is also a time problem, caused by the limited working hours of company doctors and safety specialists.

The initial intention of adapting existing methods of assessment therefore had to be abandoned. A number of research projects were initiated on the basis of comprehensive studies containing critical analyses of methods (09.005, 09.009, 09.011). Expert consultations were also organised and workshops held with the aim of developing a practical method of assessment that:

- takes account of the main influencing factors;
- can be applied safely;
- produces plausible results;
- does not take a long time;
- can be adapted to the personnel and economic resources of SMEs.

The method needed to provide a detailed assessment not only of work-related strain but of the overall health of the musculoskeletal system.

Account also had to be taken of the varying requirements of the users. Although the potential user groups of corporate management (plant manager, head of department, personnel officer), specialists closely involved with production (production managers, health and safety specialists, supervisors) plus company doctors and health promotion staff usually have a good knowledge of the activity to be assessed, they have no specialist knowledge of ergonomics.

To achieve a workable method of assessment, the collaboration of users, technical specialists, associations and organisations involved in

occupational health and safety was sought early on in the process. Agreement and coordination with the Committee of the *Länder* for Occupational Safety and Health (LASI) was particularly important.

Based on the information gathered, a modular system of methods for analysing stress and strain in manual handling of loads was developed. It consists of four modules, as listed in the box.

Modules of the practice-based methods inventory

- objective assessment of workload by means of key indicators (so-called key indicator method, KIM);
- self-assessment of subjectively perceived stress and strain by the worker;
- questionnaire on health complaints relating to the musculoskeletal system, completed by the worker;
- medical orthopaedic examination of the musculoskeletal system by the company doctor.

The modular approach

The key indicator method of assessing lifting, holding, carrying, pushing and pulling a load directly addresses the requirements of the load-handling decree. A special assessment form allows the loading situation to be assessed easily by recording the main features of the activity (key indicators) and assigning a score to each, in order to show how urgently action is needed. The result is a point score that gives a direct indication of the range of risk. Overall scores of up to 25 points are regarded as relatively safe. Scores of over 50 points are regarded as high risk, and action is needed. Scores of 25–50 points require that the risk assessment takes account of the individual employee's capabilities. In this case, modules 3 and 4, about the perceived individual stress and strain and complaints relating to the musculoskeletal system, may provide important information.

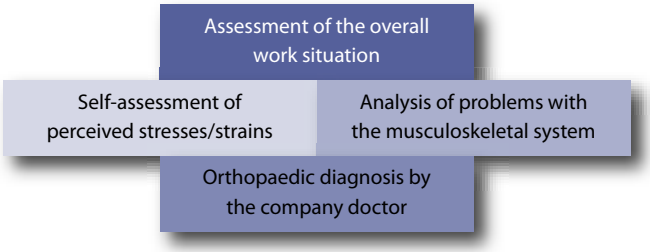
Module 2 in the inventory, self-assessment of subjectively perceived stress and strain, is done with a standardised survey form containing 47 questions. The questions cover topics such as what employees think of their workplace, what situations they find particularly stressful, and so on. The answers draw on employees' expert knowledge of their own situation. The individual replies are used to identify key areas in which action can possibly be taken. The changes achieved are easy to document. The method gets employees involved and strengthens their motivation.

The third element of the inventory, a questionnaire on complaints of the musculoskeletal system, serves to analyse existing problems and rounds off the overall picture with questions such as: Are there repeated complaints at the workplace? Where and when does pain occur? What can be done? The answers allow conclusions to be drawn about the development of the symptoms and their connection with the activity in question, and are an important tool in assessing whether the employee is working within the limits of his physical resilience and in preventing the development of chronic disorders.

For the fourth step, the medical orthopaedic examination by the company doctor, a special step-by-step diagnostic technique for musculoskeletal diseases was developed (Grifka et al., 2006). It is tailored to the needs of company doctors, and allows a reliable assessment of the condition of the musculoskeletal system in just a few minutes. The results provide the company doctor with an important means of deciding what work an employee can do, and can form the basis for ergonomically based action, and the initiation of medical treatment and assistance.

Each of the four modules produces valuable results on its own and can be used separately according to the user's qualifications and the employee's area of work. The real value of the system lies, however, in the ability to combine methods on different levels. In particular, combining objective assessments with subjective judgements makes it possible to avoid incorrect assessments, and indications of the true causes can be obtained. They are not necessarily linked to the heavy nature of the physical work. The results help both decision-makers and employees to identify their personal risk potential and thus to successfully avoid injury in future.

Model of the good practice methods inventory



Elements of the good practice methodology

Outlook

Ten years after the load-handling decree came into force the practice-based methods inventory for the assessment of working conditions has proved its worth in manual load handling.

The key-indicator method, as the core of the system, has become the standard method used in practical assessment work, and is recommended by Germany's Committee of the *Länder* on Occupational Safety and Health (LASI) for application in assessments made in accordance with *ArbSchG* and *LasthandhabV*. The questionnaires on the subjective assessment of stress and strain and of health complaints are valuable tools for use by employees as 'experts on their own situation', as well as for the critical appraisal of the results of objective analyses and assessments.

Step-by-step orthopaedic diagnostic investigations are used by company doctors for the systematic and standardised logging of disorders of the musculoskeletal system. The four-stage assessment

provides each of the groups of people responsible for company health and safety with a suitable means of assessment. The methods and the worksheets and instructions for their use are available both in the print media and on the Internet (LV9, 2001; LV29, 2002; Steinberg & Windberg, 2004; Steinberg et al., 2004, www.baua.de/prax).

The standard training programme 'Back compass' is currently available for use in conjunction with the methods inventory. In addition to the examination methods, it offers 13 coordinated seminar modules containing basic knowledge of physical loading, facts, background information, practical applications and solutions to problems. The content can be adapted to meet the needs of specific target groups and can be used for both standard and advanced training in the company. The programme can be downloaded from www.rueckenkompass.de

Information about the step-by-step orthopaedic diagnostic system is provided separately in a certified advanced training seminar for company doctors and industrial health specialists, and contains background information and in-depth knowledge (Grifka et al., 2003).

The methods inventory is constantly being updated in line with changes in working conditions and scientific discussion of work-related symptoms and diseases of the musculoskeletal system. The tasks for the next few years will be to extend the list by including other risk factors such as repetitive activities, stressful postures, climbing, and forceful exertion. In addition, the methods and solutions for worksite health promotion will be integrated. The aim is to create a toolbox that, in addition to covering load handling, also guarantees the comprehensive analysis, assessment and designing of physical work.

Gustav Caffier is a medical doctor who specialises in physiology and occupational medicine. He is the head of the research unit 'Work design for physical strains, musculoskeletal disorders' of the Federal Institute for Occupational Safety and Health (BAuA) in Berlin. He is engaged in the National Initiative 'New quality of work' and is a member of the Integral Prevention Action Group.

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Participative strategy for the management of musculoskeletal disorders in industry

Numerous methods of evaluating the risk of musculoskeletal disorders (MSDs) are described in the literature. These include checklists, assessment scales, observation techniques and sophisticated measurement procedures.

All these methods, for example, the well-known RULA (McAtamney and Corlett 1993) and the OWAS (Centre for Occupational Safety, 1994) methods, are primarily quantification procedures used by epidemiologists; very few are oriented towards action. Measurements performed in the context of prevention concern the environment, the materials and the task; trying to understand how they interact and how they can be adjusted to reduce risk. These procedures are completely different from those required in risk assessment studies that attempt to integrate exposure over a representative period.

This article presents a cost-effective strategy in four stages of increasing complexity to prevent MSDs. The so-called Sobane strategy can be used successively, when necessary, by workers, Occupational Safety and Health (OSH) practitioners and experts with complementary qualification levels. The objective is to guide people to recognise the conditions with a risk of MSDs, and to identify the most adequate corrective or preventive measures.

Principles

This strategy is based on some fundamental principles that need to be underlined.

1. Knowledge levels of all parties are complementary

Knowledge about what really occurs in the work situation decreases from the employee who experiences the job every day, to the expert who collects only the information needed for the specific problem for which they were called in.

On the other hand, qualification in health, safety and well-being increases in the opposite direction, from the employees, foremen and managers who are often not aware of the risks involved, to the expert who is specialised in a single field.

It is therefore logical to consider that the two sets of knowledge — about the work situation and about the principles of health, safety and well-being — are complementary. It is necessary to organise cooperation in an interdisciplinary way between the workers, their local management, occupational physicians, OSH practitioners and other experts.

2. Workers are the main actors in risk prevention and well-being at work

The goal of an OSH intervention in the work environment is the maintenance or the improvement of the well-being of the employees. No relevant action can be taken without the unique knowledge of the work situation held by employees. Employees must therefore be the main actors of prevention — and not the objects — and must be regarded as such by OSH practitioners and others.

3. A holistic view of the problems

Employees see their work situation as a whole and not as a set of distinct and independent facts; they are 'well' or 'not well', they like their job or do not like their job. In addition, all aspects of the work situation are interrelated. This is particularly true in the field of MSDs as most epidemiological studies demonstrate that they do not have a single cause but are linked to almost all aspects of the work situation. (Malchaire et al., 2001). A comprehensive approach is therefore required.

4. Small- and medium-sized enterprises (SMEs) must be targeted effectively

Large companies usually have a well-trained OSH practitioner and effective consultation mechanisms, problems are quickly dealt with, and the frequency and severity of accidents and occupational diseases are relatively low. However, more than 60 % of employees in western countries work in SMEs employing fewer than 250 people. The situation regarding OSH in such companies is much more variable than in most large companies. Any prevention methods must therefore be addressed to SMEs by taking account of the limited means and competences available within them.

The four stages of the Sobane strategy

Sobane is a strategy for risk prevention in four stages:

- screening
- observation
- analysis
- expertise

It is not specific to the problems of musculoskeletal disorders. Strategies with similar objectives were developed and validated in the fields of heat stress (ISO/CD 15265, 2000; Malchaire et al., 1999), noise (Malchaire, 2000), hand-arm vibration (Malchaire and Piette, 2001) and other fields (safety, fire and explosion, work on VDUs, chemical and biological agents). For further details see the website www.sobane.be

The characteristics of each of the four stages are summarised in Table 1.

Table 1 — Characteristics of the four stages of the Sobane strategy

	Stage 1 Screening	Stage 2 Observation	Stage 3 Analysis	Stage 4 Expertise
When?	All cases	If problem	Difficult cases	Complex cases
How?	Simple observations	Qualitative observations	Quantitative observations	Specialised techniques
Cost?	Very low 10 minutes	Low two hours	Average two days	High two weeks
By whom?	Workers and people of the company	Workers and people of the company	Workers and people of the company + specialists	Workers and people of the company + specialists + experts
Expertise:				
▪ work	Very high	High	Average	Low
▪ ergonomics	Low	Average	High	Very high

Stage 1 — Screening

At this stage all aspects of the work situation are quickly reviewed and obvious solutions are implemented immediately. This stage is performed by those who are directly involved and who know the working conditions at first hand, the workers and their technical management, and people from the maintenance, purchasing and/or the engineering departments, when possible.

A guide has been prepared to help all participants in a two-hour screening meeting considering all aspects of the work situation, and possible risks within it. Recommendations are made about who the coordinator should be and how to organise the meeting.

The screening guide, called *Déparis* (*Dépictive participative des risques*, Participative screening of the risks), includes 18 tables which consider successively the following aspects:

1. working areas
2. work organisation
3. accidents
4. electricity and fire
5. commands and signals
6. work material, tools, machines
7. work postures
8. efforts and handling operations
9. lighting
10. noise
11. atmospheric hygiene
12. thermal environments
13. vibrations
14. autonomy and responsibilities
15. work content
16. time constraints
17. personnel relationships — hierarchy
18. psychosocial environment

Stage 1 is short, simple to understand and simple to use. It is not time-consuming so that it can be used systematically as soon as a problem is suspected. Once this stage has been completed a decision has to be made about investigating the risk factors in more detail in order to determine how they can be avoided and to make the work situation as comfortable as possible. If this is the case, Stage two will be employed.

Stage 2 — Observation

This stage is started by the same people who carry out stage one. A meeting is usually organised to brainstorm problems and to determine what can be done in the short-term. The procedure is simple and straightforward. Aspects of the work situation directly or indirectly related to the musculoskeletal constraints can be reviewed in depth, one by one, to find the optimum condition for each of them. At the end, all information is put together and reviewed, and decisions about preventive actions are taken.

The Observation stage is guided by a list of 50 work aspects grouped under 20 headings as follows:

1. workstation — standing
2. workstation — sitting
3. workstation — other postures

4. work with visual display units
5. workstation — obstructions
6. provision of the tools, materials, controls
7. tools
8. vibrating tools
9. postures — neck, shoulders
10. postures — elbows, wrists/hands
11. efforts of the wrists/hands
12. repetitiveness
13. handling equipment
14. characteristics of the load
15. load lifting
16. pushing/pulling with the arms
17. work environment
18. lighting
19. temporary organisation
20. work organisation

Prior to the meeting, the coordinator is invited to eliminate items from the list that do not concern improvements to the work situation.

A data sheet assists discussion under each heading. At the bottom of each data sheet, and for each work aspect, two sections provide information on the following themes.

- Why be concerned with this? This section attempts to motivate the group in explaining what can result in the short and long run if this aspect is neglected.
- What can be done?
- Recommendations: this section provides indications about possible actions that are easy to implement.

During the meeting, the participants are invited to focus successively on each aspect and to consider:

- whether the situation is acceptable or should be improved;
- at what time in the process, and for what technical reasons it occurs;
- how the workplace, the task, the work procedure or the organisation could be improved to avoid it.

No limit values are specified, the optimum situation is simply one that requires the minimum rotations, twisting, forces or fatigue.

Participants are also invited to consider the efficiency of the proposed solutions, and to determine whether the assistance of an OSH practitioner is required. At the end of the meeting, the coordinator summarises the findings and the recommendations, specifying who is going to be responsible for what and when, and listing the work aspects for which an analysis (Stage 3) is requested.

