



Sustainable workplaces of the future – European Research Challenges for occupational safety and health



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– European Research Challenges for
occupational safety and health

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Foreword

I am delighted to present this PEROSH position paper on the occupational safety and health (OSH) research challenges for the future. The paper is a joint effort of the PEROSH members and explains OSH research challenges and needs towards 2020.

In line with the EU2020 Strategy for smart, inclusive and sustainable growth, one of the aims of the PEROSH research is to contribute to healthy, safe, innovative and sustainable workplaces, and in keeping people healthy and longer at work. Identification of the research needs and expected outcomes is important to keep abreast of the emerging trends and risks in this field.

Given the strong relationship between performance and occupational safety and health, improving the quality of work and working conditions and achieving better performance should be considered as two sides of the same coin rather than conflicting goals.

Particular challenges are the rapid ageing of the labour market population and that workers face longer working careers. At the same time, many workers leave the labour market prematurely due to disability and ill health. The working conditions of an ageing workforce and strategies to improve and retain fitness, as well as adequate return-to-work programmes should receive greater attention.

There is increasing evidence that several physical and mental working conditions in middle age predict future disability retirement. Musculoskeletal disorders are the main occupational disease category affecting the European workers, and are amongst the most significant causes of sickness absence. Moreover, psychosocial risks are on the rise throughout Europe due to rapid changes in the nature of work and organisations and the growing competition on the global market.

The emergence and development of new technologies such as information and communication technology solutions, robotics and nanotechnologies, have lots of potential for new preventive solutions, changing working conditions and the workplace environment. At the same time, they can lead to new risks to workers and overrule known solutions. As nanotechnology applications and use expand very rapidly, safety of emerging nanomaterials should be integrated as quickly as possible. A European position in these fields is required to understand these complexities, and anticipate the opportunities and consequences of implementation in a coordinated manner.

There is also a need for effective prevention of accidents at work, particularly among vulnerable groups and in small and medium sized enterprises. The integration of a 'safety culture' and a 'zero accident vision' in European enterprises and organisations can have positive impacts on OSH management. Research should thus contribute to a positive safety culture in enterprises.

These are crucial times for Europe. Therefore, we hope that this paper can contribute to identify the European challenges ahead, and will move forward the visibility and importance of coordinating research and development efforts in occupational safety and health for Europe.

Professor Didier Baptiste

Chairman of PEROSH
Scientific Director of INRS

About PEROSH

PEROSH, founded in 2003, is comprised of 11 Occupational Safety and Health (OSH) institutes from 10 European countries, employing approximately 1.000 researchers and experts and affiliated to national authorities and health insurance systems.

PEROSH aims at giving a wider European voice to evidence based OSH research. We are committed to reinforce and coordinate OSH research and development efforts in creating a broad European network with European organisations and institutions and other stakeholders, such as research consortia, social partners and governments.

Joint collaboration in fields of common interest is one of the key objectives of the network. This generates synergies and efficiently uses resources and knowledge from the different countries to improve the impact of OSH research.

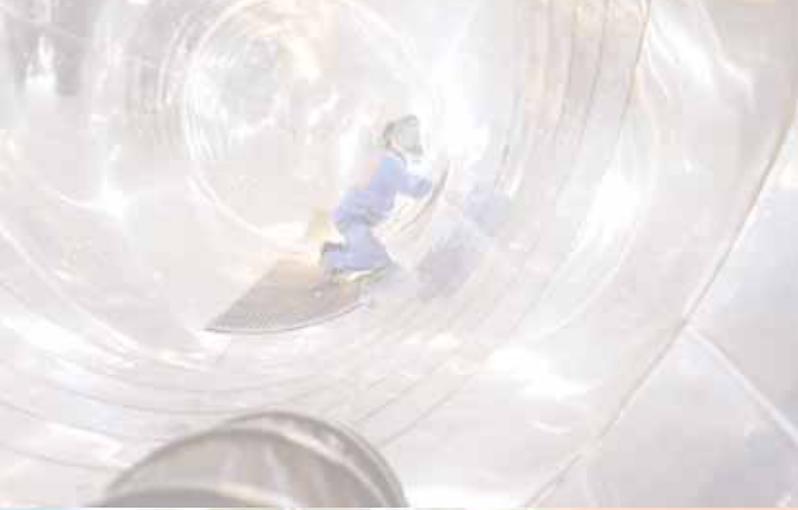
Currently, the member institutes are involved in a number of joint research projects that have been set up within PEROSH. Research topics include:

- work and well being
- ageing of the workforce
- safety of nanotechnology and nanoparticles
- the development of a clearinghouse for systematic reviews in OSH
- the development of a cross-culture methodology and criteria for the improvement of EU comparative data
- determination of standardised workplace protection factors for respiratory protective devices
- the promotion of safety culture and of a zero accident vision at the workplace.

Member institutes

- Federal Institute for Occupational Safety and Health (BAuA), Germany
- Institute for Occupational Safety and Health of the German Social Accident Insurance (IFA - DGUV), Germany
- Central Institute for Labour Protection - National Research Institute (CIOP-PIB), Poland
- Finnish Institute of Occupational Health (FIOH), Finland
- Health and Safety Laboratory (HSL), United Kingdom
- Institut National de Recherche et de Sécurité (INRS), France
- National Institute for Occupational Safety and Prevention (INAIL), Italy
- National Research Centre for the Working Environment (NRCWE), Denmark
- Institute for Occupational Safety and Health (Prevent), Belgium
- National Institute of Occupational Health (STAMI), Norway
- Netherlands Organisation for Applied Scientific Research (TNO), Netherlands

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Introduction

This paper seeks to clarify the research challenges for occupational safety and health (OSH) for the next decade, and summarizes the research challenges towards 2020 that are put forward by the PEROSH members. These challenges are identified in the framework of future topic scanning, using general forecasting exercises, literature reviews and stakeholder discussions, which were organized by the individual institutes.

The purpose of the consultation process was to identify what OSH topics the European institutes specialised in, and what they see as the major trends and future challenges in the world of work and their impact on OSH. A second part of the consultation analysed future research needs, solutions and deliverables that will be necessary in the long run to ensure a healthy working life for Europe's workforce, and to secure social progress in the EU.

The consultation of the member institutes led to the prioritisation of seven main research challenges that are significantly prevalent and innovative in terms of preventing ill health and occupational accidents.

The PEROSH members will continue to proactively cooperate along these lines to further enhance European evidence-based research collaboration on the current and future working environment. A proactive identification of new areas of focus for research and development, and the analysis of themes in which European strategic partnerships can be enhanced, are necessary to be able to overcome future challenges.

Methodology

Based on their forecasting exercises, the PEROSH members submitted articles on their five top priorities for future OSH research. The topics were listed and prioritised according to frequency of occurrence, so as to identify potential challenges for research towards 2020. Consequently, the number of challenges are limited to the following seven main research challenges:

- Sustainable employability to prolong working life
- Disability prevention and reintegration
- Psychosocial well-being in a sustainable working organisation
- Multifactorial genesis of work-related musculoskeletal disorders (MSDs)
- New technologies as a field of action for OSH
- Occupational risks related to engineered nanomaterials (ENM)
- Safety culture to prevent occupational accidents

Subsequently a synthesis of the articles was produced. In order to achieve convergence on the challenges, the synthesis was distributed among the member institutes for comments and adapted accordingly. In some cases there are obvious overlaps and relations between the themes. However, for reasons of clarity the topics are treated separately from each other, and are linked wherever necessary.

Many European countries are facing similar socio-economic challenges. A certain number of challenges are thus convergent and recurrent in Europe, while others are specific to only some of the countries. This implies that the complete picture is broader than the seven challenges that are described in this paper. Therefore, an overview of the priorities received has been integrated in the annex.



Sustainable employability to prolong working life

Summary

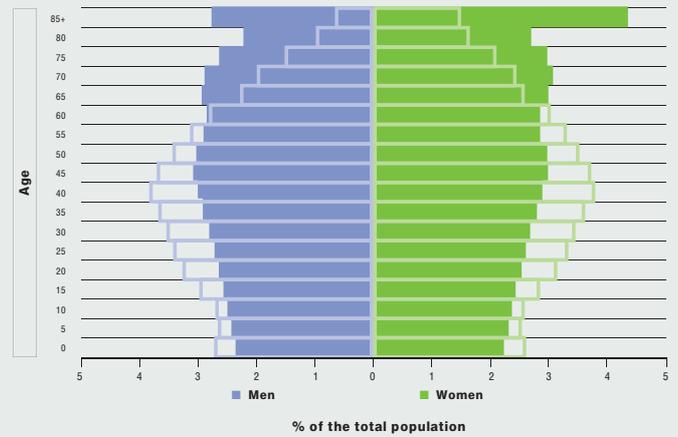
Demographic change will be a major driver for labour market developments in Europe. These developments will also have a huge impact on occupational safety and health. For governments, enterprises and citizens alike, it will be of crucial importance to prolong working life in a healthy and productive manner. Research should contribute to a paradigm shift in OSH from its focus on work as a risk factor of ill health to work as a source of vitality, empowerment, healthy ageing and participation in society. A multi-actor approach should be developed to create a common ground. Working conditions, education and training and motivation to prolong working life are the main topics.



1. Description of the priority, what is at stake? Why is it a priority?

Demographic change will lead and is already leading to ageing of the population, including the working population (see figure). At the same time, many workers leave the workforce well before the official retirement age. Decreasing income due to a shrinking workforce and growing expenditure for pensions, health and long-term care poses a major threat to the welfare in Europe. The key challenge is to increase the productive work participation of people aged 55-70 years, women, the long-term unemployed and people with disabilities. This is even more important in view of the worldwide economic crisis and globalisation, in which the European region faces strong competition. Importantly, raising the official retirement age will not automatically result in productivity gains.¹

Figure 1. Population structure and ageing in 2010 (bordered) and 2060 (solid colours) in EU-27.



Source: Eurostat (demo_pjangroup and proj_10c2150p), 2060 data are projections (EUROPOP2010 convergence scenario)

Although it is obvious that employers will need to employ more older people due to an increasing shortage of younger workers, negative stereotyping of older workers still persists in many countries. Little is known about this difficult mix of prejudice and actual demand/supply frictions for older workers on the labour market. In addition, new psychosocial risks emerge due to new technologies, the growing use of ICT, the expanding service sector, and new forms of work such as telework, self-employment and flexible work. Also migrant work is expected to increase. At the same time, several 'old' hazardous or strenuous labour conditions will remain a reality for many professions. Since these workers enter working life before their twenties, prolonging working life will be very difficult if they have to remain in the same profession during their career. Hence people, if they continue to work for increasingly long periods of time, will be exposed to new and existing risk factors for longer and later in life.



2. Research needs at European level

The proposed research should contribute to a paradigm shift in OSH from its focus on work as a risk factor of ill health to work as a source of vitality, empowerment, healthy ageing and participation in society. This will lead to close cooperation of OSH and HRM, and to a bridging of the gap between OSH and health-care. Within this broad scope the following topics could be addressed:

2.1 General

Studies that investigate which health-related factors, work-related factors, skills and knowledge, social factors, and financial factors influence motivation, work ability and the opportunity for prolonging working life, as well as actual behaviour. Secondly, studies on disability prevention and re-integration are needed (see also Disability prevention and reintegration). It is recommended that research includes, but is not limited to, older people. Transnational studies may provide insight into the influence of cultural and institutional factors.

An integrative risk assessment and state-of-the-art instruments on sustainable employability, both at company level (company policy benchmarks etc.) and employee level should be developed.

Additionally, there is a need to develop a multi-actor approach in which various stakeholders are brought together, i.e. employee and employer organisations, insurance companies, service providers (OSH, HR, rehabilitation etc.) and other companies involved to implement actions for sustainable employability.

2.2 Working conditions and health

In evaluation studies the following questions need to be answered: How can working conditions and health in workers with physically and or mentally demanding jobs be improved? Which interventions are cost-effective? Risk assessment instruments and solutions should be developed.

Methods and models for tailor-made workplaces that enhance work ability and motivation to prolong working careers are needed. This may include job carving, job crafting (re-engineer-

ing job requirements to fit the individual worker) and workplace and career adjustments. Special attention should be given here to precarious work.

Intervention studies on workplace health promotion and lifestyle are needed: facilitators, barriers and cost-benefit analysis, interventions including corporate culture, personal leadership and work-life balance, and targeting different groups of workers including precarious groups of workers.

2.3 Education and training

The working environment has to be converted to a learning environment: How can company culture enhance lifelong learning that keeps skills and abilities up to date and facilitates mobility in the labour market? Innovative and interactive learning methods, such as those based on virtual reality technology and gaming, are needed. These tools should be geared to different target groups (e.g. sector, level of skills/education).

2.4 Motivation to prolong working life

Design and test interventions aimed at increasing motivation to prolong working life with a focus on positive psychology, engagement, and resilience. In challenge 3, psychosocial wellbeing is covered in general, whereas the issue here is the motivation to keep on working above the age of 60.

Study which job characteristics could entice older employees to remain in employment, productive and in good spirit and which institutional incentives would be appropriate (flexible pension age, tax measures etc.).

Many if not all European countries face similar problems in dealing with the demographic changes and the need for labour market reforms and innovations in the field of OSH, human resources management (HRM) and worker oriented healthcare. By dealing with sustainable employability at a European level, countries could learn from each other and try to set up (large) research projects together. Transnational projects will contribute to our knowledge of how cultural and institutional differences influence sustainable employability and the costs and benefits of interventions in different settings.



Deliverables

- Individual and organisational determinants of the prolongation of working life while maintaining good health and high productivity.
- Cost-effective individual and organisational interventions and measures (e.g. regulations and legislation) that extend working life in good health and productivity.
- Cost-benefit analysis on the societal level demonstrating a positive return on investment in human capital will encourage the promotion of sustainable employability.
- Research agenda which addresses, from an integrative multidisciplinary perspective: sustainable working conditions, workplace health promotion, improvement of lifelong learning, and career development and mobility, and workplace system ('social') innovation.

¹ For references see publications on the European level:

– CEDEFOP, *Future skills needs. Medium-term forecast. Synthesis report*, 2008.

– European Agency for Safety and Health at Work, 'European Survey of Enterprises on New and Emerging Risks. Managing safety and health at work', *European Risk Observatory Report*, 2010, osha.europa.eu

– Eurofound, *Demographic change and work in Europe*, www.eurofound.europa.eu, 2010.

– OECD, *Live longer, work longer* (Paris: OECD Publications), 2006.

– OECD, *Human Capital: How what you know shapes your life. OECD insights*, 2007.

– OECD, *Sickness, Disability and Work: Breaking the Barriers*, Vols. 1-3, 2010 (Paris: OECD Publications, 2006, 2008, 2010).

– OECD, *Innovative workplaces. Making better use of skills within organisations*, 2010.



Disability prevention and reintegration

Summary

About 6% of the working-age population leave the labour market permanently due to disability. The primary diagnostic causes for disability retirement are musculoskeletal diseases and mental disorders. Priority areas for disability prevention are young workers with long careers, ageing workers with a growing amount of chronic diseases and partial disability, and workers in heavy and hazardous occupations. The following actions are needed: (i) updated systems and strategies for occupational health and safety protection and improvement of the working conditions leading to work disability, (ii) both national and corporate-level strategies, solutions and management of sickness absence, disability, job retention and return to work.



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1. Description of the priority, what is at stake? Why is it a priority?