Stage 3 — Analysis

In most cases, working conditions can be significantly improved and the risk of MSDs eliminated, based on 'Observation' discussed above.

However, if it is not possible to find satisfactory solutions, or, if after implementing the technical or organisational solutions identified at that level, the problem remains; a more detailed analysis, oriented towards the body zone recognised at risk during Stage 2, is required.

The assistance of an OSH practitioner (physician, nurse, ergonomist or engineer) is now necessary to:

- review the observation made at the previous stage;
- make, if necessary, a video recording of the different ways of performing the task;
- observe more closely specific gestures, movements or efforts;
- discuss alternative work procedures in more detail with workers and management;
- suggest more specific or sophisticated solutions.

Stage 4 — Expertise

The analysis may not provide solutions for some particularly sophisticated working conditions, so that more technical investigating methods might be required to determine adequate solutions.

The investigation can be based on the direct measurements of angles, of electromyographical activities of muscles, and of speeds of movement. This requires the use of sophisticated and costly transducers and recorders, carried by a sample of workers during representative periods. The method used will depend on the problem encountered and does not need to be discussed here. This requires the intervention of experts, who are specialised in the use of the sophisticated equipment, the collection of the data and the interpretation of the results. These experts should have extensive

qualifications and the means not only to assess the specific risk but also to bring about the most cost-effective solutions. Their expertise, however, will often be limited to this particular field. The proposed solutions must therefore be integrated in the whole context of the working conditions so that they do not lead to other problems of a different nature.

Discussion

The validation study consisted in checking its user-friendliness, its understanding and its efficiency in 10 real situations.

The strategy was well received by the operators and the people who used it. The documents, tables and guides were judged by the operators and their management to be understandable, practical, usable, helpful and cost-effective in creating dialogue between them and in identifying solutions. OSH practitioners also welcomed this strategy as it allowed them to work more efficiently and see the practical results of their analyses.

These tools helped to improve communications and demonstrated the respective role of each party. It also optimised their intervention to improve the health of the operators.

The method represents a shift of paradigm from the occupational health and safety approach that tries to avoid harm to employees, and one that is considered to be a financial and social burden for the company, to an approach that emphasises the well-being and health of the employees and the technical and economical health of the company.

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Preventing musculoskeletal disorders (MSDs): a priority in Navarre

Manual handling of loads, sustained and/or forced postures, and repetitive movements are common risk factors in companies in the Navarre region of Spain. Musculoskeletal disorders (MSDs) leading to time off work are therefore a priority occupational health concern.

The incidence and impact of MSDs

According to data provided by the *Encuesta Navarra sobre Salud y Condiciones de Trabajo, Salud y Riesgos Laborales percibidos (2006)* (Navarre survey on working conditions and health, occupational health and observed risks (2006)), 51 % of workers claimed that they had to adopt forced postures, 49 % said that they carried out repetitive movements, and 15 % said that they exerted themselves significantly or handled loads.

A study carried out in 2004 by specialists of the Navarre Institute for Occupational Health (INSL) in 193 companies with high rates of occupational disease, employing 6 356 workers, showed that 51 % of them were at risk as a result of manual handling of loads, 45 % as a result of forced postures, and 23 % as a result of repetitive movements.

The year 2005 accounted for 5 315 cases of MSDs, 37.8 % of all cases of occupational diseases occurring in Navarre with an incidence rate of 24.5 MSDs per 1 000 workers. There were 3 892 'lost–time' accidents at work reported due to over-exertion (31 % of total accidents) and 1 423 cases of occupational musculoskeletal diseases (92 % of the total of occupational diseases). These figures rise if we take into account not only incidents but also relapses, which are more frequent in this kind of disorder than in other occupational diseases.

Sick leave data for 2002 reveal that 114 734 days were lost as a result of MSDs in Navarre, 32.7 % of the total days lost through occupational diseases; 73 730 working days were lost due to accidents at work resulting from overexertion, with an average time off work of 19.5 working days, and 41 004 days were lost, with an average absence from work of 24.7 working days due to occupational diseases of a musculoskeletal nature.

The data give an indication not only of the extremely serious problem which must be treated as a priority within the context of occupational risk prevention because injuries of this type are increasing, but also the indifference to MSDs by companies that see them as an inevitable aspect of the job or, in some cases, as an employee claiming injuries sustained outside of work to injuries caused by work.

Table I lists the economic activities with the highest incidence rates for MSDs in Navarre.

Table 1: Economic activities showing the highest rates of MSDs, Navarre 2005

Economic activities (NACE [CNAE — 93] code)	Number of workers	Occupational diseases totals (*)	Musculoskeletal injuries (*)	Musculoskeletal injuries as a % of occupational diseases	Rate of incidence of musculoskeletal injuries (**)
35 Manufacture of other transport equipment	46	24	7	29.2	152.2
2 Forestry	187	68	14	20.6	74.9
17 Textile industry	591	59	33	55.9	55.8
25 Manufacture of rubber and plastics	3 591	466	197	42.3	54.9
45 Construction	22 714	3 246	1 078	33.2	47.5
63 Supporting and auxiliary transport activities; activities of travel agents.	1 351	111	60	54.1	44.4
28 Manufacture of fabricated metal products	8 638	1 070	370	34.6	42.8
24 Chemical industry	1 845	178	74	41.6	40.1
15 Food and drink industry	11 189	1 052	446	42.4	39.9
20 Wood and cork industry	1 879	225	72	32.0	38.3
34 Manufacture of motor vehicles and trailers	11 086	774	414	53.5	37.3
All activities	217 174	14 074	5 315	37.8	24.5

Source: Navarre Institute for Occupational Health.
(*) Accidents at work with days off work and incidental occupational diseases (relapses are not taken into account).
(**) Rate of incidence calculated per 1 000 workers.
Includes those persons covered by agricultural workers' own system and salaried employees.
Includes self-employed persons who have opted to be covered for accidents at work and occupational disease.

Navarre's 'Campaign to prevent musculoskeletal disorders'

INSL, together with interdisciplinary technical health teams, has been implementing specific actions in companies with high rates of absence due to occupational musculoskeletal diseases since 2001. In parallel, there has been specific monitoring of accidents at work resulting from overexertion in companies with higher than average total rates of occupational disease. In 2004, the campaign to prevent musculoskeletal disorders was drawn up and submitted in the Autonomous Community of Navarre, coordinated by the INSL. The aim of the campaign is:

- to increase awareness among those involved in occupational risk prevention on the health and socio-economic impact of musculoskeletal disorders;
- to carry out the transfer of knowledge and experience in promoting the application of preventive improvements in jobs with MSD risk factors;

- to draw up company preventive programmes and analyses which consider this kind of exposure and injury across the board with a view to reducing their incidence in the workplace.

The campaign is carried out in conjunction with the Navarre Council for Health and Safety, a body with tripartite representation, with the cooperation of the mutual insurance societies for accidents at work and occupational diseases, and external prevention services providing technical assistance to companies with the highest rates of MSDs.

Principal activities of the campaign

Information

- A specific portal for MSDs was up on the INSL website: the contents of the portal are shown in Table 2. Health professionals and other interested parties have shown interest in the site which had 175 000 visitors in 2004 and 341 620 visitors in 2005.
- A publicity leaflet entitled *Occupational musculoskeletal disorders* was created in 2002 as part of the INSL's Basic Documentation collection of teaching materials, and 5 000 copies were published.
- A *Manual of good ergonomic practices in construction and the application of solutions* was published and distributed in 2005 to companies in the sector: the manual was based on a joint study by the Work Foundation for Construction in Navarre and the Universal Mutual Insurance Society, and funded by the Navarre Institute for Occupational Health.

Table 2: Contents of the MSD prevention portal on the INSL website (www.cfnavarra.es/insl)

General information on the campaign

Injury rate and statistics by CNAE (National Consensus of Economic Activities)

Specific research particulars for
- Accidents at work resulting from overexertion
- Occupational diseases of a musculoskeletal nature

Support materials
- Legislation
- Standardisation
- Technical notes on prevention TNP
- Assessment methods
- Articles and studies relating to ergonomics
- Videos and computer applications
- Leaflets and posters
- Internet addresses
- Bibliography

Good practice

Subsidies and assistance

Provision of training activities

Training activities

- **Eight technical workshops** were held on the general theoretical and practical aspects of MSD prevention, and attended by 800 people.
- **Four experience-sharing workshops** were held to enable representatives from various companies to recount their experiences, and to share the strengths and weaknesses of actions implemented by their organisation in the field of MSD prevention. Three hundred people attended these events.
- **A musculoskeletal 'school'** was set up to train specialists and health workers from prevention services, internal and external, as well as committee members, prevention delegates and representatives of the management of companies. The workshop courses are given to groups with a maximum of 20 students over two consecutive days, taking a total of 10 hours and given by two bodies specialising in this kind of training activity. This was considered to be of the utmost interest due to the positive experiences based on training in active ergonomics.

In 2004–05, 14 workshop courses were provided for a total of 237 participants. The objectives of these workshops are to:

- analyse and improve their daily living habits, including those related to the workplace;
- increase participants' awareness to take better care of their backs;
- create a habit of carrying out preventive or relaxation exercises during the working day;
- improve their basic fitness.

Aid and subsidies

The Government of Navarre, through the INSL, established a helpline for non-profit-making bodies to carry out research into the prevention of occupational risks. Aid amounting to EUR 121 000 was granted during 2004/05 for MSD research. The Directorate-General for Work also established a line of subsidies totalling EUR 36 600 for investment in improvements to working conditions involving 13 companies.

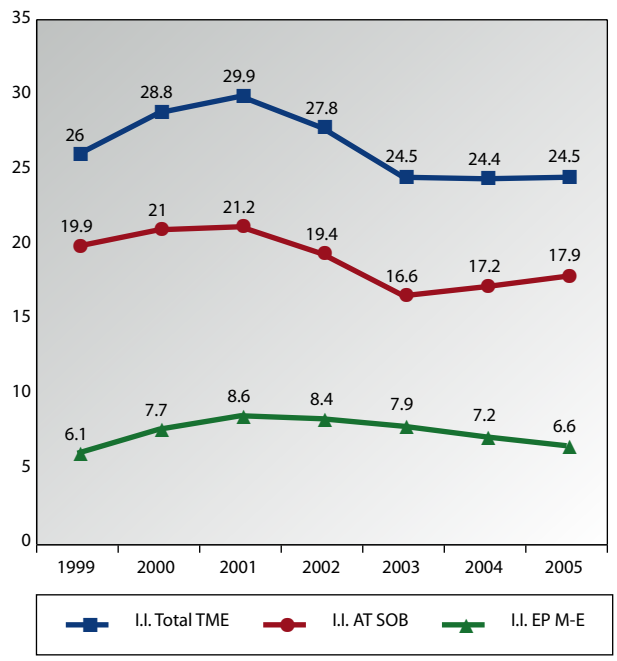
Monitoring companies with high rates of MSDs

In addition to the high accident rate programme, 159 companies in Navarre were identified in 2004 with an MSD incidence rate of more than 35 MSDs per 1 000 workers, which was 50 % higher than the average rate of 24.4 MSDs per 1 000 workers for all companies and sectors.

In 2005, a document was sent to these companies and they were visited with a view to promoting the implementation of good practices aimed at preventing MSDs. In these companies, which had declared a total of 1 737 musculoskeletal injuries — 1 183 accidents at work resulting from overexertion and 554 occupational diseases of a musculoskeletal nature — the rate of occupational disease resulting from MSDs fell by 22 % to 1 348 — 891 cases of accidents at work resulting from overexertion and 457 occupational diseases.

Graph I illustrates the changes in the MSD incidence rate in Navarre between 1999 and 2005 for accidents at work resulting from overexertion and occupational diseases of a musculoskeletal nature.

Graph 1: Incidence of musculoskeletal injuries in Navarre, 1999–2005



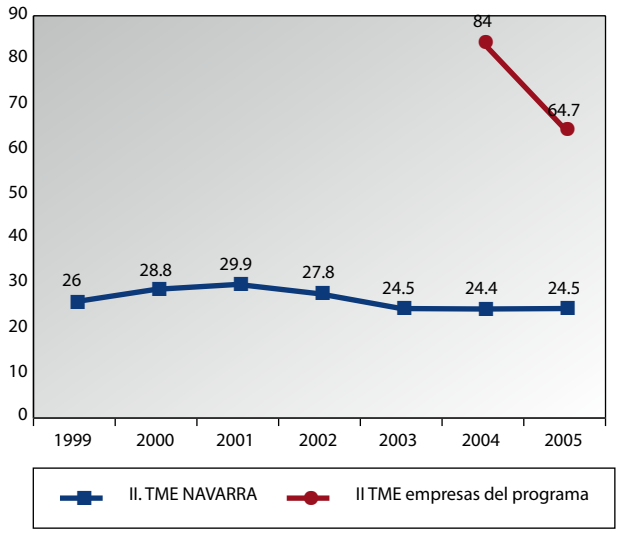
Key:

- Blue line — Rates of incidence: total MS injuries
- Pink line — Accidents at work due to overexertion
- Green line — Rates of incidence of MS occupational diseases

Year	Number of workers	Accidents at work due to overexertion	Rate of incidence (*) of accidents at work due to overexertion	Musculoskeletal occupational diseases	Rate of incidence (**) of musculoskeletal occupational diseases	Total musculoskeletal injuries	Rate of incidence (**) Total musculoskeletal injuries
1999	170 542	3 394	19.90	1 047	6.14	4 441	26.04
2000	181 001	3 809	21.04	1 399	7.73	5 208	28.77
2001	189 309	4 020	21.24	1 637	8.65	5 657	29.88
2002	195 752	3 795	19.39	1 647	8.41	5 442	27.80
2003	202 225	3 351	16.57	1 604	7.93	4 955	24.50
2004	210 553	3 629	17.24	1 518	7.21	5 147	24.45
2005	217 180	3 892	17.92	1 423	6.55	5 315	24.47

(*) All rates are calculated per 1 000 workers.
(**) Incident cases, excluding relapses.

Graph 2 illustrates the comparative changes for all companies (blue line), and the 159 included in the programme (red line).