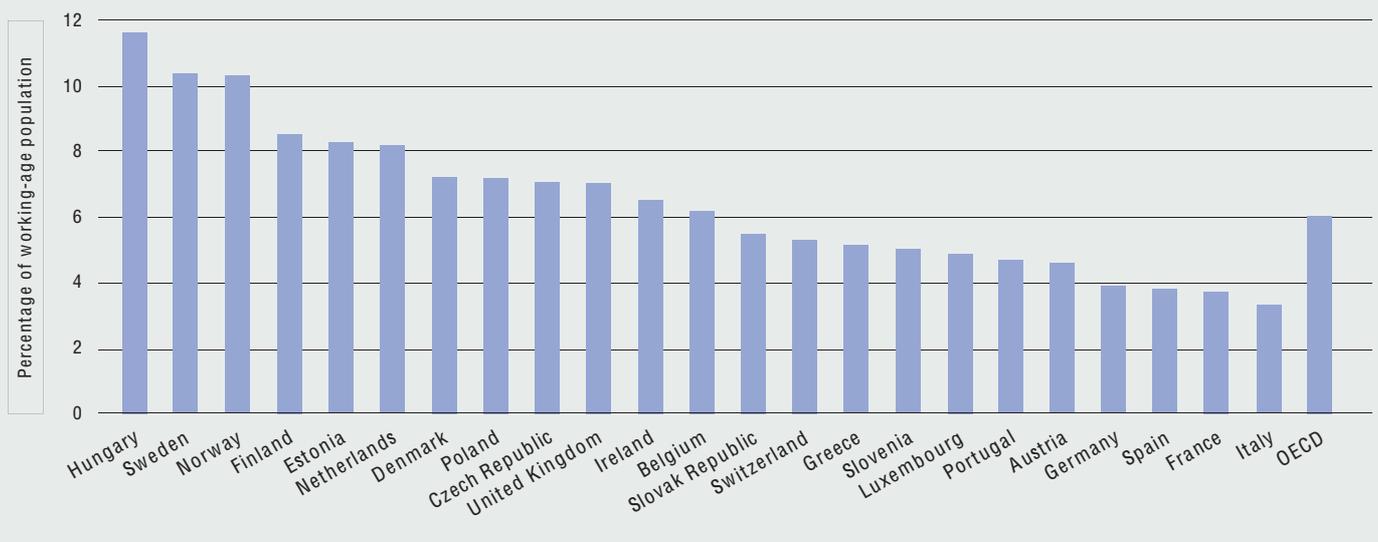
The increasing societal costs of the expanding retired population are forcing industrialised countries to find new ways to make careers lifelong.² In OECD-countries, about 6% of the working-age population rely on disability benefits. Based on the recent report³, OECD countries are spending on disability benefits twice as much as they are spending on unemployment benefits. The report concludes that too many workers leave the labour market permanently due to disability, and not enough people with reduced work capacity manage to remain in employment. Increasing work load due to insecurity, work stress, discrimination and the increase of precarious and casual work as well as migration due to EU enlargement calls for active policies in occupational health measures in several occupational sectors.

The primary diagnostic causes for disability retirement are musculoskeletal diseases and mental disorders. There is increasing evidence that several physical and mental working conditions in middle age predict future disability retirement. The predicting factors are strongly related to the socioeconomic position and working conditions of the workers. Priority areas for disability prevention are young workers with long work careers, ageing workers with a growing amount of chronic diseases and partial disability, workers in heavy and hazardous occupations (high strain, physical work, shift work) and workers not surrounded by a good OSH culture or with lower risk perception (e.g. immigrants, precarious workers and young workers).⁴

In order to prevent disability and an early exit from working life, the following actions are needed: (i) updated systems and strategies for occupational health and safety protection and im-

Figure 2. Disability benefit recipiency rates are high and still increasing in many countries.

Disability benefit recipients in percentage of the population aged 20-64 in a number of OECD countries for 2008 or latest year available



Source: OECD, The OECD "Sickness, Disability and Work" project



provement of the working conditions leading to work disability, (ii) national and corporate-level strategies, solutions for and the management of sickness absence, disability, job retention and return to work.⁵

2. Research needs at European level

2.1 Etiological research

The research should aim at identifying processes, factors and combinations of factors which - when modified - will prevent symptoms and associated disability, and enhance the return to work. Insight is needed into the processes and factors associated with sickness absence, disability and disability pensions and the major causes of sickness absence, disability, musculoskeletal and mental disorders.

The role of work-related, socioeconomic and individual factors and their interactions with musculoskeletal and mental disorders should be clarified. Research should develop a more holistic approach towards musculoskeletal and mental problems within the workplace taking into account risk factors as well as supportive factors such as changes at work, psychosocial aspects, different «vulnerable groups» and the working environment.

2.2 Intervention studies

Intervention studies are needed to assess whether symptoms and disability can be decreased and work participation increased with various measures. The intervention measures can be aimed at work development, work modification, working hours, work environment and organisation, lifestyle, or health service provision and OSH cooperation between the different stakeholders. An important component is the dialogue between the worker, employer and healthcare provider and the empowerment of the disabled worker. Job retention and workplace-based return-to-work (RTW) strategies and interventions including case management approaches are needed to prevent employees with chronic illnesses moving into disability or early retirement pensions.⁶

2.3 Occupational safety and health management

The role, quality and effectiveness of the health care provider and the occupational safety system in preventing work disability should be analysed and improved. Research should implement new methods in OSH to tackle disability. The use of different co-operation models to provide occupational health services and cooperation between the occupational health service provider and employers have to be investigated. Moreover and especially with regard to workers with chronic conditions, OSH and health-care services are insufficiently coordinated and inefficient with respect to productivity and prolonging working life. Models for this integrated care should be developed and tested for their costs and benefits.

The use of economic incentives rewarding organisations that develop and maintain safe and healthy working environments needs additional examination. Research should lead to the development of occupational safety and health management in small and medium sized enterprises.⁷

Based on new research, there is a need for evidence-based actions and new policies at both national and corporate level, and for new practices of the national health care providers and insurance companies responsible for occupational safety and health.



Deliverables

- Development of new national labour and health care social security benefits and incentives aimed at improving work participation
- Development of feasible infrastructures for disability prevention and reintegration
- Guidelines for the mapping, management and evaluation of risk factors and supporting factors focused on specific target groups
- Development of low cost and local accessible tools
- Development of training content
- Review and improvement of best practices at different levels

² Härmä M. Adding more years to the work careers of an aging workforce - what works? *Scand J Work Environ Health* 2011;37(6):451-453.

³ OECD. The OECD "Sickness, Disability and Work" project [Internet]. Paris: OECD; [cited 17 September 2010]. Available from: www.oecd.org/els/disability.

⁴ Viikari-Juntura E, Kausto J, Shiri R, Kaila-Kangas L, Takala EP, Karppinen J, Miranda H, Luukkonen R, Martimo KP. Return to work after early part-time sick leave due to musculoskeletal disorders: randomized controlled trial. *Scand J Work Environ Health*, online first 27.10.2011, doi:10.5271/sjweh.3258

⁵ Loisel P. Intervention for return to work - what is really effective? *Scand J Work Environ Health* 2005;31(4):245-247.

⁶ Martimo KP, Shiri R, Miranda H, Ketola R, Varonen H, Viikari-Juntura E. Effectiveness of an ergonomic intervention on the productivity of workers with upper-extremity disorders--a randomized controlled trial. *Scand J Work Environ Health*. 2010 Jan;36(1):25-33.

⁷ Viikari-Juntura E, Burdorf A. Return to work and job retention--increasingly important outcomes in occupational health research. *Scand J Work Environ Health*. 2011 Mar;37(2):81-4.



Psychosocial well-being in a sustainable working organisation

Summary

Psychosocial risks are considered an emerging risk across the European Union and a key challenge in modern occupational safety and health management. Findings reported that in Europe work-related stress is of concern for managers and workers due to its connection with risks for workers' health and safety and with its subsequent costs for organisations. The increasing changes in the nature of work and organisations, and the growing competitive nature of the global marketplace have increased workers' exposure to psychosocial hazards and the emergence of unknown hazards. Research in this area should contribute to a better understanding of the determining factors of physical, psychological and mental health and their impacts, and of the positive factors that may improve well-being including the development of integrated approaches to the management of psychological risks.



1. Description of the priority. What is at stake? Why is it a priority?

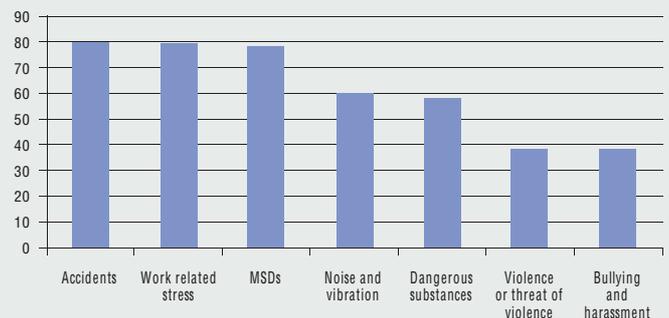
Across the European Union (EU) psychosocial risks, which are defined as «those aspects of work design and the organisation and management of work, and their social and environmental contexts, which have the potential for causing psychological, social or physical harm» have been identified as an emerging risk and as a key challenge in modern occupational safety and health management.⁸

As reported by the Fourth European Working Conditions Survey, one out of five workers from the EU15 and almost one in three from the 10 new member States believed their health was at risk due to work-related stress.⁹ Furthermore, the ESENER survey reported that work-related stress is of major or some concern for 79% of interviewed European managers, while violence and harassment are of major or some concern for almost 40%.¹⁰

Regardless of the figures, this issue has become particularly challenging, since the nature of work and work organisation has broadly changed over the last decade and is likely to change further in the coming years, due to the financial and economical crisis.