We are aware that since we are dealing with a sample of companies selected for their high rates of MSDs, a proportion of this improvement between 2004 and 2005 is the result of random decline, but we believe it to be appropriate to indicate these results given their significance.

Plan of action for MSD prevention in companies

The campaign implemented by the Navarre Institute for Health at Work, as well as providing companies with training information support, is intended to promote specific plans of action within those companies. Having assessed the scale of the problem and its particular characteristics, the management of the company, together with workers' representatives, must draw up and implement a plan for the prevention of musculoskeletal disorders to comprehensively study the causes and factors at play, as well as the different kinds of measures to be adopted.

Table 3 indicates the main actions to be implemented in companies for the prevention and control of musculoskeletal disorders.

Table 3: Example plan for preventing musculoskeletal disorders in companies

Plan for preventing musculoskeletal disorders in companies

Diagnostic actions

- To investigate all musculoskeletal injuries in order to gather information about determining factors and causes.
- To assess the possibility of risks of a musculoskeletal nature in all jobs.

Prevention measures

- To design or redesign work stations, equipment and tools, adapting them to workers and tasks, promoting workers' participation in the search for solutions to improve working conditions.
- To incorporate equipment and instruments for facilitating the handling and transport of heavy loads.
- To organise work in such a way as to provide for the alternation of tasks and to facilitate the rotation of muscular groups subject to high work demands.
- To establish a training plan at all company levels — management responsible for purchasing, innovation, engineering, personnel, workers, etc.
- To instruct workers on appropriate working methods and the practice of self-protection exercises.
- To monitor health in accordance with the protocols specific to workers facing risks of musculoskeletal injuries.

Conclusions

Musculoskeletal injuries represent more than a third of all occupational diseases. The Navarre Institute for Health at Work promotes and coordinates a campaign to prevent musculoskeletal disorders.

Partly because of a general lack of awareness of the impact of this kind of injury on workers' health, and partly because of the way companies are organised, there is significant resistance to MSD prevention. This emerging risk must therefore be dealt with in a planned and integrated manner with all of the players involved in occupational risk prevention acting together.

Companies that do not take into account the design of workstations, the organisation of work, and the use of technology aimed at preventing musculoskeletal injuries, are not sufficiently forward looking and fail to comply with the fundamental duty to safeguard the health and safety of their workers.

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Improving ergonomics through patient lifting hoists: the Canadian experience

Nurses and nursing assistants have high rates of low back pain. Approximately one-quarter of Ontario's nurses have musculoskeletal pain most or all of the time (Shamian et al., 2001) ([1]). There is no doubt that manual patient transfers contribute to musculoskeletal pain among nurses.

The need to improve retention and recruitment of healthcare professionals is recognised across Canada (Health Canada, 2003). One third of registered nurses in Canada are over 50 and many are retiring early (Health Canada, 2004). Early retirements may arise due to discomfort stemming from the physical demands of work. In recognition of the looming staffing shortage, in 2006 Ontario's Ministry of Health and Long-term Care (MOHLTC) instituted a province-wide strategy for retaining nurses. Part of the strategy is funding ceiling-mounted patient lifting hoists in healthcare facilities across the province to reduce manual patient transfers. Installing lifting hoists combined with worker involvement in health and safety should enable healthcare facilities to develop a comprehensive ergonomic approach to prevent musculoskeletal injuries (MSIs).

Justification for funding patient lifting hoists

Convincing decision-makers to invest in ergonomic interventions requires justification. Ergonomic interventions can be justified based on costs of workplace injuries and absenteeism, application of ergonomics guidelines, and evidence that the intervention will prevent MSIs. Decision-makers in Ontario, bolstered by evidence of reduced injury rates and cost-savings in British Columbia, were convinced to invest CAD 80 million in ceiling-mounted patient lifting hoists.

Musculoskeletal injuries and absenteeism — statistics and costs

Since the province funds hospitals and long-term care facilities, the province also pays for costs related to MSIs suffered by healthcare workers. In Ontario, workers who are injured at work are eligible for compensation through the Workplace Safety and Insurance Board (WSIB). WSIB premiums are related to injury rates in an employer's sector and facility. In one year in Ontario, approximately 8 780 out of 370 000 healthcare workers suffered workplace injuries resulting in lost-time and compensation by the WSIB (Ontario Safety Association for Community and Healthcare (OSACH), 2006). More than a third (42 %) of these injuries were related to patient handling, and over half were MSIs (OSACH, 2006). Direct costs of compensated injuries among healthcare workers in Ontario are estimated at CAD 34 million per year (OSACH, 2006).

Reported WSIB injury rates do not account for absenteeism due to unreported work-related MSIs. In 2003, Canadian registered nurses were absent for 15.4 days as opposed to 9.1 days for the average Canadian worker (Sajan et al., 2006). Some of the increased absenteeism among nurses may be related to the physical demands of their work. MSIs among healthcare workers represent a significant cost to the healthcare system through WSIB premiums and absenteeism. Provincial funding of lifting hoists should reduce these costs.

Using ergonomic guidelines to justify investment

Ergonomic guidelines clearly show that lifting patients increases the risk of low back injuries (Snook et al., 1991; Waters et al., 1993). The National Institute for Occupational Safety and Health (NIOSH) lifting equation is an ergonomic evaluation tool that assesses the risk of back injuries based on aspects of the lift, including load weight (Waters et al., 1993). Although the guidelines were created for lifting objects, not people, they can be used to estimate acceptable weights. Using the NIOSH equation, the most a person can lift with minimal risk of back injury under ideal conditions is 23 kg.

Lifting conditions in healthcare are rarely ideal. Some factors that reduce the acceptable weight are the distance of the load from the body, twisting, and handle quality (Waters et al., 1993). When lifting people, additional risk factors are the patient's mobility and level of cooperation. For example, the risk of injury increases if a patient drops their bodyweight unexpectedly during a transfer. The need for mechanical lifts in healthcare is evident when applying ergonomic guidelines, such as the NIOSH lifting equation or Snook's tables (Snook et al., 1991).

An evidence-based intervention

Evidence shows that patient lifting hoists reduce injury rates. Prior to British Columbia's province-wide implementation of lifting hoists, they were tested in selected healthcare facilities (Ronald et al., 2002; Yassi et al., 2001). British Columbia's compensation claims dropped dramatically following installation of ceiling-mounted lifting hoists in 2002 (Spiegel et al., 2002). In fact, British Columbia's investments in lifting hoists paid for themselves in 1.3 to 3.7 years (Spiegel et al., 2002). A follow-up study in British Columbia over a three-year period showed the lower injury rates were sustained (Chhokar et al., 2005). Evidence from British Columbia that patient lifting hoists were an effective ergonomic intervention contributed to Ontario's decision to

([1]) Healthcare is publicly funded in Canada and is administered by the provinces. Ontario and British Columbia are provinces in Canada.

implement the same intervention. Healthcare facilities in the European Union may be able to apply similar evidence to justify investments in ergonomic interventions.

Government agencies involvement

Several government agencies contributed to Ontario's investment in lifting hoists. The nursing effectiveness, utilisation and outcomes research unit established that Canada is facing shortages in healthcare staff (O'Brien-Pallas et al., 2003; O'Brien-Pallas et al., 2005). Funding lifting hoists province-wide was proposed by the Nursing Secretariat, an organisation whose mandate is to advise the government about health policy from a nursing perspective. The Nursing Secretariat was able to use evidence from British Columbia about the effectiveness of the lifting hoists. British Columbia has a research programme entitled 'Making healthcare a healthier place to work' that is focused on evidence-based policy making (Yassi et al., 2004; Yassi et al., 2005a). These sources of information, along with WSIB statistics, enabled Ontario's Nursing Secretariat to justify the need to invest in lifting hoists. The federal government provided the bulk of the funding for the patient lifts through a diagnostic medical equipment programme.

Other factors that influence MSI rates

Equipment to prevent MSIs

Although patient lifting hoists are a good start, other equipment also influences musculoskeletal strain. Electric, height-adjustable beds reduce loading on the back (Nelson et al., 2003). Incorporating the patient sling into clothing or bedding reduces the frequency of patient handling (Nelson et al., 2003). Leaving at least 90 cm of clearance around beds and toilets reduces awkward postures (Takala et al., 1987). Placing items, such as grab bars, paper towel dispensers and sinks in strategic locations facilitates ease of access and maximises a patient's ability to assist during transfers. Walking belts with handles are helpful when transferring patients without a lifting hoist (Garg et al., 1994). A review of practices and equipment used during patient transfers within a healthcare facility may reveal additional factors that influence MSI rates.

Staffing levels and workload

All ergonomic problems cannot be resolved with equipment. Lower staffing levels lead to higher workloads which are related to higher rates of MSIs and lower job satisfaction among nurses (Shamian et al., 2001; Aiken et al., 2002). Currently, there are no requirements in any Canadian jurisdiction to control workload through defined nurse–patient ratios (Tomblin Murphy, 2005). Healthcare facilities may deal with staff shortages through overtime. Increased overtime is related to increased absenteeism (Joint Provincial Nursing Committee, 2001). Workload, staffing levels, and overtime must also be addressed to reduce health problems among healthcare staff.

Training in patient transfer techniques

Many intervention studies in healthcare have focused on training staff about patient transfer techniques. However, a systematic review of intervention studies to reduce MSI risk factors has concluded that interventions based only on training about transfer techniques have no impact on injury rates (Hignett, 2003). Based on this systematic review, training staff about patient handling techniques should be accompanied by actions to reduce MSI risk factors in the work environment.

Worker involvement in MSI prevention

Many changes to reduce the risk of MSIs must be tailored to the workplace. In Ontario, the Occupational Health and Safety Act requires workplaces to establish joint health and safety committees (JH&SC) comprised of managers and workers. At least half of the members of the JH&SC must be workers. JH&SCs are mandated to inspect the workplace monthly, to identify hazardous situations, and to make recommendations to the employer to improve the health and safety of workers. Employers must respond to written recommendations of the JH&SC. In workplaces where there are many MSI risk factors or high injury rates, an ergonomics committee may be formed that functions through the JH&SC (Occupational Health Clinics for Ontario Workers, 2004).

Ergonomic interventions developed by workplace parties are effective at engaging the workforce and reducing injury rates (Moore et al., 1998; Evanoff et al., 1999). Participatory ergonomics approaches involve establishing a team of staff members to identify and recommend solutions to ergonomics issues. The team receives training about hazard identification and time to identify and prioritise safety problems and to recommend corrective actions. Along with reducing injuries and absenteeism through participatory approaches, engaging staff in prevention efforts increases knowledge and stimulates staff to identify ways to improve their work environment (Menckel et al., 1997). Engaging workplace parties in addressing risk factors is part of a comprehensive ergonomics approach to MSI prevention.

Conclusions

Based on past experience, Ontario's investment in lifting hoists will improve the physical work environment of nurses. This, in turn, should reduce injury rates and overtime required to replace absent workers. A healthier work environment should improve job satisfaction and assist in recruiting and retaining nurses (Shamian et al., 2001). Through its alleviation of shortages of nurses, Ontario's investment in lifting hoists should also improve quality of care and patient safety (Yassi et al., 2005(b)). Similar investments may lead to comparable benefits in healthcare facilities in the European Union.

Ergonomic interventions must match the needs and resources of workplaces. Provincial legislation in Ontario gives workers the right to inspect the workplace and to make recommendations to improve health and safety. Due to high rates of MSIs in many industries, it is essential that workplace inspection activities identify and correct ergonomic concerns. Establishing an Ergonomics Committee is one way to ensure an ongoing focus on ergonomics and MSI prevention (Occupational Health Clinics for Ontario Workers, 2004).

Although this article focuses on reducing MSIs in healthcare, the same principles apply to other sectors. A comprehensive ergonomics approach is required to prevent the costs, pain, and suffering caused by MSIs. The justification for ergonomic interventions is strengthened by combining information about costs related to MSIs, results from ergonomic evaluation tools, and evidence about effective interventions. Evaluating ergonomics interventions enables a workplace to improve the implementation of the intervention and to justify future investments in ergonomics. Publishing ergonomic evaluations may convince other workplaces to implement similar changes. Training staff in the workplace about MSI risk factors empowers them to make recommendations to improve their jobs.

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Occupational risk assessment of manual load handling by under-18 year-olds

In Italy, under-age employment is an extremely complex phenomenon. It is difficult to investigate and, despite several different approaches, investigations have been unreliable because of the irregularity, illegality and type of work undertaken by young people. This has affected not only the economic and social aspect but also the ethical and political scenario. However, the national statistical data on accidents and occupational diseases confirm the so-called vulnerability of young workers, and call for specific action to protect them.

Risks to young workers

Many young workers are engaged in tiring work activities including lifting and carrying heavy loads, or in tasks that involve maintaining awkward postures or performing repetitive movements that may impair their musculoskeletal development and result in the onset of work-related musculoskeletal disorders (MSDs).

Many tasks that can be safely carried out by adults are unsuitable for younger workers because they require a medium to high level of physical strength and coordination.

Adult workers engaged in tiring and repetitive activities frequently suffer from MSDs such as lower back pain, carpal-tunnel syndrome or upper limb tendonitis. However, little is known about the risks to children and adolescents engaged in similar activities and whether they also experience musculoskeletal disorders.

Only a few studies have assessed the extent of the physical effort required by children and adolescents in manual load handling and even less data are available on the risks to young workers from these tasks.

It is clear that in the same working environment, children and adolescents are exposed to the same risks as adults. Young people and adolescents are however biologically different from adults from the viewpoint of anatomy, physiology and psychology as they are in a period of growth and development. Consequently, these risk factors may turn out to be more damaging to children and adolescents than to adults.

It is known that, on average, the long bone growth ends at about the age of 21 in males and 18 in females. As a result, overexertion and awkward postures in workers younger than this may cause bone deformity, particularly to the vertebral column and to long bones. Furthermore, at this age, overexertion is very likely to result in inguinal and scrotal hernia. In young people, prolonged orthostatic positions (having to stand for long periods) can easily lead to lower limb muscular fatigue, pain, and swelling of the legs as well as varicose veins, while repetitive movements of the upper limbs result in muscular fatigue which shows itself with pain.

Legislation

According to Article 6(2) of the European Directive 94/33/EC on the protection of young people at work (transposed in Italy by Legislative Decree 345/99):

> *The employer shall implement the measures provided for in paragraph 1 on the basis of* ***an assessment of the hazards to young people in connection with their work****.*
>
> *The assessment must be made before young people begin work and when there is any major change in working conditions, and must pay particular attention to the following points:*
>
> *(a) the fitting-out and layout of the workplace and the workstation;*
> *(b) the nature, degree and duration of exposure to physical, biological and chemical agents;*
> *(c) the form, range and use of work equipment, in particular agents, machines, apparatus and devices, and the way in which they are handled;*
> *(d) the arrangement of work processes and operations and the way in which these are combined (organisation of work);*
> *(e) the level of training and instruction given to young people.*

Assessing the risk

Assessing the risk from manual load handling is no easy matter as no data are available on children's physical capabilities in relation to age, sex, height and physical development. Furthermore, since children's response to risk factors to the musculoskeletal apparatus differs from that of adults, exposure limit values that are valid for adults may not safeguard children.

For example, the National Institute for Occupational Safety and Health in the United States (NIOSH) recommends a maximum load weight of 50 lbs (22.7kg) to be lifted by an adult under ideal conditions. This is perhaps not applicable to children and adolescents because of the differences in physical strength between them and adults. It should also be taken into account that height, physique and level of development may also vary from child to child, and from child to adolescent. In recent years, risk factors for musculoskeletal pathologies affecting young people have been studied only in relation to specific activities involving physical strain for children. Studies have focused particularly on physical strain related either to sport activities requiring physical strength such as weightlifting and weight training to increase muscular strength, or on the effect of carrying backpacks to school.

When it comes to sport, all researchers agree that children should not perform activities involving excessive physical effort or lift excessive weights but no guidance is provided on limit values according to which a load or an effort can be defined as 'excessive'.

Sports activities involving physical effort may result in accidents (muscle strain, tendon break, fractures and dislocations) and in repetitive movement-induced pathologies that may particularly occur through overexertion. However, it seems unlikely that physical activity can negatively affect physical development, although the available data are not clear. Any damage to the growth cartilage is usually preceded by disorders associated with repetitive movements. Consequently, the presence of pain warns that the child is overloading their musculoskeletal system and measures can be taken.

In a working environment, however, overload limit values cannot be set according to whether pain occurs.

Physiological factors

Young people taking part in sports that involve weightlifting frequently suffer from vertebral column (lumbar part) pathologies. The risk is associated both with trunk flexion and rotation while bearing loads which may cause spondylolisthesis (one vertebra slipping forward on the adjacent vertebrae), herniated disc, paraspinal muscle strain and, with the column extension, may result in articular facet arthropathy (lower back pain), intra-articular fractures and spondylolysis.

The high incidence of these vertebral column pathologies among young people, especially apprentices, seems to flow from inadequate development of the trunk muscles and of the abdominal wall. The development of muscular strength among young people is directly related to age, build, physical activity and growth stages.

The American Academy of Paediatrics and the American Orthopaedic Society for Sports Medicine advise children and adolescents against playing sports involving high stress on the musculoskeletal apparatus such as weightlifting and bodybuilding, at least before physical development is complete.

Various studies have been conducted on the potential link between low back pain and the use of the school backpack among young people, although the results are contrasting. A recent study (Siambanes et al., 2004) conducted on 3 498 students from California, revealed that the greater the weight of the backpack as a percentage of the student's bodyweight the more likely students were to report back pain. Though the authors of this study are not able to fix a safe weight limit value, they claim that a reduction in the weight of backpacks can lead to a reduction in cases of lower back pain among children and adolescents.

The Centre for Allied Health Research at the University of South Australia has investigated young people's capacity to carry heavy school backpacks and drawn up guidelines on maximum recommended loads. The guidelines state that 'until further definitive limits are available for children of different ages and stages of development', backpack weight should not exceed 10 % of the body weight. To date, this is the only 'safety' limit value available in the literature as far as the maximum weight young people are allowed to carry, and it refers exclusively to the use of school backpacks.

Further investigations

The potentially negative effects of some types of work on the musculoskeletal apparatus of children and adolescents needs further investigations, in particular to:

1. identify activities that pose a high risk to the musculoskeletal apparatus;
2. assess the physical capacities of children and adolescents in relation to age, physical structure and development;
3. assess the risk level to the musculoskeletal apparatus for activities performed by children and adolescents.

Once these data are made available it will be possible to perform a targeted risk assessment for individual young people entering the labour market to ensure their working environment is free of risks for their musculoskeletal apparatus.

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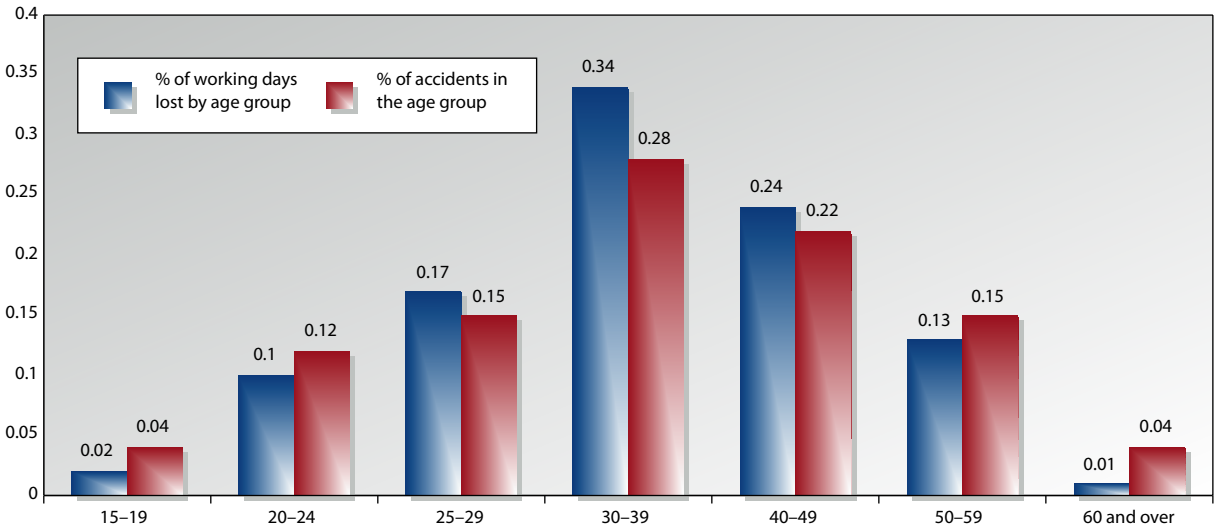
Siambanes, D., et al. (2004), 'Influence of school backpacks on adolescent back pain', *J Pediatr Orthop*, Vol. 24, pp. 211–217

Table 1: Working days lost and the number of accidents by age group

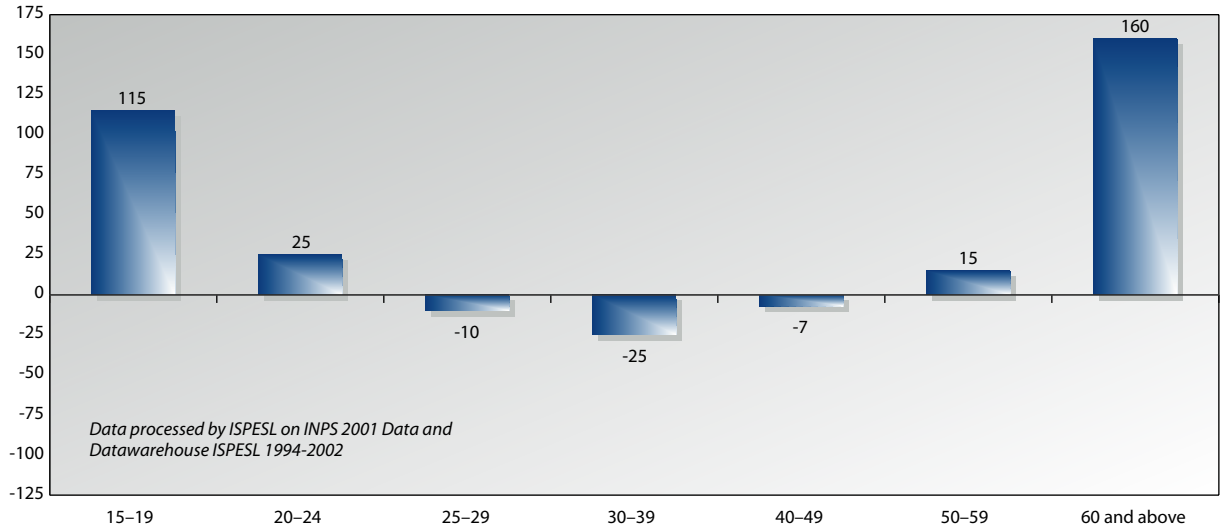


Data processed by ISPESL ON inps 2201 data and ISPESL 1994-2002

Table 2: Occupational diseases compensated in the 1984–2004 period

Accident risk assessment by age group

Risk assessment is calculated on the comparison between the age group distribution of working days lost and accidents at work. Below zero values refer to groups at lower risk. Above zero values indicate groups at higher risk.



Source: Data processed by ISPESL on INAIL data

Table 3: Types of diseases in descending order according to % of compensated cases

Workers aged 19 years and under (Total, 1 406 cases)

Rank	Disease	%	Workers aged 19 and under as % of total workforce	Rank in the overall distribution
1	Cutaneous (skin) diseases	61	10.2	2
2	Lead	9	0.8	13
3	Aliphatic amines	3	0.4	18
4	Hearing loss and deafness	3	48.6	1
5	Aromatic hydrocarbons	3	0.4	16
6	Aliphatic hydrocarbons	3	0.3	21
7	Non-tabulated diseases	2	7.7	4
8	Bronchial lung disease not induced by silica or dusts	2	0.9	12
9	Nickel	2	0.2	29
10	Chromium	1	0.4	17
	Others	11		
Total		100		

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Upper limb disorders caused by excessive physical strain among seat upholsterers

Diseases resulting from one-sided or excessive physical strain of the nerves, muscles, bones and joints come under the category of occupational disorders which must be reported. Yet, in practice, such diseases are hardly ever reported.

There are two different explanations. First, this group of diseases does not belong to the category of occupational diseases for which compensation can be claimed. As a result, most doctors see the administrative burden as unnecessary and fail to report the disease. Since there is no financial compensation, patients are also in no hurry to report it.

The second explanation is the problem of diagnosis. The disease may arise as a result of a leisure activity; so, if the patient reports it themselves, it can be difficult to establish the cause. A similar clinical picture can arise as a result of sport or leisure activities or overtime performed outside main working hours, e.g. in construction work. Only where the same clinical picture occurs in several instances in the same occupation can the disease be considered occupational in origin.

The authors observed injuries occurring at an almost accident-like rate among seat upholsterers in six cases over a nine-month period. In five cases, the dominant hand was used; in one case, both hands. Following an analysis of the working process, these injuries could be attributed to excessive physical strain of the wrist. On the recommendation of the occupational health service, changes were made to the technology which reduced the overload. Since these changes, no new disorders have arisen. It was striking that the case history of five patients included previous instances of upper limb disorders. Their predisposition may have contributed to their injury.

As the disease has been unfairly neglected, we consider it worthwhile discussing our recent experience in this field.

Trial subjects

The Occupational Disease Department of Győr-based Kardirex Healthcare Centre reported six local seat upholsterers as suffering from work-related disorders between November 1998 and June 1999. The most important information on the patients is set out in Table 1. All except one were between 20 and 24 years of age, while the exposure period ranged from 10 days to nine months.

The traumatologist diagnosed strain in three cases and one case each of contusion, tendonitis and pseudarthrosis of the os naviculare. The

Table 1: Key data on seat upholsterers

Initials, sex	Age	Exposure period	Diagnosis	Case history
D.K., male	22	9 days	Distorsio poll.man.d.	L. shoulder op.(fracturing of collarbone)
N.L., male	20	13 days	Distorsio carp.l.d.	R. forearm — fracturing
M.K., male	20	8 mths	Distorsio carp.l.d.	L. wrist — fracturing (wiring)
B.J., male	20	2 mths	Contusio carp.l.d.	L. wrist — fracturing
G.F., male	40	8 mths	Tendinitis antebrach.l.u.	—
P.I., male	24	3 mths	Pseudoarhtr.navic.l.d.	Both arms — fracturing

origin of these traumas could be established on the basis of each patient's case history and, in each case, the work contributed to the recurrence of the patients' complaints. It was debatable whether the tendonitis was work-related in origin, since it was reported in only one case. In the other basically identical cases which occurred, the etiological role can apparently be attributed to one of the phases of the working process described below. It is striking that, except in one case, all patients had upper extremity trauma in their case history — in three cases on the other side of the body.

Conservative therapy led to recovery without any after-effects in five patients, the pseudarthrosis of the os naviculare in one patient requiring surgery. Four patients returned to work, using the new technology.

Analysis of the work process

The job of a seat upholster is a complex one. The end product — among others — is the seats for the Audi TT Coupe.

The working process consists of the following activities:

- The metallic frame of the seat is fixed to the revolving frame, then pre-upholstered; in other words, the foam and leather, cut to the right size, are put in place.
- The seat leather is fastened to the metal frame; at first, this was done using press-studs, so it was not continuous.
- The protective cover for the airbag and headrest is mounted.
- The upholstered back of the chair is placed on the belt conveyor.

The critical phase involves wrapping the seat cover around the slats to fasten the seat leather, since during this process both upper extremities are exposed to considerable physical strain.

Preventive measures

To reduce the risk of exposure, we recommended introducing complex measures, assuming optimal cooperation in the workplace.

Following agreement with the customer, the dimensions of the upholstery were increased to the maximum limit authorised by the designer. This reduced considerably the amount of force required by the worker.