The evolution of new working practices and the increase of restructuring processes (i.e. company reorganisation, closures, mergers and acquisitions, downsizing, outsourcing, relocation, etc.), to deal with the growing competitive nature of the global marketplace, have led to an increased exposure to recognised psychosocial hazards and the emergence of new hazards. Identification of these hazards is needed to reduce the associated health and safety risks.¹¹

Figure 3: Health and safety concerns reported to of some and major concern (% managers, EU27)



Source: ESENER Survey, EU OSHA (2008)

Dealing with psychosocial risks factors is not just relevant for policies on workers' health. Also, it can represent a key challenge for economical policies, since psychosocial risks can impact the organisational health of companies, thereby affecting their performance.¹²

Given the strong relationship between performance and occupational health, improving the quality of work and working conditions and achieving better performance should be considered as two sides of the same coin rather than conflicting goals. For instance, studies have suggested that between 50% and 60% of all lost working days have some link with work-related stress. This represents a huge cost in terms of impaired economic performance. Furthermore, as outlined by Eurofound¹³, companies with a high level of employee satisfaction, based on high rankings for trust and social capital, perform better over time.

In order to develop sustainable working conditions two main aspects require special attention: 1) the need of reducing the effects of psychosocial risk factors on physical, psychological and mental health. This should be done by further developing knowledge on their determinants and impacts and promoting the development of an integrated management approach to psychological risks to ensure a widespread adoption of the more advanced norms; 2) the need of exploring resources and positive factors (such as individual resources and attitude, organisational and work aspects) and to promote interventions and practices that may improve employees' well-being.¹⁴



2. Research needs at European level

2.1 Research needs on determinants

Research in the following areas is needed:

- investigate the effect of the individual resources (in terms of knowledge, skills, individual attitudes, personal characteristics and motivation etc.) on employees' psychological and mental health, and their impact on preventing mental disorders and promoting positive aspects (e.g. work and life satisfaction, motivation, well-being etc.).
- understand the influence of organisational and work related factors (e.g. working conditions, social context, physical context, management, etc.) on psychological and mental health and well-being.
- explore resources and positive factors that may influence and improve workers' well-being and examine which influences are modifiable in a workplace to achieve a global concept of well-being at work.
- highlight how group resources (such as social capital, team working and group support) may impact on individual psychological and mental health and groups' health and under which conditions; and what the consequences on individual and organisational productivity are.
- seek and analyse further under explored factors such as ethics, job insecurity, work- life balance, information overload, working hours etc. that can have an impact on work-related stress, mental disorders and on the development of organisational and individual well-being.
- highlight how new ways of working, innovations in the production system and the diffusion and use of information and communication technology (ICT) are connected to the quality of work, safety and health and well-being of workers.
- investigate the effects of restructuring (structural and functional changes such as company reorganisation, closures, mergers & acquisitions, downsizing, outsourcing, relocation etc.) on employees' motivation, workplace and social behaviour and health and, in turn, how these effects might even thwart the success of the restructuring.
- understand the link between vulnerable groups (ageing workers, gender differences, precarious employment forms, boundaryless work¹⁵, etc.) and psychosocial risks (see also Disability prevention).

2.2 Research needs relating to impact

Additional research on impacts is needed, especially to:

- connect major chronic diseases and disorders of great public health relevance (e.g. cardiovascular diseases and common mental disorders etc.) to the work context and psychosocial aspects, such as work related stress, violence and harassment.
- deepen the analysis of the multi faceted nature of the etiological development of musculoskeletal disorders (MSDs), considering both physical and psychosocial factors (understanding further their independent and interactive effect on the development of MSDs).
- highlight and improve policies, practices and interventions for reducing the impact of work-related stress tailored to organisations' needs and economical sustainability.
- analyse the under explored impacts of work-related stress and other related aspects, which have received less attention in the past (such as work engagement and workaholism) and their effects on employees' health and productivity. Since withdrawal behaviours (such as turnover, absenteeism and lateness) are affected by organisational climate dimensions through the mediating effects of specific occupational stressors.
- investigate the action priorities on work-related stress and well-being in different EU countries and the degree of development and implementation of effective workplace interventions, strategies, guidelines and policies on work-related stress in EU companies by focusing on their approach to the issue and the inclusion of all psychosocial risk factors (including new emerging risks).
- underline the benefits of new ways of working in terms of employees' engagement, job motivation, organisational flexibility, workplace relationships and perceived career prospects and their impact on aspects related to occupational health and safety.
- deepen the connection between work-related stress and violence and harassment in order to understand effective organisational interventions and actions aimed at reducing their occurrence.
- assess and highlight the socio-economic impact of work related stress and its consequences in terms of the costs, the effects on specific groups of workers and productivity.
- understand what work organisation and management practices can influence the impacts of restructuring on employees well-being and how.



Deliverables

- Improvement of instruments for diagnosis, monitoring and evaluation of psychosocial risk factors, by including new risks, positive factors and elements which may “protect” employees’ health and increase workers’ well-being.
- Development of an integrated approach to the management of psychosocial risks in order to ensure a widespread adoption of the European legislation, the enforcement of which is also hindered by a lack of research on these kinds of integrated management methodologies.
- Increasing the effective evaluation of work-related stress, possibly by developing measurement proposals and analysis tailored to the business sector, companies and organisational branches.
- Development of effective work-related stress management processes, taking into account prototypical working conditions and the changing nature of the labour market (economic crisis, migration, atypical contracts).
- Development of measures, risk assessment, training and learning programmes related to the new ways of working.
- Raising awareness on the impact of stress on companies: in terms of health consequences, productivity, costs and impact on specific groups of workers.
- Raising awareness about violence and harassment in specific countries/sectors and dissemination of best practices among companies and employees.
- Updating of the current guidelines/policies or development of additional guidelines/policies for occupational health and safety.
- Development of a European platform to foster the transnational cooperation and the sharing of research findings among European OSH research institutions.

⁸ EU-OSHA, Annual Report, 2007.

⁹ EuroFound, The Fourth European Working Conditions survey, 2007.

¹⁰ EU-OSHA, European Survey of Enterprises on New and Emerging Risks, 2010.

¹¹ EU-OSHA, Annual Report, 2007.

¹² To deepen the relation between organisational health and performance: EuroFound, Quality of work and employment in Europe Issues and challenges, Foundation Paper n. 1 February, 2002; EuroFound, Links between quality of work and performance Survey, 2009; EuroFound, Management practices and sustainable organisational performance, 2009.

¹³ EuroFound - Links between quality of work and performance Survey 2009.

¹⁴ As outlined by EuroFound an holistic approach to mental health promotion include the promotion of wellbeing because «health cannot – and should not – be viewed as merely the absence of illness or disease; but rather as a `state of positive physical, mental and social wellbeing». and enhancing functioning. EuroFound, Mental health promotion in the workplace – EuroFound, A good practice report, 2011.

¹⁵ In case there is no fixed pattern for the location, time, manner and amount of work that has to be carried out. This can impact on workers’ psychosocial health.



Multifactorial genesis of work-related musculoskeletal disorders (MSDs)

Summary

Work-related musculoskeletal disorders (MSDs) are of immense importance in the occupational sphere. In Europe, work-related MSDs are leading the statistics for sickness absence and result in high direct costs (costs of treatment) and indirect costs (loss of production).

Usually the causes of work-related MSDs are multifactorial and there are numerous work-related risk factors for the various types of MSDs. Workers are generally exposed to several factors at the same time and the interaction of these effects are often unknown.

Research in this area should contribute to a better understanding of work-related MSDs that allows for an evidence-based development of appropriate and more effective prevention approaches and risk assessments.

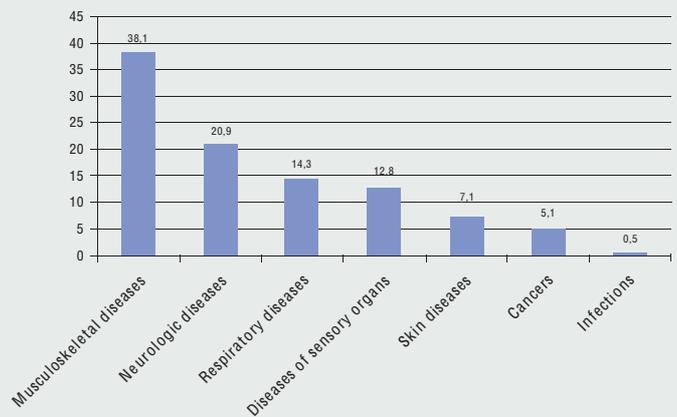


1. Description of the priority, what is at stake? Why is it a priority?

According to the European Foundation for the Improvement of Living and Working Conditions, more than one third of European workers suffer from work-related musculoskeletal disorders (MSDs)¹⁶. MSDs are the cause of a high percentage of sickness absence, rehabilitation cases and early retirements. They are among the most significant diseases in terms of their costs to industry, e.g. direct costs for treatment and production losses. Work-related MSDs represent the main occupational disease category affecting European workers (see Figure 4). These disorders are widespread in all occupational sectors but agriculture and construction are the two most affected sectors.

From the Fifth European Working Conditions Survey (EWCS) in 2010 it can be concluded that European workers remain as exposed to physical and mechanical factors – e.g. manual materials handling, working in awkward postures, repetitive work and vibrations – as they did 20 years ago. One third of the workers (33%) reported that they carry heavy loads at least a quarter of their working time, while almost one in four (23%) are exposed to vibrations¹⁷. Nearly half of all workers (46%) work in awkward postures for at least a quarter of the time, and repetitive hand or arm movements are a feature of work for more Europeans today than they were 10 years ago¹⁷.

Figure 4: Proportion of occupational diseases in 12 EU member states according to the European Occupational Diseases Statistics obligatory list 2005



Source: OSH in figures: Work-related musculoskeletal disorders in the EU – Facts and figures, European Agency for Safety and Health at Work, 2010

Apart from physical and mechanical risk factor groups, organisational and psychosocial factors, as well as individual and personal factors may contribute to the genesis of MSDs.

The demographic shift and the pending rise in the retirement age constitute further challenges for European countries. Prevention of occupational MSDs is increasingly being conducted against the backdrop of a progressively ageing workforce.

Usually the causes of work-related MSDs are multifactorial and there are numerous work-related risk factors for the various types of MSDs. Workers are generally exposed to several factors at the same time and interaction of these effects may aggravate adverse effects. While some health risks associated with single exposures are well understood, there is a lack of knowledge of health risks due to the combination of different exposures. For workplaces that are similar at the European level, a European effort is therefore reasonable. More intervention studies that prove effects in decreasing work-related MSDs at a high evidence level are needed. It is also necessary to understand the genesis of MSDs better, including the mechanisms behind this. This should lead to better models for MSD prevention.



Improved prevention of MSDs in the workplace by the avoidance or reduction of musculoskeletal workloads will translate into a considerable health benefit for employees and at the same time a considerable economic benefit for businesses. The resulting contribution to enhancing fitness for work and employment is in the interests of the economy and society as a whole.

2. Research needs at European level

In order to make substantial achievements in the further development of effective MSD preventive measures, close cooperation between OSH research organisations in Europe will be required. The following research at EU level is needed:

2.1 Literature reviews

Literature reviews are essential on:

- mixed exposures/risk factors together with MSD incidences and their occurrence in various fields of employment/occupational groups in Europe.
- physiological/psychological/biomechanical models associated with the genesis of work-related MSDs.
- risk assessment tools.

In this way, a common starting point can be defined and knowledge gaps can be identified.

2.2 Genesis of work-related MSDs

Research on the genesis of work-related MSDs is necessary, e.g.

- interaction of combined physical risk factors and physical and psychosocial risk factors.
- links between MSDs and individual physical capacity.
- conduction of epidemiological studies, e. g. analysis of specific work disability patterns.

2.3 Internationally concerted developments

There is a need for internationally concerted developments of:

- task exposure databases and data exchange within OSH research organisations.
- risk assessment tools and prevention strategies with regard to mixed exposures.
- workplaces that accommodate elderly employees and employees with MSD.

2.4 High-quality MSD intervention studies

- International research should conduct high-quality MSD intervention studies, e.g. RTC-studies (randomised controlled trials), on primary, secondary and tertiary MSD prevention levels, including technical interventions, organisational interventions, person-orientated interventions, participatory approaches and cost-effectiveness interventions.



Deliverables

- Risk assessment tools and databases for different user groups (experts to practitioners in SMEs).
- Assessed best practice tools, recommendations, guidelines for ergonomic work design, including psychosocial aspects to prevent MSDs.
- Evaluated return to work programs for workers affected by MSDs.

¹⁶ Eurofound – European Foundation for the Improvement of Living and Working Conditions, European Working Conditions Survey (EWCS) 4., 2007. Available at: <http://www.eurofound.europa.eu/pubdocs/2006/98/en/2/ef0698en.pdf>

¹⁷ Eurofound – European Foundation for the Improvement of Living and Working, Conditions European Working Conditions Survey (EWCS) 5., 2010. Available at: <http://www.eurofound.europa.eu/surveys/ewcs/2010/index.htm>



New technologies as a field of action for OSH

Summary

The emergence and rapid development of new technologies are changing the working conditions and working environment. New technologies have a lot of potential to deal with existing and well-known OSH questions such as e.g. the design of the man-machine interface, the real time monitoring of work environment parameters. Simultaneously, new technologies stimulate research in a number of new domains of scientific development such as the development and application of smart and functional materials. Challenge is to reduce possible OSH risks at an early stage by usage of these new technologies. Moreover the development of new technologies may lead to the emergence of new hazards and risks and overrule known solutions. Research should therefore support the development of a common European position with regard to new technologies and OSH in order to anticipate the possibilities and consequences of technology implementation.

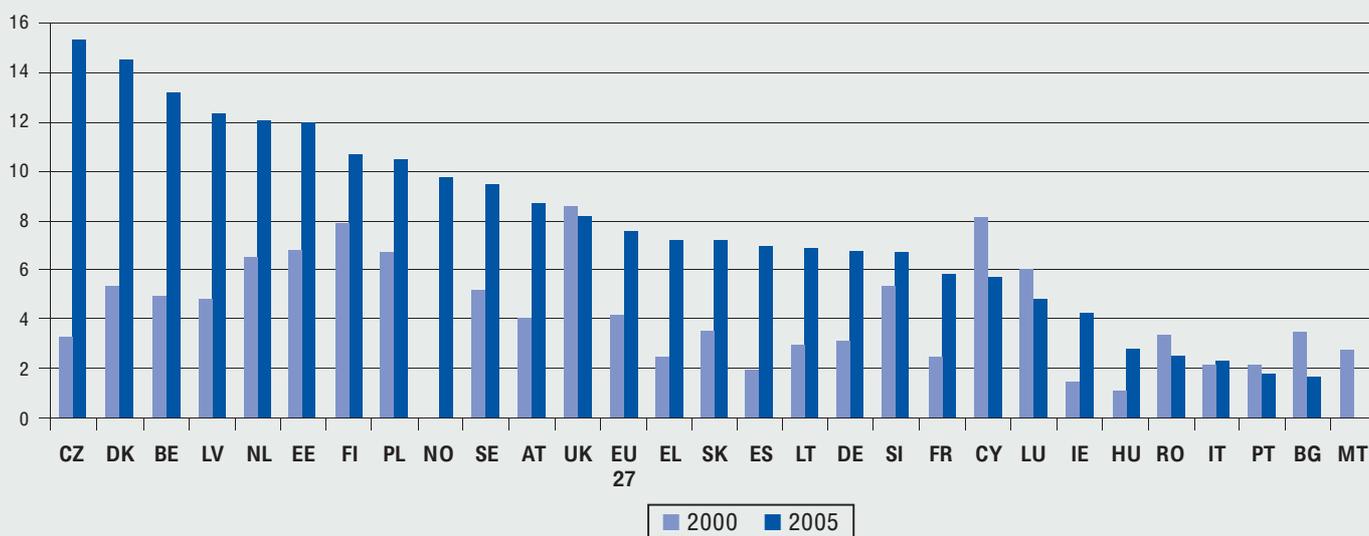


1. Description of the priority. What is at stake? Why is it a priority?

New technologies and concepts are currently changing working conditions (work equipment, environment, man-machine-interaction), based on and triggered by technological progress like miniaturisation, wireless information transfer and high-performance mobile power sources (e.g. measurement sensors and displays in personal protective equipment). This development is illustrated by a study of Eurofound. Based on results of the EWSC in 2010¹⁸, the use of telework (including new ICT applications and other forms of electronic collaborative working) is steadily growing in the European countries and leads to new possibilities but also to a differentiation in OSH risks.

These technologies, their impact on every day life and on the working environment are addressed by research programmes like "Information and Communications Technology" (ICT), "Ambient Intelligence" (AmI), "Ambient Assisted Living" (AAL) or "pervasive computing". All these programmes are based on a technological vision of ubiquitous computing primarily described by Mark Weiser¹⁹. It embraces activities of research and development using networks of sensors, processors and agents to enhance private and working environments by automated, unobtrusive and adaptive features, and is helping users to reach their goals. In summary, current research on new technologies focuses on the development of the technical components (e.g. sensors, actuators) and questions regarding safety and health that have not been addressed up to now.