The presses served the same function, reducing significantly the amount of physical strength required to compress the seat (see illustrations above). Instead of the press-studs used at first, the seat leather was fastened using continuous slats. To wrap around the slats — and at the same time reduce the amount of physical effort required — a wooden-handled 'spatula' was used as a tool (see illustrations below).

A protective glove for the hand, made of a combination of leather and textile and cut off at the top of the fingers, protects the palm of the hand from injury (see illustration below).

These activities occur over a period of eight hours a day with a 20-minute lunch break. This means that during each shift, a worker could assemble 25–30 chair backs. As a work organisation measure, we recommended that upholsterers switch places every two hours, thus reducing the physical strain each day.

Results

The series of complex preventive measures involving a change in technology, the use of tools to reduce the physical strain and the introduction of regulations on work organisation achieved the desired result. Since these measures were introduced, no new incidences of disorders caused by excessive use of the upper extremities have occurred.

Discussion

In our view, the most important lesson from our study is that injuries caused by work-related one-sided or excessive physical strain can be properly diagnosed through an extensive analysis of the working process. By using sensible measures to reduce the excessive strain, adapting the work to the worker and optimising the use of the worker, such injuries can be prevented.

Our observations also suggest that when conducting prior physical aptitude tests for activities involving considerable physical strain of the upper limbs, we need to pay special attention to previous hand or arm injuries. By producing a *locus minoris resistentiae,* or place of less resistance, these injuries may predispose a person to disorders caused by overuse.

Work-related upper limb disorders account for an increasing number of cases of work incapacity. In the United States in 1992, these disorders — together with those of the neck region of the same origin — afflicted some 960 000 people and accounted for 60 % of new work-related illnesses (Pransky et al., 1992).

In their comprehensive work, Armstrong et al. (1975) list numerous occupations affected, including butchers, welders, packers, data inputters, scissor manufacturers, levellers, and sausage producers. Banaszkiewicz and Waskiewicz (1969) describe exposure among fishing-net makers, Maeda et al. (1977), cigarette packers. Tichauer and Gage (1977) highlight the role of the size and construction of tools. All authors describe the pathogenic role of frequently recurring movement. It is no accident that in 1999, Halder's monograph on work-related locomotor diseases was already in its second edition.

Hungarian literature on occupational health is still relatively poor when it comes to this particular area. Soós (1960) describes brickpickers with tendomyositis. Horváth's l975 topic of study was paratenonitis calcarea. Horváth et al.'s 1980 monograph describes the radiological picture of work-related locomotor diseases. Pórszász and Mmtsai (1997) deal with carpal tunnel syndrome among bus drivers.

The cases reviewed, including Soós's account referred to above, show, however, that in its typical form, the disease — where a similar disorder appears in several instances in the same sector — can be diagnosed and that the cause of the disease can be identified after careful analysis of the working process. This is the key to prevention.

We hope that our brief account will awaken interest among the medical community in Hungary and elsewhere in Europe in this increasingly significant group of diseases and that this unfairly neglected but important issue will soon attract the attention it deserves from the medical profession.

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Work-related diseases caused by physical overload in Estonia

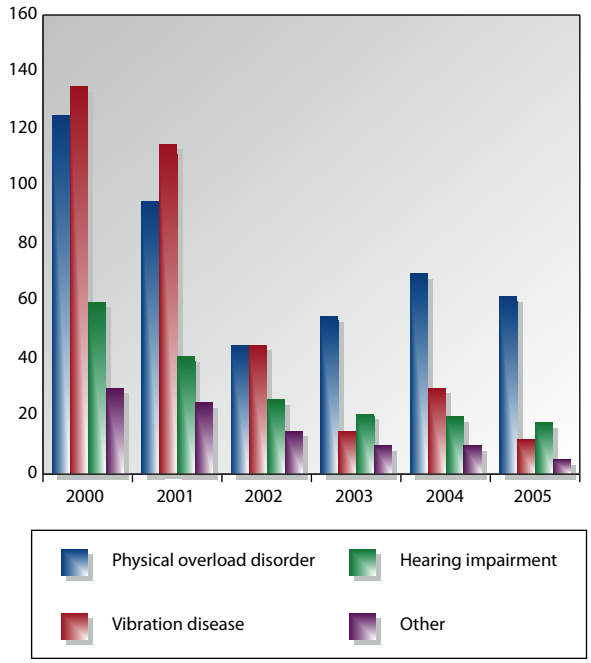
Numerous studies of musculoskeletal disorders have been published over the last two decades (see Viikari-Juntura et al., 1996; ICOH, 1996; Sluiter et al., 2001). According to Kurppa et al., 1991, tenosynovitis and peritendonitis are 13–15 times more common in people who perform strenuous manual work compared with the frequency of these diseases in the population. It is estimated that occupational musculoskeletal disorders (MSDs) on average account for 32 % of all musculoskeletal disorders. According to calculations made in the Nordic countries, almost one per cent of the gross domestic product of each of these countries is spent on these diseases (ICOH, 1996). For Estonia this would amount to at least EUR 110 million a year.

Despite continuing automation of work processes, many jobs still involve long periods of work in a forced position, static tension of a few muscular groups, repetitive movements, manual handling of loads, and other risk factors for MSDs. Stresses and strains associated with computer use affect many people throughout the working day. It is estimated that about 30 % of the total Estonian workforce of some 650 000 is involved in work which could potentially give rise to MSDs.

Occupational disease statistics

For various reasons, there has been constant under-diagnosis of occupational diseases in Estonia. Although occupational diseases caused by physical overload have become the leading occupational disease, at 55 %, the absolute number of cases is unrealistically low. Figure 1 shows the results of occupational diseases survey by North Estonian Regional Hospital Centre for Occupational Diseases in 2005.

Table 1: Number of patients diagnosed with occupational diseases in Estonia 2000–05, percentage reflects the proportion due to physical overload



The fact that approximately 90 % of people with an occupational disease have been deemed unfit for work in their existing job is a cause for concern (Kahn et al., 2003). A survey of occupational diseases sufferers revealed that:

- 73 % experienced a negative attitude on the part of the employer to their diagnosis of an occupational disease;
- 88 % were worse off financially after they were diagnosed with an occupational disease;
- only 6 % were retrained for a new job.

This situation persists despite the Estonian-Finnish twinning projects in 1999–2002 and 2003–04 in the field of healthcare services, which included training in the prevention and diagnosis of occupational diseases (Finnish Institute of Occupational Health, 2004).

Diagnosis of occupational diseases

In Estonia occupational diseases are diagnosed on the basis of the EU-recommended list of occupational diseases. A list of occupational diseases effective in Estonia was drawn up and came into effect with the Minister of Social Affairs' Regulation No 66 of 9 May 2005. Experience has shown however that this knowledge can be effectively applied only when society as a whole becomes aware of the importance of occupational health. The survey conducted as part of the twinning project with Finland found that in Estonia:

- 58 % of companies have made no investments in occupational healthcare;
- 70 % of companies have no occupational safety representatives among their employees;
- only 30 % of companies had a contract for occupational healthcare services;
- in 64 % of cases, the employer had refused to compensate for injuries without a court judgment.

It is also regrettable that there is no national support institution for multidisciplinary occupational healthcare activities that could organise applied research, develop methodological materials for the promotion of occupational health, direct further training, and would be competent to perform expert assessments. The Occupational Health Centre that had operated for many years was liquidated under uncertain circumstances in 2004. Unfortunately, no law concerning occupational accident and occupational disease insurance has been enacted in Estonia.

Work-related MSDs

A relatively new but no less important problem is that, in addition to the small number of cases of occupational diseases, thousands of people have been diagnosed with work-related MSDs. According to a study published in 2004 (Kahn et al.), health disorders of various kinds caused by overexertion were found in 485 (40.9 %) of 1 186 employees examined.

In the study of employees from different fields, conducted in 1999–2003 by occupational healthcare specialists of the National Institute for Health Development, work-related diseases were discovered in approximately 30 % of these (see Table 2).

Table 2: Frequency of physical work-related MSDs in employees from different fields

No	Field of activity	Total number of subjects	People with physical overload disorders	
			number	%
1	Dental therapy	230	126	54.7
2	Sewing and footwear industry	210	83	40.0
3	Engineering industry	200	63	31.5
4	Poultry farming/meat processing	501	130	26.0
5	Construction	131	31	23.6
6	Furniture industry	421	82	19.5
7	Office work (different fields)	501	130	16.0
	Total	2 194	645	33.8

With increased detection of work-related musculoskeletal disorders, more attention is being paid to the quality of risk analysis in workplaces and, above all, to ergonomic and more employee-friendly design of workplaces. This requires highly qualified occupational health specialists and good cooperation between them, employers and employees.

Optimisation of the work process and reorientation of employees to recreational sports and healthy ways of life also has an important role in the prevention of work-related MSDs. Considerably greater use should be made of relaxation exercises at the workplace and broader opportunities for rehabilitation therapy should be created.

The quality of diagnosis of work-related MSDs has also become an issue in occupational medicine. It is well known that subjective complaints — pain, fatigue, decline in the capacity for work, etc. — have an important role in the identification of MSDs caused by

physical overload. A more thorough investigation, for instance the use of electroneuromyography, is very difficult to implement during routine medical examinations of employees. This method is known to give information only on the neurological aspects of the neuromuscular system. Conditions for the recovery of the neuromuscular system during work and between two working days have not been evaluated.

Diagnosis using myometry

A novel myometric method for diagnosing such disorders has been developed at Estonia's Tartu University by Dr Arved Vain. The method is completely non-invasive and is designed to avoid inelastic deformation or neural reactions in the measured tissue. The method's reliability and repeatability is shown by Bizzini, Mannion (2003), Korhonen, et al., (2005) and Viir, et al. (2006). It provides the following discrete steady state values:

- oscillation frequency of skeletal muscle (Hz) which characterises the tension in the muscle in the absence of contractile activity, i.e. tone, on the basis of which the conditions for micro-capillary blood circulation of skeletal muscle can be evaluated;
- damping rate of muscular tissue oscillation (logarithmic decrement) which characterises the elasticity of the muscle. The elasticity describes ability of muscle to restore shape and the conditions for the metabolic processes during the actual work effort — less elastic muscles need more time to restore the shape between the contraction and relaxation of the movement cycle and therefore less blood is delivered to the muscle;
- stiffness (N/m) which characterises the ability of the muscle to resist to changes in shape, e.g. stiffer antagonists muscles require more effort to stretch out, making the movement less efficient.

Specifically for the occupational health setting, population reference values of the myometric parameters were developed in a double blind study by two teams of researchers led by Professor Hubert Kahn. Based on the statistical frequency of complaints, eight pre-selected muscles of limb and trunk of a representative sample of 1 796 employees of Estonian companies were tested. Sub-groups were created using meaningful critical factors of age, sex and body mass index. It appeared that the groups also had homogenous myometric measurements and there appeared to be statistically significant differences in the parameters between each of the groups. This can be considered a statistical validation of these population reference values. As an essential validation of the reference values, it was established that in the later stages of the diagnosed pathology, the indications of the two teams of researchers coincided. Also, it appeared that the healthy group of people had significantly lower tone and stiffness as well as better elasticity of the muscles. A positive significant correlation ($p<0.01$) (Vain et al., 2006) between myometric parameters and arterial blood pressure was demonstrated. This result provides some evidence that increased muscular tone can be associated with the obstruction of arterial blood flow.

Practical application of the results of this study builds on an idea that measurement results of each patient obtained by this method is compared with the values of similar people (in terms of sex, age and body mass index) in the population. If the patient's results are close to the average of the population reference value, there is no indication of abnormal condition. In case of tone and stiffness, extreme low (average – 1.5 standard deviation) and high (average + 1.5 standard deviation) values signify indications for potential muscle disorders. Extreme low values of elasticity can be considered a warning sign. The feedback from therapists that have applied this measurement method in the regular occupational health checkups can be summarised as follows:

1. these myometric measurement results are consistent and provide new relevant parameters for assessing muscle condition;
2. parameters contribute significantly to increased accuracy of work-related MSDs, localised at level of a single muscle;
3. the method is simple and completely non-invasive, with instant results; it can be used to carry out extensive surveys of working populations, enabling potential disorders to be discovered early.

Conclusion

On the basis of the preliminary results, this method makes it possible to improve considerably the diagnosis of musculoskeletal disorders caused by physical overload. As work-related diseases caused by physical overload have become one of the central issues of occupational health, it is appropriate to develop and implement a broad-based programme for the comprehensive tackling of the problem in order to reduce considerably such health disorders, particularly their development into occupational diseases.

It also makes possible the timely detection of a cumulative trauma of skeletal muscles and the timely implementation of preventive measures on the basis of information gathered in the course of a medical occupational health examination. It is worth bearing in mind that implementing preventive measures is far less costly than therapy.

Prof. D. M. Hubert Kahn reformed the Estonian occupational health system after independence was reinstated in 1991. He works at the Institute of Experimental and Clinical Medicine as a scientific director, and leads the Department of Clinical Toxicology and the Centre of Occupational Health. He is responsible for developing long-term cooperation with the Finnish Institute of Occupational Health, is the initiator and publisher of The Estonian Newsletter, and founded Preventme Ltd, a private company providing occupational health services. He is a member of the International Commission on Occupational Health and, over the past five years, has led a project dealing with applicability trials of a novel myometric muscle measurement method in occupational health practice.

Viive Pille graduated as a medical doctor from the University of Tartu in 1994 and started her career as an occupational health doctor at the Clinic of Occupational Diseases, becoming Head of the Centre for Occupational Diseases in North Estonian Regional Hospital in 2001. She is active within the Estonian Society of Occupational Health Doctors, and acts as a coordinator in a training project 'Managing occupational risks related to asbestos'.

Milvi Moks graduated from the University of Tartu in 1967 as a medical doctor, and joined the Institute of Experimental and Clinical Medicine. She has participated in studies assessing the risk in the work environment, bio-monitoring, and determining the work ability of employees. She is currently focusing on ergonomics, and is an active faculty member in Tallinn Health College. She is also involved in studies aimed at enhancing the diagnostics of exertion-related musculoskeletal disorders with the novel myometric method.