Figure 5. Development of telework in the EU27 and Norway, 2000 and 2005 (%).



Source: Eurofound, *Telework in the European Union, 2010*



New technologies leave a lot of scope for OSH-relevant questions, e.g. the design of the man-machine interface. This can range from simple support for the user through to an almost complete automation of functions or practical steps. Due to a considerable lack of knowledge regarding the impact assessment²⁰ many countries are currently engaged with research questions like these, focusing on their use as so-called adaptive work assistance systems (WAS, e.g. “smart” products, furniture and environment, equipped with e.g. RFID-Chips). In systematically dealing with the topic as a whole, two different aspects should be considered.

1.1 Possibilities of new technologies for the improvement of OSH

On the one hand, new technologies offer opportunities for new and advanced solutions regarding existing and well-known issues in OSH, e.g. real time monitoring of work environment parameters (exposure to noise, chemical substances, temperature etc.). Moreover, recent scientific developments in the domain of materials engineering offer many new opportunities for the application of smart and functional materials in the areas which have been perceived so far as dominated by traditional technologies – for example in textile industry (see ISO Technical Report No. ISO/PDTR 00248435²¹). Here it is important to stimulate the application of new technologies in the OSH area, but at the same time to anticipate these opportunities for particular technologies at an early stage of development, to steer their further implementation towards OSH.

1.2 New hazards and risks of new technologies

On the other hand, the implementation of new technologies changes familiar work environments and may thereby in turn lead to the emergence of new hazards and risks and may invalidate known solutions.²²

To minimise the negative consequences of new technologies on OSH, an early and comprehensive impact assessment is necessary. Once the respective risks of new technical solutions are identified, their development can be modified accordingly to avoid a negative impact on OSH in practice.

2. Research needs at European level

Regarding these two aspects of the challenge, the following research and development topics are needed:

- Adaptation of protective efficiency and the functionality of personal protective equipment to new hazards and changes in the working environment. Intelligent personal protection devices.
- Designing safe workplaces by using virtual reality applications
- Implementation and usability of adaptive wearable IT in work environments.
- Improvement of the quality of air and the acoustic comfort of rooms in the working and life environment by using innovative technical solutions
- Analysis and improvement of OSH for mobile workplaces
- Cognitive aspects of new technology usage
- Technology-mediated influence of user’s attitudes and behaviour
- Impact assessment of WAS-controlled work-environments

Research on new technologies/WAS directly follows the activities of Sixth and Seventh EU Framework Programme, not longer focusing on basic technologies but on practical application.

The increasing development and implementation of adaptive and unobtrusive technologies at international level as well as the significant engagement of leading OSH-related research institutes in this topic further emphasise the need to deal with the topic “New technology and OSH” at European level.

Finally, the harmonisation of different international research allows synergy effects and a stronger influence on current technology developments.



Deliverables

- Identification of OSH-relevant issues and opportunities of new technologies and a technology impact assessment, in order to anticipate the consequences of technology implementation at an early stage, based on scientific findings.
- Development of a common European position regarding new technologies and OSH, allowing a joint, goal-oriented impact on European technology research and development. This challenge involves a special opportunity to influence these new technologies by preventive actions during the design of the technology before widespread introduction into the world of work.
- Practical guidelines should be derived in a second step to support the implementation of new technologies/WAS in European enterprises. Scientific findings in this area should also function as a starting point for the further acquisition of external funding.

¹⁸ European Foundation for the Improvement of Living and Working Conditions. *Telework in the European Union, 2010*. Available at: <http://www.eurofound.europa.eu/eiro/studies/tn0910050s/tn0910050s.htm>

¹⁹ Weiser, M., *The Computer for the Twenty-First Century*. *Scientific American*, 265(3), 94-104, 1991.

²⁰ Nakashima, H., Aghaja H. & Augusto J.C. (Eds.), *Handbook of ambient intelligence and smart environments*, New York: Springer, 2009.

²¹ ISO Technical Report No. ISO/PDTR 00248435: *Textiles and textile products – Smart textiles – Definitions, application and standardization needs*, International Organisation of Standardisation.

²² Riva, Giuseppe; Vatalaro, Francesco; Davide, Fabrizio; Alcañiz, Mariano: *Ambient Intelligence. The Evolution of Technology, Communication and Cognition Towards the Future of Human-Computer Interaction*. Amsterdam: IOS Press, 2005.



Occupational risks related to engineered nanomaterials (ENMs)

Summary

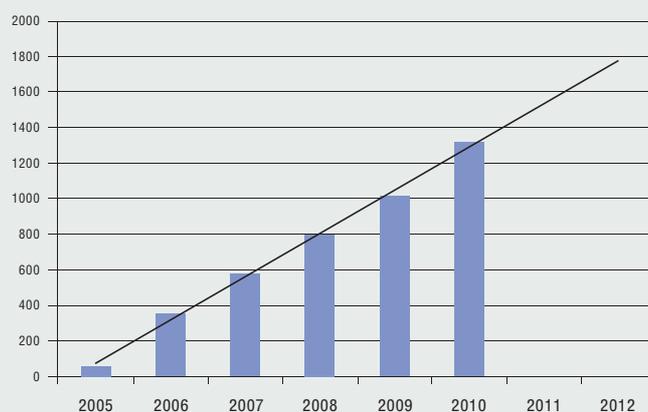
Engineered nanomaterials present new challenges to understanding, predicting and managing health risks to workers. As nanotechnology applications and uses expand, safety of these emerging materials is identified as one of the research priorities. It has been shown that the physical characteristics of nanoparticles can influence their effects in biological systems, but results from available studies are insufficient to elucidate the potential health concerns. Research efforts have to address knowledge gaps in potential toxicity of nanomaterials, occupational exposure measurement and effective risk management procedures. In this area, European level collaboration is an obvious choice due to the complexity of the issues.



1. Description of the priority. What is at stake? Why is it a priority?

Since the beginning of the 21st century, nanotechnologies have developed enormously, judging simply by the number of products now on the market and the funds dedicated to research and development (R&D) in this area²³. The direct employment generation impact of nanotechnologies is estimated to be around 2.3 million jobs worldwide by 2015, of which 0.9 million in USA and 0.4 in Europe. Nanotechnology-based applications will substantially improve the performance of many products through the unique properties of ENMs²⁴.

Figure 6: Progression of products listed in the Consumer Products Inventory.



Source: <http://www.nanotechproject.org/inventories/consumer>

At the same time however, the nanoscale size of ENMs generates concerns with regard to the potential health and safety risks. The earliest and most extensive exposure to nanomaterials is most likely to occur in the workplace. Therefore the health and safety of workers exposed to ENMs and products containing ENMs are a key issue. Significant research has been performed to assess occupational exposure and the impact of nanomaterials on health and safety. However, occupational risks associated with manufacturing and the use of ENMs are not yet clearly understood and there is still a great considerable lack of knowledge²⁵.

Additional research is needed to address the gaps. The main goals of this research are to assure safe handling of ENMs while attaining the societal benefits of nanotechnology. Regarding the complexity of knowledge gaps, there is a clear need to join forces and to coordinate ongoing efforts for research in this domain at European level. The results of the research will then be translated in various forms which are understandable to stakeholders: workers, enterprises, regulators and the society at large²⁶.



2. Research needs at European level

The potential risks of ENMs must be managed through identification of hazards, measurement and control of exposure. The research needs include the following:

2.1 Research in toxicology to understand the specific biological properties of ENMs and identify their potential adverse effects

Specific goals in this area should focus on exploring the material characteristics that contribute to biological effects (e.g. size, shape, surface area, surface activity, solubility, trace components and surface coating) and investigating effects and mechanisms of effects of different types of ENM on biological systems (in vivo, in vitro)²⁷. The ultimate aim of the research is to reduce the need for testing and provide a foundation for a safety classification of ENMs based on their physical and chemical characteristics.

Another key issue is the adaptation of the existing methods of testing for toxicity of nanomaterials and the development of new screening methods. These methods should be suitable for predicting the potential effects: short and long-term pulmonary and systemic effects of inhalation exposure to nanomaterials, genotoxicity, reproductive toxicity and immunological responses. They should be relevant in terms of determination of dose-response relationships between deposited dose and the adverse effects. New intelligent testing strategies adapted to a high number of ENMs are required to be applied for future testing.

There is also a need to address the criteria for a proper description of the dose in relation with the adverse effects. Overall, increasing the knowledge with respect to hazards of ENMs will contribute to the setting of occupational limit values.

2.2 Research in ENM characterisation and metrology

The overarching goal in this research area is the development of harmonised reliable methods to assess occupational exposure to ENMs and to produce preliminary work for standardisation. The predominant route of occupational exposure is inhalation.

There is a need to test the effectiveness of instruments and to develop improved measurement tools (affordable and portable devices which allow personal and on-line detection of ENMs and their distinction from nanoparticles originating from sources other than industrial processes). In addition, from a workplace moni-

toring perspective there is a need to define which significant characteristics of ENMs should be measured and how. Common measurement strategies should be defined and field-tested.²⁸

The research needs also to include an understanding of the potential release and the fate of ENMs after emission. One promising approach is to benchmark (and if possible harmonise) dustiness testing. Exposure should be assessed for all stages of the ENM life cycle. However current knowledge is mainly from primary production with very limited data for applications. Research about release of nanomaterials during the use of ENMs in liquids or embedded in matrices is needed.

Exposure modelling is used in regulatory risk assessment. Extensive work is still required for validation of existing exposure models when applied for ENM and for new model approaches to be developed.

2.3 Research on exposure control and risk management

There is a need to conduct quantitative evaluation of efficiency of ventilation and capture devices at workstations producing or handling ENMs.

The following issues should be investigated: containment efficiency of ventilation devices, robustness of the containment with respect with to disturbances, influences of the ENM source and surface contamination.

Another key research area relates to the effectiveness of respiratory protective devices. Face seal leakage and protection factors against nanoparticles have to be studied in laboratory and in the workplace.

The result of the research will be translated into risk management guidance. Risk management has to be integrated in the early stages of the development of new substances and technologies. In this context, research is needed to validate appropriate control banding techniques.



Deliverables

- Tools for performing regulatory risk assessment, including: adequate methods for nanomaterial toxicological endpoint testing, intelligent testing strategies to predict the toxicological effects of new nanomaterials and reduce the need of testing; occupational scenarios for workers exposed covering the life cycle of nanomaterials; risk characterisation guidance. Reducing the level of uncertainty about the risks should enable the EU to regulate nanomaterials.
- Instrumentation and strategies for measuring occupational exposure to nanoparticles at the workplace.
- Generation of high quality, systematic exposure data enabling modelling exposure.
- Guidance and standards that enable companies, regulators and other stakeholders to responsibly deal with uncertain risks during the production and use of ENMs.
- Methodologies for risk assessment and management for workers exposed to ENMs.
- Innovative safe-by-design approach for the scientific community and industry.

²³ Woodrow Wilson International center for Scholars, *The project on Emerging Nanotechnologies*, <http://www.nanotechproject.org>

²⁴ MC Roco, *The long view of nanotechnology development: the National nanotechnology Initiative at 10 years*, *J. Nanopart. Res.*, 2011, 13:427-445.

²⁵ S. Iavicoli, F. Boccuni, *Challenges and perspectives of occupational health and safety research in nanotechnologies in Europe*. *Industrial Health* 2010,48(1):1-2.

²⁶ S. Binet, E. Drais, S. Chazelet, A. Radauceanu, M. Reynier, M. Ricaud, O. Witschger. *Risques liés aux nanoparticules et nanomatériaux, compte rendu de la conférence Nano2011 et perspectives*.

²⁷ K. Savolainen, H. Alenius, H. Norppa, L. Pylkkänen, G. Kasper, *Risk assessment of engineered and nanotechnologies – a review*; *Toxicology*, 2010, 269, 92-104.

²⁸ G. Ramachandran, M. Ostraat, D.E. Evans, M.M. Methner, P. O'Shaughnessy, J. D'Arcy, C.L. Geraci, E. Stevenson, A. Maynard, K. Rickabaugh. *A strategy for assessing workplace exposures to nanomaterials*, *Journal of Occupational and Environmental Hygiene*, 2011, 8:11, 673-685.



Safety culture to prevent occupational accidents

Summary

Accidents at work continue to result in high rates of fatal and serious injuries, hospitalisation, work absence, disability and premature retirement. An estimated 6.9 million people in the EU27 had one or more accidents at work in 2007, 5,580 of which were fatal. There is therefore a need for new evidence-based knowledge about the most effective initiatives for preventing accidents at work, particularly among vulnerable persons such as young workers, migrant workers and in small and medium sized enterprises. Heightening of 'safety culture' in European enterprises and organisations can have a positive impact on occupational safety and health awareness, and on how they are perceived and dealt with. Diagnostic tools such as the Safety Climate Tool and the Nordic Occupational Safety Climate Questionnaire are an important contribution to promoting a strong safety culture in enterprises. In addition, adoption of a 'Zero accident vision' has shown to be an ethically sustainable commitment strategy based on the idea that all accidents at work are preventable. Research in these areas should contribute to a better understanding of more tangible conditions that contribute to establishing a positive safety culture in enterprises, to develop comprehensive instruments for the assessment of safety culture and through the expansion of a 'Zero accident vision' in the European Member States.

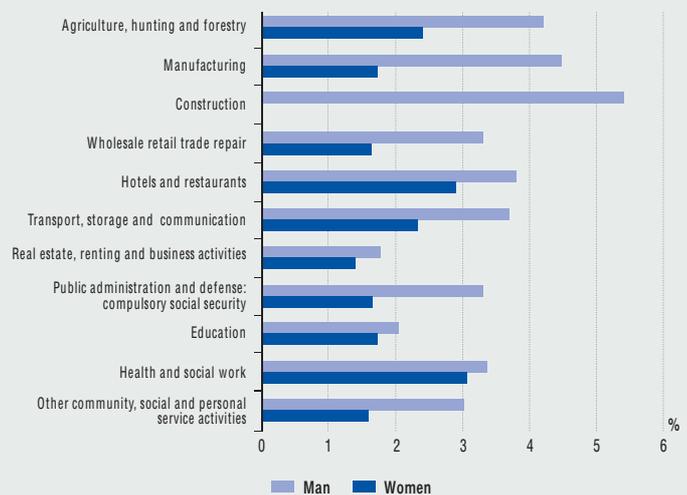


1. Description of the priority. What is at stake? Why is it a priority?

In spite of technological and organisational improvements, accidents at work continue to result in high rates of fatal and serious injuries, hospitalisation, work absence, disability and premature retirement. An estimated 6.9 million people in the EU27 had one or more accidents at work in 2007 (see figure 7), 5,580 of which were fatal²⁹. There is therefore a need for new evidence-based knowledge on the most effective initiatives for preventing accidents at work, particularly among vulnerable persons such as young workers, migrant workers and in small and medium sized enterprises. This will contribute towards fulfilling the EU action plans aimed at a 25 % reduction in the number of accidents at work by 2020, and thereby support the community strategy 2007-2012 on improving quality and productivity at work³⁰.

Figure 7. Workers in the EU27 reporting one or more accidental injuries at work or in the course of work in the past 12 months in their main job in different sectors (%).

(sample size below publication limit for 'fishing', 'mining and quarrying', 'electricity gas and water supply', 'construction' (women), 'financial mediation', 'private households with employed persons' and 'extra-territorial organisations and bodies').



Source: Eurostat, *Health and safety at work in Europe (1999–2007) – A Statistical Portrait*. Luxembourg: Publications Office of the European Union, 2010.

European statistics show that small and medium enterprises account for 82% of all occupational injuries and 90% of all fatal accidents, and that rates for accidents at work have been increasing for young workers (under the age of 25). Workforce migration is increasing in the EU27, and particularly female and young migrant employees work in sectors and occupations with unsatisfactory occupational safe and healthy (OSH) conditions³¹.

EU enterprises have come a long way in the 20th century with technological and organisational approaches to reduce accidents at work and to promote corporate social responsibility. Formal safety policies and procedures, however, continue to be challenged when being put into practice. The current economic crisis (following 2008) has exacerbated this problem resulting in reduced OSH investments in favour of productivity and financial goals.



Workplace safety culture is generally recognised as being an important concept in the prevention of accidents at work and ill-health, and can be seen as a concept for exploring how formal and informal organisational aspects influence OSH in a positive or negative way. Heightening of 'safety culture' in European enterprises and organisations can have a positive impact on occupational safety and health awareness, and on how they are perceived and dealt with.