Dr Arved Vain is a senior research associate at the Institute of Experimental Physics and Technology, University of Tartu, and Head of the Supervisory Board of Müomeetria Ltd, the commercial developer of the myometric muscle measurement method. Since 1974 he has supervised many research projects in biomechanics, clinical medicine and sport training; and has written over 200 publications on biomechanics and movement analysis in different kinds of sport.

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National campaigns on back pain

Back pain has received particular attention in Great Britain from the Health and Safety Executive (HSE). It was the focus of two campaigns combining media, stakeholder and inspection strands in summer 2005 and autumn 2006, and a third campaign, probably including a new emphasis on upper limb disorders, will run in 2007–08. This article gives an account of what the HSE has done so far, together with some learning points that might help others intending to run publicity, stakeholder and inspector campaigns concurrently.

In 2004 the HSE decided it needed to concentrate on doing fewer things in a bigger way. It needed to prioritise its work, and ensure it spent its money combating the bigger health and safety risks facing employers and workers. The Health and Safety Commission (HSC) strategy for workplace health and safety to 2010 and beyond recognised the part both communications and operational activities contributed to improving health and safety outcomes. Evidence indicated that a mixed approach, combining the two, would have the greatest impact. Running a combined communications and operations campaign focusing on a major health or safety issue would:

- maximise impact;
- strengthen the HSE's internal project working;
- solidify and strengthen established relationships and build new relationships with key external stakeholders to raise the profile of health and safety.

Back pain was an obvious candidate for one of the campaigns. In 2003–04 back pain was the biggest cause of musculoskeletal disorders (MSDs) in the United Kingdom accounting for an estimated 4.9 million working days lost. This equated to one in every six days lost from work-related sickness absence, with each worker taking an average time off of 18.7 days, at an estimated overall cost to society of over GBP 2.7 billion a year.

Although the number of new cases had declined over previous years, there were still an estimated 74 000 new cases each year. While the scale of the problem was certainly enough to justify making it the focus of a campaign, there was another reason. A simple, effective public health message, 'Stay active with back pain', had been used in a public health campaign in Scotland with considerable effect. The HSE decided that employers and workers elsewhere in Britain would benefit from hearing this message and made it one of the basic messages of the publicity campaigns.

Backs! 2005

The encouraging results in Scotland plus the results of a campaign in Victoria, Australia led the HSE to believe that a publicity campaign would have a real impact on the number of new cases.

The key messages we wanted to put across through the media were: for employers — *Better backs mean better business,* and for employees: *Simple, easy steps can reduce the risk of back pain*. The objectives were to:

- raise the profile of back pain as a cause of work-related ill health;
- educate employers in the best ways to reduce the incidence of work-related back pain;
- create personal responsibility amongst employees to take care of their backs and avoid future problems with back pain.

While many of the press advertisements followed the HSE's policy of speaking 'business to business', some of the radio adverts addressed employees and stressed, through humorous situations, the importance of using lifting aids. For example, one advertisement featured a weightlifter using a lifting aid to win the competition.

Lord Hunt, the Minister responsible for Health and Safety, launched the national campaign on 5 June 2005. There were national and trade press advertisements, radio ads and local events to stimulate further press and radio coverage. In all, in addition to paid advertising, 406 press and radio pieces were generated.

Overall the response to the media campaign from employers and workers was positive. A sample of 3 000 managers, supervisors and employees was interviewed to gauge the effectiveness of the publicity campaign. Advertising raised awareness in all sectors but was particularly strong in manufacturing and construction.

Radio advertisements made more of an impact with employees than those in the press, although employers and supervisors had a high awareness of press advertising. As a result of the campaign there was an increase in the number of supervisors and employers who said they would use the HSE's website as a first source of health and safety information. Employees were more likely to think about their own lifting and handling techniques, with those who had seen the advertisements more likely to seek advice from managers, supervisors and other sources.

A 'Better backs' campaign website was created and the HSE's own website was updated to reflect campaign activity. These attracted

58 300 unique visitors with around 70 % of visitors from Great Britain and 50 % of all visitors new to the HSE's website. Analysis of general trends for website interest suggested that most hits occurred between April and July 2005. The numbers fell during August and September, coinciding with the holiday period. Visits to the website increased in October and November but there was very little interest in December/early January, another holiday period. The peaks of website interest also coincided — in June/July 2005 and January–March 2006 — with the main phases of the inspection campaign.

While the publicity strand was new for the HSE's musculoskeletal team, the intensive work with stakeholders also broke new ground. In total, the HSE engaged with 39 national stakeholders who had the potential between them to influence an audience of approximately 10 million workers (this figure is based on stakeholder information). They included large companies, trade unions, health and safety groups, charities, trade associations, public sector employers, a large insurance company, national retailers and professional organisations. They were encouraged to be innovative in their support and were invited to access the HSE event fund of GBP 100 000 (see box for examples)

In total, we know of 119 events related to *Backs! 2005*, of which, 80 had some financial support from the HSE.

Backs! 2005 campaign: examples of work done following stakeholder events

An insurance company identified that 30 % of all claims arose from MSDs. They therefore helped clients develop bespoke MSD programmes. As a result, the company expects a reduction of 25 % in MSD claims. This will yield direct cost savings of GBP 500 000 and indirect cost savings of GBP 4 million a year.

A local authority targeted the 35 000 voluntary workers involved with the Glastonbury music festival providing information and advice that could be taken back to their full-time employers.

A company employing 150 workers had 15 MSD incidents in 2004 (including 10 related to bad backs) resulting in 240 days sickness absence. They have since reassessed handling risks using the HSE's manual handling assessment chart (MAC), raised awareness amongst staff and brought in physiotherapy services. In the following months they have had no new incidents and MSD sickness absence has reduced by around 80 %.

In Great Britain, health and safety enforcement is split between local authorities, who also have responsibilities for other matters such as food hygiene, and the HSE's national inspectorate. One of the features of the *Backs! 2005* inspection campaign was the degree of integration between the HSE and local authorities in targeting and visiting workplaces. In total, 479 HSE inspectors and local authority Environmental Health Officers (EHOs) made over 4 000 inspection visits, including132 joint visits, each lasting on average 3.5 hours. Most inspections resulted in advice, but 200 visits led to an enforcement notice requiring action to be taken. The estimated number of workers visited was 515 000. The potential additional audience reach, via multi-site organisations, suppliers and contractors, ran to several million workers.

Better Backs

The evaluation of *Backs! 2005* publicity showed that more than a third recalled the advertisements and 46 % of those planned to do something about MSD risk in their workplace. The radio advertisements were a clear winner in terms of impact. This success,

and the continuing commitment within the HSE to prioritising work on the bigger health and safety issues, meant that a follow-up campaign was inevitable. Having done it once, the project team was encouraged to do even better next time.

The HSE decided to run the follow-up campaign in autumn 2006 to avoid clashes with the summer holiday season and to give the team more time to plan. The campaign was called *Better Backs* with the intention of keeping the same name, without an identifying year, for future campaigns in 2007 and possibly beyond. Whereas 2005 concentrated mainly on preventive measures (lifting aids and risk assessment) *Better Backs* extended the scope of the campaign to focus on the holistic approach needed to deal with back pain. Promoting sensible workplace precautions that reduce the risk of back pain was still important but additional elements of the campaign included providing advice to employers on managing sickness absence and return to work, and emphasising the positive benefits of staying active with back pain. The campaign encouraged employers and employees/workers to work together to tackle this problem.

The 2006 publicity campaign was built around a fictitious rock band (Bäackpain) with a high concern for the comfort and safety of their own and their employees' backs. The group's drummer carefully adjusted his ergonomic chair, the roadies used lifting aids to move the large amplifiers and a group member looked after his own back with some gentle exercise in the park. There were five or six scenarios in all, allowing for the precautionary, health and return to work messages to be covered. The band featured in radio, press and outdoor advertisements as well as on a campaign website. The HSE wanted to make sure that the message was firmly linked in people's minds to work while at the same time promoting the wider public health message that back pain affects virtually everyone at some point in their lives, i.e. it does not stop at the 'factory gate'. The strapline for the whole campaign was 'Whatever your job, look after your back'. The campaign generated press comment and emails to the campaign website.

The HSE launched the publicity in nine regional venues on 9 October 2006 in partnership with the supermarket chain, Tesco. At the time of writing, a full evaluation of the campaign is still under way, looking at awareness and behaviour amongst target audiences.

However, it is already clear that our messages have been spread widely. In total, 151 pieces of editorial coverage were achieved across print, broadcast and online media. At the same time, the number of hits on the HSE's musculoskeletal pages doubled over the three weeks of the inspection campaign and the radio advertisements reached an audience of 15 million people. A BBC Breakfast Business News presenter even referred viewers to the *Better Backs* campaign site on air.

By early October 2006 stakeholder involvement was already active, and 170 companies had signed up to show their support. In the regions, the PR agency used local companies who had a good story to tell about improvements from the year before to front events this year. This improved credibility and will hopefully encourage new companies to sign up for future campaigns. The HSE financially supported about 55 stakeholder events and at least another 30 were held. A larger number of local authorities came into partnership with the HSE than the previous year, with over 200 involved. Another new element in 2006 was a discussion forum, hosted on the HSE's campaign pages, for employers to exchange advice on how to prevent and manage cases of back pain. This was discreetly monitored to ensure the information in the forum was sound and legal.

The inspection arm of the campaign ran for three weeks from 16 October to 5 November, with the HSE and particularly local authorities contributing a substantial amount of operational time. Inspectors dealt with everything from the handling of Halloween pumpkins at vegetable markets to the handling of fine art at auction houses. The very high level of participation in the inspection campaign by local authority inspectors was particularly encouraging, and demonstrated the growing maturity of partnership working between the HSE and local authorities as regulators. One feature common to the previous was the increased use of the HSE's manual handling assessment chart (MAC). Hits on the relevant website pages trebled during the campaign. It is very satisfying to know that as a result of effective publicity, effective workplace assessments are being undertaken.

2008 campaign

The HSE plans to run a third campaign in January/February 2008. Back pain accounts for about 46 % of the total of MSDs. The next

largest segment is upper limb disorders (ULDs), which account for about 40 %. So, in order to have a significant impact on the total number of MSDs, it is also necessary to tackle ULDs. To this end, over the last couple of years, HSE ergonomists have been working on a ULD tool, similar to the MAC, for inspectors to use to assess the level of risk of tasks involving repetitive and forceful movements or grips. At the time of writing, the HSE is planning to have this tool ready, and inspectors trained to use it, in time for the campaign. The tool will specifically exclude assessment of ULD risks associated with display screen equipment (DSE) use — although DSE risk assessment may form a separate arm of the campaign.

Lessons learnt

Many of the lessons the HSE learnt from the 2005 campaign were about its own working practices and its relationships with external stakeholders and other inspectorates. Where countries have different inspection systems, such lessons are probably not directly relevant. But there are other things it might be useful to pass on.

It is clear that doing a few big things, rather than a lot of little ones, does produce value for money. The time and effort put into back pain (and other key issues such as workplace transport, and slips and trips) has taken away from lower priority work and from sector-specific projects. But the two biggest causes of work-related ill health, MSDs and stress, are found in every industry. The evidence appears to suggest that in Great Britain at least this is what is needed to reduce the overall level of ill health. And, employers find it helpful to be asked to concentrate on fewer subjects in depth.

It is vital to start planning at least 12 months in advance. External partners may have even longer lead in times, so make sure they are signed up early on. Use whatever planning tools are well understood by everyone in the organisation, so that those only marginally involved know why things are being done in a particular way.

Companies, trades unions, trade associations and other external organisations welcomed the opportunity for genuine partnership working with enforcing authorities. The HSE's openness and demonstrations of partnership in *Backs! 2005* was very much appreciated, for example the offer of event funding and speakers, provision of background information, and production of a stakeholder toolkit. Stakeholders in Great Britain would like to see this approach continue and some of these are multinational companies with offices elsewhere in the European Union.

David Lewis is a career civil servant with the United Kingdom Health and Safety Executive (HSE). Since 1993, he has worked on the development of the HSE's health policies, and has spent the last six years as a Senior Policy Advisor on the HSE's musculoskeletal disorders priority programme, including the planning and implementation of the three 'Better backs' campaigns described in this article.

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The war on MSDs

After years of ineffective campaigns and incoherent policies it is time to declare total war on MSDs, using appropriate weapons and all available human resources. Needless to say, a coordinated strategy is also a must if the battle is to be won…

Bearing in mind the results of the fourth European working conditions survey in 2005 (see the article by Sara Riso in this publication), it may be argued that action taken against MSDs up to now has not only been totally inefficient but actually wasteful, because for about two decades MSDs have been the top-ranking complaint of European workers.

A great deal of attention has been focused on this issue: directives have been transposed into national laws, good practice guidance has been drawn up and many other initiatives have been taken. Occupational experts, factory safety inspectors and trade unions have been involved in campaigns to reduce the incidence of MSDs. Some companies have invested in technology to assist in load handling and mitigate other risk factors. But MSDs are as prevalent as ever. What is everyone doing wrong? And why is so much unnecessary suffering still taking place?

The causal link between mechanical strain and locomotor system disorders is well established. Clear scientific evidence has existed for many years, and many high quality peer reviewed articles have been published in prestigious journals. Musculoskeletal disorders affect any body parts that are subject to intense mechanical strain; not only the lower back but also the neck and upper limbs.

Focus on risk factors

To win the war on MSDs, the campaign needs to be focused not so much on the diseases themselves, but on the risk factors for these diseases. The strategies suggested below are based on the European preventive approach that aims to protect workers from these risks, so they do not succumb to MSDs in the first place.

The risk factors should be seen in terms of European Directive 89/391/EEC on health and safety, which stresses active preventive measures. The emphasis is on eliminating risk factors and, if this is not possible, on minimising their impact — taking into account the latest technological and scientific developments relating to workplace design. At the same time, it is necessary to monitor the health of the exposed workers, to inform them clearly about the dangers to their health and to make sure they have any necessary personal protective equipment.

The abundant scientific literature reinforces what workers have known for generations, and what they have felt in their aching joints. There is no doubting the ill effects of repetitive movements, vibration, forced postures, overexertion due to handling loads that are too heavy, and other common strains on the musculoskeletal system.

We also know that to these biomechanical stresses can be added organisational or environmental stresses such as heat, cold, etc., requiring workers to wear protective gloves or other personal protective equipment (PPE) that will alter their sensitivity and gripping ability. These extra strains are particularly prevalent in sectors such as construction and food processing, where the application of special standards, for example HACCP-type ([1]) hygiene procedures, places extra demands on workers.

More recently, it has been observed that white–collar workers who are not exposed to conventional biomechanical risk factors, such as carrying, pushing or pulling heavy loads, also tend to develop MSDs. This underlines the need to focus not only on narrowly defined stress factors such as biomechanical loads, but on cognitive and emotional stressors as well. These tend to be especially prevalent in service professions such as healthcare, policing, teaching, etc.

([1]) 'Hazard analysis and critical control point'. See http://ec.europa.eu/food/food/biosafety/hygienelegislation/guidance_doc_haccp_en.pdf

Stress also rises when the requirements of the task conflict with the working environment, e.g. when a task requiring high concentration has to be performed in a very distracting environment. In such a case, the situation may not be as clear-cut as simply ensuring that the environment complies with the latest version of the EU noise directive or is properly lit according to the prescribed standards. A task demanding high concentration could be thwarted by something as apparently minor as the irritating creaking of a fan or a conversation in the next room.

This example illustrates how important it is to consider the whole working situation and not assume that the stereotypical causal factors of MSDs — such as the biomechanical ones — are the only risk factors in operation.

Socio-economic costs of inaction

Working environments and systems, and the types of work we do, are very complex nowadays. They mirror the complexity of the modern world. We should not be surprised, then, that the physiological impact of work on human health and well-being are also extremely complex.

For over two decades it has been common knowledge in the industrial countries that MSDs are induced by work-related circumstances, yet they are still prevalent and they still have enormous socio-economic consequences. These diseases make substantial inroads into social security resources in many countries. The situation persists because incompliant organisations are able to ignore basic regulations and good practice. They do so because they are not required to pay for the ill health they produce; on the contrary they are able to build their short-term profit by skimping on the costs of prevention and failing to manage OSH issues. These organisations are able to transfer the costs of the ill health of their workers on to society at large. These costs come in the form of hospital treatment, disability pensions, etc. Companies that ignore health and safety are eroding Europe's competitiveness, well-being and progress, and severely undermining the so-called Lisbon strategy. ([2])

Five steps in the campaign

Europe can no longer afford a situation where every five years we are again told that MSDs are the main occupational diseases in Europe whereas in the US and Canada demanding but effective strategies have reversed this trend. Everyone involved in occupational health and safety should redouble their efforts to combat MSDs. All available ammunition should be thrown at the problem and tactics that have been shown to be effective should be coordinated and made available to all organisations, big and small, to ensure the war is fought on all fronts.

This war against MSD risk factors is grounded on a systematic fight in five stages, represented by the five layers of the following pyramid:

In this systematic approach, what is needed are:

1. a set of references: directives, laws, standards and good practice guidelines to be distributed to everybody in order to be applied throughout Europe;
2. a massive awareness-raising campaign, in which the references are disseminated as widely as possible to make every relevant company, institution, employee and self-employed worker throughout Europe aware of their obligations and how to implement them. A similar effort has to be directed to first-line prevention officers (e.g. company doctors) and the labour inspectorate, because their expert knowledge of risk assessment and prevention strategies is crucial in the success of the campaign;

([2]) The Lisbon strategy is a 10-year strategy for economic, social and environmental renewal in Europe. It was signed by EU governments in March 2000.

3. an effective implementation programme carried out in consultation and with the workers; this could involve the support of external consultancy if necessary;
4. systematic inspection of all workplaces to assess risk factors for MSDs and suggest actions to mitigate them. This could be followed by a second inspection of incompliant organisations;
5. if the secondary inspections prove unsatisfactory, the inspectors must have the power to implement immediate and effective sanctions.

Demographic challenge

The European demographic situation poses a particular challenge in occupational health terms. To ensure that older workers stay fit enough to work when they are over 60 years old (or 67 in some EU countries), it becomes even more urgent not only to focus on preventive measures but to emphasise health and well-being throughout a person's entire working life.

The World Health Organisation definition of health goes beyond the narrow concept of merely the absence of illness; it is an abstract concept that includes a perfect state of well-being — physical, mental and social.

But health at work is much more than this: it includes capacities and skills such as technical knowledge and creativity, cooperation and camaraderie, imagination and the ability to work in a team, independence and emotional intelligence, balance between work and family life, balance between repetitive movements in a sedentary posture causing MSD and recreational physical activities to resource body and mind, etc.

Investing in the prevention of MSDs is not an extravagant add-on for companies, but an ethical obligation that will also reap rewards in terms of good health and economic outcomes. It is an investment that Europe must make now because years of hesitation have taken an unacceptable toll on the workforce.

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PETER RIMMER
The Napo Consortium, Europe

Napo: safety with a smile

The Napo series of animated films is produced in computer graphics featuring characters in the world of work. The main character, Napo, and his partners express themselves in wordless language. Their stories have an educational value. They provoke questions and stimulate debate; sometimes they provide practical solutions or lead to them. But how did Napo originate? Where does he come from? And how can Napo help 'Lighten the load'? Peter Rimmer, Project Manager for the Napo Consortium, explains.

The origins of Napo

Napo is an original idea conceived by a small group of OSH communications professionals in response to the need for high quality information products to break down national boundaries and address the diverse cultures, languages and practical needs of people at work.

The Napo films are not designed to provide comprehensive coverage of a topic, nor should they be seen as training or teaching films. The role of Napo and his friends is to provide an appetiser to OSH through their engaging characters, amusing story lines, and their humorous and light-hearted approach. 'Safety with a smile' is Napo's contribution to safer, healthier and better workplaces.

Each film is co-produced by a number of European Institutions — HSE (United Kingdom); HVBG (Germany); INAIL (Italy); INRS (France); SUVA (Switzerland); and AUVA (Austria) with support from the European Agency for Safety and Health at Work in Bilbao.

The Napo Consortium emerged from the European Year of Safety and Health 1992–93, and the European film festivals held in Thessaloniki, Greece (1992) and Strasbourg (1995).

The European Commission had supported film festivals in the belief that it was possible to adapt the best videos for use throughout the European Union. This proved difficult. Many films are made by commercial production companies unwilling to give up their rights. Cultural differences mean that images, storylines and the look and feel of the film make it difficult to adapt and transfer films across national boundaries.

As a result, four active and concerned communications professionals met to discuss ways in which it might be possible to commission and produce films specifically for use across Europe, and formed a small working group based on the personal interest and contribution of individuals, and not on any institutional basis.

The birth of Napo

The group put together a proposal, a specification and an invitation to tender to produce a video about safety signs, and identified two production companies from each of their own countries who were invited to put forward a treatment. Via Storia, a French company from Strasbourg, won the contract. Napo was born!

The first video *Best Signs Story*, a film about safety signs in the workplace, featured at the EU Film Festival in Edinburgh in 1998, and won awards at the World Congress in Sao Paulo in 1999, and at national film festivals in France and Germany.

In 2003, the European Agency for Safety and Health at Work in Bilbao expressed interest in a third video to support the European Week and its theme of 'Dangerous substances'. An agreement was reached with the Consortium to enable the Agency to supply master copies of the video to all Member States, candidate and EFTA countries with clear provisions on non-exclusive use, rights and costs. This collaboration has continued.

Napo's films

The Napo series of films is produced in computer graphics. They feature characters in the world of work, faced with safety issues. The main character, Napo, and his partners express themselves in wordless language. Their stories have an educational value. They provoke questions and stimulate debate on specific aspects of safety at work. Sometimes they provide practical solutions or lead to them.

It is this blend of education, cultural neutrality and humour set in a cartoon style that gives the Napo series its identity. Napo is a likeable but careless character. The universal language of Napo makes the films suitable for everyone. Each scene is independent of the others and can be used as one stand-alone film, or individually, scene-by-scene.

Napo — the hero!

Napo is the hero of the cartoon series. He is symbolic of an employee working in any industry or sector. Napo is not limited to one specific job or work environment but his personality and physical appearance remain the same in all the films.

Napo is quite a normal person — neither good nor bad, neither young nor old. In this respect, his culture is neutral. He is a willing worker who can be the victim of situations over which he has no control but he can also identify hazards or risks, and make good suggestions to improve safety and work organisation.

Napo is a likeable and attractive character with strong reactions and emotions. When he is annoyed, bored or in love — it shows! As such, everyone can identify with Napo, from young employee to someone who has worked in the company for many years.

The supporting cast

There are a number of key characters in the Napo films. The boss is the main supporting character. He might be the foreman, site manager or factory director; he represents authority. The boss gives the orders and sets the rules, and always instructs Napo directly.

He is not only concerned about the safety of his staff but also about productivity. Often, he is under pressure from his superiors or his clients. Sometimes he gives orders that are contradictory or impossible to carry out. Contrary to the saying, the boss is not always right.

Miss Strudel is an intense woman who represents a level of authority higher than or parallel to that of the boss. She might be the client, the works inspector or the company nurse who puts pressure on the boss and his staff. Miss Strudel is amusing through her excesses. Napo himself may be seduced occasionally by her rather special charm.

Napette is a colleague who may perform the same or similar duties to Napo or a different job but in the same work environment. Occasionally she makes mistakes in her job. Napette is attracted by Napo's charm but her attempts to help him sometimes irritate or annoy Napo.

Depending on the stories, Napo may have other colleagues working in the same company and doing the same or similar jobs. These characters serve as a foil to Napo's exploits. For the main part, they are sensible employees who more or less follow the rules.

A frog, a dog and other animals also enter the world of Napo. These animals are likeable characters that help to develop the stories and give a cartoon touch to the adventures of our hero. In true cartoon style, objects come to life and react to or criticise the behaviour of Napo; for example, the safety signs that speak and wave their arms in the film 'Best Signs Story'.

The best way to use Napo is to think Napo

The Napo series is not the universal key to solve all health and safety problems. Napo is not a safety expert. His point of view is not that of

the safety professional! The films are not designed to provide comprehensive coverage of a topic, nor should they be seen as training or teaching films.

The role of Napo and his friends is to provide an appetiser to OSH through their engaging characters, amusing story lines, and light-hearted approach. The best way to use Napo is to think Napo. 'Safety with a smile' is Napo's contribution to safer, healthier and better workplaces.

Because Napo is a cartoon character he can explore areas that would not be possible in drama or documentary films. He is indestructible and everlasting, unlike the workers we are trying to protect.

Napo films can be used in their entirety or sequence by sequence — this will depend on the audience, their views and attitudes to safety at work, and the environment in which the film is shown. Too much Napo can dilute the importance of the series.

Their stories also have an educational value. They provoke questions and stimulate debate on specific aspects of safety at work. Sometimes they provide practical solutions or lead to them. It is this blend of education, cultural neutrality and light-heartedness that gives the Napo series its identity.

Napo in 'Lighten the load!'

A new Napo film was released in spring 2007 to support the European campaign on musculoskeletal disorders (MSDs). Many films have been produced about MSDs, manual handling, lifting and carrying, and repetitive injuries. The objective of the latest Napo production was not simply to repeat what is already well covered in existing films, most of which are technically excellent and produced to high standards, but to provide a new entrée to the topic. It was an opportunity to 'think outside of the box' and to be imaginative — always easier said than done — and to capitalise on humour and the Napo way of doing things!

The film looks at the concept of 'managing the load', not only the load being carried by a worker but also all the strains and stresses being put onto the body by material being moved, the environmental factors in which the work is being carried out, hazards in the workplace, and the pace at which the task is being carried out.

Napo in 'Lighten the load' shows some of the consequences of getting it wrong and makes links with work organisation, rhythms, stress and difficult situations/workplaces. It uses cartoon and animation to show, for example, the use and abuse of muscles expanding or contracting, destroyed or suffering.

The global message is that repetitive movements, bad positions, long and unchanged posture, and physical effort can have negative effects on the body and consequently lead to absenteeism, labour turnover and higher costs for employers, and pain and suffering for workers.

The film also returns to the basic simplicity of Napo — plain backgrounds, and few distractions from the main point of each scenario.

Coming soon

The next Napo film will support the European 2008 campaign on risk assessment and will be available early in 2008. A Napo website will be launched in 2007 at www.napolfilm.net

Peter Rimmer is a communications and marketing consultant. He was Director of Information with the UK Health and Safety Executive (HSE) for 16 years, and has worked extensively in Europe on Phare and twinning projects, and in partnership with European colleagues in the production of films in the Napo series. He is chair of the International Film & Multimedia Festival Jury of the ISSA/ILO World Congress, and an assessor for Health Promotion Wales, the Corporate Standard. He writes for Safety & Health Practitioner magazine and is the editor of Health Protection Matters, a magazine published by the UK Health Protection Agency.

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Musculoskeletal disorders as industrial diseases?

Musculoskeletal disorders (MSDs) have never been included in Norwegian legislation governing industrial illnesses. The move has been discussed on several occasions but changes in legislation have stalled for political reasons by arguments put forward by trade and industry and, in part, by the medical profession. There is now sufficient documentation and evidence available to prove that such disorders, subject to certain pre-conditions, can be attributed to conditions in the workplace.

This article argues that certain MSDs are well-defined conditions that can be predominantly attributed to one or more specific work tasks and should therefore qualify for compensation. This is pre-conditioned by a well-defined condition that can be predominately attributed to one or more specific work tasks. It is possible to use examples from other Scandinavian countries to identify an opportunity for a change in Norwegian legislation in this area of law.

Background and terminology

Musculoskeletal disorders cause a high degree of discomfort, pain and reduced mobility and motor functions that, in turn, can result in absence from work and a life on disability pension for the sufferer. These cases are also the cause of high costs to the public purse. See Box 1 for a definition of the terminology.

Work-related MSDs — a definition

'Musculoskeletal disorders' is a group term for pain, discomfort or other abnormal conditions in muscles, tendons, joints or nerves that result in reduced functionality. To be called work-related, there must be a well-documented relationship to work; either a cause of or an aggravation by specific work tasks.

In this connection, repetitive strain injuries and load-related disorders encompass work-related MSDs. Repetitive strain injury and load-related disorder are not well-chosen terms in that they say something about causality factors that are not always present. This is illustrated by the high volume of research indicating that the lack of load can be a risk factor.

Accepting liability for compensation in these cases that potentially result from work will spur the work being done to prevent MSDs. Norway is amongst a minority of western countries that do not legislate in favour of this type of compensation, and the only country, as far as is known, that legislates explicitly against load injuries developed over time as a possible occupational illness. It should be noted that the International Labour Organisation (ILO) included MSDs on its list of industrial disease as far back as 2002.

Evidence for causality

Several MSDs have well-documented work-related causes, and a number of critical reviews of available literature have been carried out in recent years. One of the best reviews was published in 1997 by the National Institute of Occupational Safety and Health (NIOSH) in the USA (NIOSH, 1997). This study concluded that there is well-documented causality between certain types of physical load strains and a number of MSDs in the neck, shoulders, arms and back (see Box 2). The MSDs discussed below are relatively easy to diagnose and the effect of the specific load strain is sufficiently well documented.

'Tendonitis of the shoulder' is used here as a collective term for disorders in the shoulder tendons. When the shoulder is used with the arm(s) raised, the muscles are activated and the tendons are put under strain as the arm is used without support. Examples include using a computer mouse with an inappropriate ergonomic working arrangement, hairdressing, electrical installation work, ceiling painting and fish filleting.

Musculoskeletal disorders with a high degree of probability related to specific mechanical loads (NIOSH 1997)

Musculoskeletal disorder	Causality
Neck pain	Static muscle activity
Tendonitis of the shoulder	Working with arms raised without support (also while using tools)
Tennis elbow Tendonitis in the forearm Carpal tunnel syndrome	Combination of high repetition and physical force, particularly in manual work

There are a large number of epidemiological studies that show a connection between tendonitis in the shoulder and jobs/professions where the arm is raised by more than 60 degrees (probably less) without support (NIOSH 1997). A dose–response relationship has been identified between the number of hours worked daily with this type of load and tendonitis in the shoulder, and shoulder and neck disorders. There are also many experimental studies that support the mechanisms behind a causality chain, i.e. support a biological plausibility.

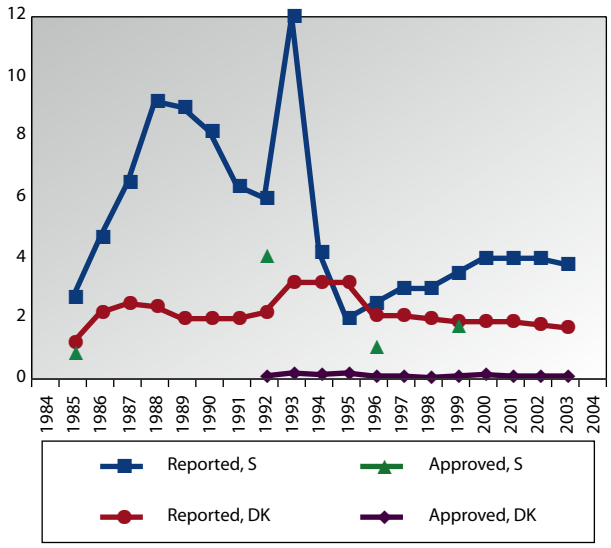
Examples from Sweden and Denmark

Why is it that MSDs are excluded a priori for compensation in industrial injury legislation in Norway when there is documentation that proves that certain disorders are caused by working conditions?

One important argument is that possible compensation claims might cost too much money, and Sweden has been used to support this view. For many years until 1990 the costs incurred under Sweden's Industrial Industry Insurance Arrangement were extremely high due, among other factors, to compensation paid to patients suffering from MSDs (see Figure 1).

Until 1993 Swedish legislation required the following proof of causality: 'a connection will be deemed to exist unless there is strong evidence to the contrary' (SOU 1998:37, p. 22). In 1993 the requirements were tightened: 'If a case of industrial injury or disorder is to be deemed to exist, one must first be able to prove with a high degree of probability that factors in the working environment can be the cause of the disorder the insured is suffering from. Further it must be deemed to be highly probable that the disorder was caused by the said factor.' (SOU 1998, Vol. 37, p. 64).

Figure 1. Reported and approved work related musculoskeletal disorders in Sweden and Denmark (Total per 1 000 workers)



Sources: ISA, SOU 1998:37M Official statistics 2003
Swedish National Board of Industrial Injuries report 1993:3
Swedish Working Environment Authority website www.av.se (4 July 2006)
Danish National Board of Industrial Injuries annual reports and website www.ask.dk (4 July 2006)

The application of the law in practice has been modified in recent years. The requirements governing causality are much stricter and the principle of 'reverse burden of proof' is no longer applied.

The number of notified MSDs in Sweden rose from around two to three per 1 000 employees until about 1984 to around 10 per 1 000 employees in the years 1988–89, and to a more stable level of around four per 1 000 employees in later years (see Figure 1). For the most part, the increase was in line with a significant rise in the rate of approval of pursued claims with 'authority in law'.

In 1980, 27 % of claims were allowed. In 1989 the number had increased to 90 % but fell back to approximately 70 % in 1992 and between 1996 and 1999 was approximately 40 %. In other words, the number of claims lodged rose dramatically while at the same time almost all claims were allowed in the years immediately prior to 1990. In 1996 approximately 3 000 MSDs were allowed as industrial injuries, three quarters of all industrial injuries in that year.

Lessons from Sweden and Denmark

The most important lesson from the Swedish experience is not to accept all MSDs as industrial injuries just because the claimant was at work.

The Danes were previously much more careful about approving compensation claims for MSDs than the Swedes. The National Board of Industrial Injuries uses a list of diseases and disorders that can be proved to be work-related — the occupational diseases list — that is revised about every second year. The disorder in question must conform to a typical clinical picture and there must not be other circumstances than the work or profession that are more probable causes of the disorder.

The MSDs of the back, neck and arms that develop over time and that are currently included on the Danish list are:

1. chronic lower back pain;
2. tendonitis and similar disorders in the forearm;
3. carpal tunnel syndrome;
4. tennis elbow;
5. tendonitis of the shoulder; and
6. chronic neck/shoulder pains.

There are special requirements for documentation to prove the causality.

The number of compensation cases for occupational MSDs in Denmark has remained fairly stable, between one and three per 1 000 employees since the early 1980s. In 1992, 5 500 cases were brought of which 255 (4.7 %) were approved for compensation. In 1996, the figures were 7 500 and 434 (5.8 %), and in 2000, 6 570, of which 485 (7.4 %) were approved. In 2003, the figures were 6 098 and 437 (7.2 %).

New legislation was introduced from 1 January 2005, opening the way for more successful claims for occupational MSDs and introducing the possibility that individual cases of an illness not included in the official list might be accepted as work-related MSDs.

Danish legislation and practice shows that it is possible to recognise and approve MSDs as appropriate cases for compensation without this necessarily proving to be a major drain on monetary resources. It has also shown that without a general definition of industrial illness/injury precise requirements can be formulated and implemented. The Danish legislation and regulations also allow for regular revisions of the basis of the law in the light of newly acquired knowledge.

What's happening in Norway?

A number of political parties, organisations and special interest groups have taken up the case. In May 1998, the Norwegian Parliament asked the government to 'report on the possibility of extending the list of industrial diseases to include certain repetitive strain injuries and load-related disorders that are clearly work-related'. On the basis of a report published in 1999 by the National Institute of Occupational Health, the Ministry of Social Affairs and Health (now the Ministry of Health and Care Services), a further report was published which proposed that lifting injuries and tendonitis in the shoulder that had developed over time should be included in the list of industrial diseases. This was designed to test public opinion to see if the legislation should be changed.

Responses to the document varied greatly. Labour unions and certain professional bodies felt that the legislator was exercising far too much caution. On the other hand, the National Insurance Administration and commercial/industrial interests were concerned that it would be both too expensive and too difficult to administer.

In autumn 2006, the Norwegian authorities stated unofficially that they have no immediate plans to introduce any changes in the legislation so that certain types of work-related MSDs that have developed over time may be accepted as occupational illnesses.

A personal point of view

In my opinion, the documentation requested and required to prove the causality chain between specific working conditions and MSDs is available. The concern in Norway that accepting such disorders as industrial diseases will become a financial drain is not necessarily justified.

It is ethically indefensible to exclude certain diseases and disorders from the legislation when these have known causes in the workplace. Recognising that this is the case would be a boost for preventive measures for MSDs in Norway in trade and industry. A report should be commissioned at the earliest possible opportunity to investigate the most suitable way in which such work-related MSDs in Norway can be treated in the same way as other industrial diseases under the law.

Bo Veiersted, MD and PhD, grew up in Sweden and studied medicine at the University of Copenhagen. He has been investigating work-related musculoskeletal disorders, especially neck and shoulder pain, at the National Institute of Occupational Health in Norway since 1986, and is interested in the medico-legal aspects of these disorders.

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VIBEKE GRETHE ANDERSEN
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Ergonomics standards in Europe: a Danish perspective

Pains in the arms, nape of the neck, shoulders and back are a widespread problem in Europe. These pains are often experienced by employees who spend a substantial part of their working day using machines or equipment of inappropriate design.

Shouldn't common European legislation and CE marking [3] deal with this?

In principle, yes because CE marking is the manufacturer/importer's guarantee that the machine complies with the requirements of common European legislation applying to machines and other products that are intended to be freely traded across borders.

But the provisions of the legislation in the area of ergonomics are broad framework provisions, and it may be difficult for a manufacturer to check the extent to which a machine causes its operator discomfort, fatigue and mental strain/stress during normal use, and whether this is sufficiently constrained by the ergonomic principles.

So couldn't the legislation be more specific?

The initial common European legislation drawn up at the end of the 1970s was much more specific, but it was so cumbersome that the Commission soon realised that it would not achieve anything. The new method was then adopted, under which legislation was drafted in terms of framework provisions, and European standardisation organisations such as CEN and Cenelec [4] were asked to draw up the more specific guidelines. CEN had many years of experience of European cooperation on standards, and was the obvious organisation to deal with such tasks. It was the technical committee TC 114, 'Safety of Machinery' that was first assigned to look at the design of machinery.

How did ergonomics become part of the work of standardisation?

Ergonomic standards were drawn up at European level and by national standardisation organisations prior to the introduction of the new method. But the factor that really stimulated development was that the new machine design standards were conspicuously deficient when it came to ergonomics. There were far too few ergonomists to serve in the working groups that were in need of ergonomics expertise.

So, instead, it was decided to create a technical committee, TC 122 'Ergonomics', to prepare harmonised ergonomics standards. These standards are at level B, i.e. they contain guidelines for a range of machines and constitute primary tools for those who draw up level C standards (those concerned with specific types of machinery). But the ergonomic standards can also be used by manufacturers, especially if level C standards are not available.

[3] European safety mark required on many products before they can be sold in Europe.

[4] CEN: European Committee for Standardisation, http://www.cennorm.be/
Cenelec: European Committee for Electrotechnical Standardisation.

What is a harmonised standard?

A harmonised standard is a standard that complies with the framework provisions of a full harmonisation directive (common European legislation on products). This is indicated by the fact that the last item in the standard is an Annex ZA, which states which directive provisions are supplemented by the standard. It is the responsibility of the Commission's CEN Consultant to ensure cohesion between the standard and the directives. Once a standard has been adopted by a majority of the Member States' standardisation organisations and approved by the consultant, it is published in the *Official Journal of the European Union* and then becomes a harmonised standard.

How many harmonised ergonomics standards are there?

The work of TC 122 and its working groups has now been going on for more than 20 years and some 20 harmonised ergonomics standards have been completed. Most European countries have taken part — the EU countries themselves and other countries that use the standards. The most important harmonised standards are those concerned with ergonomic principles of machine design, anthropometric guidelines (dimensions in relation to the measurements of the human body and their variations), biomechanical guidelines (strength, weight, working postures etc.), displays and power units, hot and cold surfaces and so on. The final touches are currently being added to a standard dealing with ergonomic principles applying to personal protective equipment before it is put to the vote. Standards are also being prepared on thermal conditions and visual display units (among other subjects); these are not destined to become harmonised standards because they are not linked to total harmonisation directives.

Must a machinery manufacturer comply with the requirements of a harmonised standard?

No — compliance with the requirements of a standard is voluntary. But if there is compliance, it can be assumed that the conditions of the directive in these areas have been fulfilled. In the absence of compliance, it must be demonstrated that health and safety requirements have been satisfied to the same level as that of the standard.

For example, Denmark has applied guidelines taken from the ergonomics standard EN 14738 'Safety of machinery: Anthropometric requirements for the design of machine workstations' to manufacturers of supermarket checkout tills.

Could ergonomics standards slow down development?

It is true that in some fields technological development is very rapid, but if the products can be improved in terms of ergonomics, manufacturers need not comply with the standards. For example, if a production plant is fully automated there is no need to decide whether strength requirements and working postures fulfil the ergonomics standards. In addition, a decision must be made at least every five years as to whether a standard should be revised. For example, new documentation in a particular field may mean that a standard will have to change.

What is the effect of the ergonomics standards?

Unfortunately the standards have not had much impact so far because too few people know that they exist. Increased use of ergonomics standards will result in better ergonomic design of machines and thereby reduce the risk of musculoskeletal problems suffered by machine operators.

Vibeke Grethe Andersen is a special consultant in ergonomics at the Danish Working Environment Authority. She works with national strategies for preventing work-related musculoskeletal disorders in Denmark, and produces national guidelines and information material about ergonomics. She participates in the European standardisation work in TC 122 Ergonomics.

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