Finally, a 'Zero accident vision' has shown to be an ethically sustainable commitment strategy based on the idea that all accidents at work are preventable. There is a need to increase European added value through the expansion of a 'Zero accident vision'. It is estimated that if all ILO Member States would use the best accident prevention strategies and practices that are already easily available, some 300,000 deaths and 200 million accidents could be prevented annually³².

2. Research needs at European level

At the European level there is a need:

- For research that provides knowledge regarding the more tangible conditions that contribute to establishing a positive safety culture in enterprises of any size. This includes looking at conditions such as regulations, social responsibility, leadership commitment, communication and safety climate.
- To study which factors influence why certain groups of workers have an increased accident risk (aetiology), e.g. young workers, older workers, migrant workers, newly appointed staff, and also groups in high injury risk industries, such as the building industry, manufacturing industry and transport.
- For research on how enterprises prioritise occupational safety and health in relation to other competing tasks and measures (e.g. safety versus productivity and quality), and how this can be addressed.
- To develop comprehensive instruments for the assessment of an enterprise's safety climate³³, as well as other occupational and health factors, in order to promote a strong safety culture within enterprises and to gain a better picture of the prevention climate in European Member States and enterprises³⁴.

- To investigate the influence of safety culture on sustaining a high and long-range level of safety in European enterprises, including work carried out under flexible and dynamic conditions (resilience).

- To conduct a review of which company-oriented approaches are most effective in improving safety and safety culture and preventing accidents at work, in order to develop the most effective approaches to accident prevention.

- To gather evidence of the effectiveness of methods to promote a 'zero accident vision' and workplace safety culture (at enterprise level), and to identify key success factors for the development of a zero accident culture.



Deliverables

- More systematic knowledge about the relationship between risks and effects of various accident prevention-methods to effectively target and select the most effective preventive measures.
- Development of diagnostic tools for the long term effects and sustainability of safety interventions (resilience), and to further develop diagnostic tools related to safety culture, including approaches to improve safety culture at European workplaces, e.g. NOSACQ-50³⁵ and the HSL Safety Climate Tool³⁶.
- Elaboration of cost effective preventive strategies and tools adapted to the individual needs of enterprises, thereby making implementation of occupational safety and health measures more feasible for enterprises, particularly for small and medium sized enterprises.

²⁹ Eurostat, *Health and safety at work in Europe (1999–2007) – A Statistical Portrait*, Luxembourg: Publications Office of the European Union, 2010.

³⁰ Com (2007) 62 final. *Improving quality and productivity at work: Community strategy 2007-2012 on health and safety at work*

³¹ Eurostat, *Health and safety at work in Europe (1999–2007) – A Statistical Portrait*, Luxembourg: Publications Office of the European Union, 2010.

³² ILO, *Safety in numbers – Pointers for global safety culture at work*. International Labour Organization, Geneva, 2003.

³³ An example of such an instrument is the Nordic Occupational Safety Climate Questionnaire (NOSACQ-50), which can easily be adapted to European Member States. Additionally, the Health and Safety Laboratory's Safety Climate Tool enables enterprises to gain insight into their safety culture.

³⁴ European Agency for Safety and Health at Work. *Occupational Safety and Health culture assessment - A review of main approaches and selected tools*. Luxembourg: Publications Office of the European Union, 2011.

³⁵ Kines, Lappalainen, Mikkelsen, Pousette, Tharaldsen, Tómasson, Törner, *Nordic Safety Climate Questionnaire (NOSACQ-50): a new tool for measuring occupational safety climate*. *International Journal of Industrial Ergonomics*, 41, 634-646, 2011. (www.nrcwe.dk/NOSACQ)

³⁶ Sugden et al., *The Development of HSL's Safety Climate Tool*. *Contemporary Ergonomics*, 245-252, London: Taylor & Francis. ISBN 978-0-415-80433-2, 2009. For information on how organisations are using the Safety Climate Tool, the benefits they are gaining, and a video demonstration of the tool, see www.hsl.gov.uk/health-and-safety-products/safety-climate-tool.aspx

Annex 1: Overview of research priorities sent by the PEROSH institutes.

1. Sustainable employability to prolong working life

- Sustainable employability to prolong working life
- Prevention in a context of an ageing population
- Work participation and sustainable careers
- Workplace Health Promotion (WHP)
- Innovative methods of training and adaptation of workplaces to increase the employability of young, elderly and disabled people.
- Enhancing employability in the changing world of work

2. Disability prevention and reintegration

- Disability Prevention Centre
- Implementation of occupational safety and health measures to protect vulnerable workers' health
- Return-to-work and reintegration

3. Psychosocial well-being in a sustainable working organisation

- Psychological well-being in a sustainable working organisation
- Monitoring of the effectiveness of methodologies for work-related stress risk assessment and management: development and dissemination of good practices within the program of stress management interventions.
- Influence of individual and work-related resources on mental health
- Psychosocial risks: the role of a new organisation
- Social capital, health, and well-being at work
- Management of psychosocial risks: regulatory framework and actions at company level
- Psychosocial risk assessment and intervention approaches
- Psychosocial working environment
- New way of working: implications for new OSH risk and benefits for knowledge workers
- Psychosocial and organisational working environment, including working hours thematic (shift work, long working hours, night work)

4. Multifactorial genesis of work-related musculoskeletal disorders (MSDs)

- Exposure and prevention of multi-factorial risks
- Predictive indicators for work-disability due to back-pain and psychological disorders
- Musculoskeletal disorders (MSD)
- Multifactorial genesis of work-related illnesses (with special emphasis on MSD)
- The factors of musculo-skeleton diseases (MSDs)

5. New technologies as a field of action for OSH

- Ambient Intelligence (Aml) – Opportunities and risks of new Information & Communication Technologies in the working environment
- Adjustment of protective efficiency and functionality of personal protective equipment to new hazards and changes in the working environment
- Improvement of the acoustic comfort of rooms in the working and life environment by using innovative technical solutions
- Analysis and improvement of OSH for mobile workplaces
- Prevention through design using virtual reality applications

6. Impact of nano-materials on occupational health and safety

- The safety of engineered nanomaterials (ENM) and nanotechnologies
- Engineered nanomaterials at the workplace
- Occupational risks in connection with the handling and producing of nanomaterials or nanomaterial containing products
- New substances and nano materials

7. Safety culture to prevent occupational accidents

- Occupational accidents, safety and safety culture
- Health and Safety of the workers employed in manufacturing sector's SMEs: focus on economic impact and OSH management's costs optimisation
- Prevention culture

8. Specific priorities

- Promoting brain fitness and cognitive performance at work
- Consequences of globalisation for risks in supply chains and risk governance

Chemical, biological and physical risks

- Bioaerosols – Correlation between workplace exposure and adverse health effects
- Improvement in analyses and assessment of complex bioaerosols in working environments
- Occupational hazards in production, processing and use of biofuels
- Chemical and biological working environment, including nano- and biotechnology
- Surveillance and prevention of asbestos related diseases and occupational cancer
- Prevention of Carcinogenic, Mutagenic or Reprotoxic (CMR) risks
- Dangerous substances replacement
- Physical agents – disregarded exposures, combination effects and health impairment
- Environmental and electromagnetic compatibility aspects of the intermediate frequency radiation related to the Power Line Communication (PLC) application in smart electricity grids - interaction with electronic devices and living environment including interaction combined with other chemical and physical factors

Exposure control

- Control Banding: Simple tools for risk assessment and management to strengthen occupational safety and health in SME
- Qualitative and semi-quantitative methodologies for chemicals exposure assessment

Monitoring

- Implementation of a branch-oriented risk-observatory with direct company feedback
- Work environment surveillance
- Working conditions trends and changes

Specific Psychosocial aspects

- Workplace violence and harassment/bullying
- Occupational health issues in general, including social inequities and life course perspectives
- Safeguarding workers' health and wellbeing in organisations undergoing restructuring

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List of abbreviations

CMR	carcinogenic, mutagenic or reprotoxic
ENM	engineered nanomaterials
ESENER	European survey of enterprises on new and emerging risks
EU-OSHA	European Agency for Safety and Health at Work
Eurofound	European Foundation for the Improvement of Living and Working Conditions
EWCS	European Working Conditions Survey
HMD	head mounted displays
HRM	human resources management
ICT	information and communication technology
ILO	International Labour Organisation
MSD	musculoskeletal disorders
NOSACQ	Nordic Safety Climate Questionnaire
OECD	Organisation for Economic Co-operation and Development
OSH	occupational safety and health
RFID	radiofrequency identification
RTC	randomised controlled trials
RTW	return-to-work
SME	small and medium sized enterprises
WAS	work assistance systems
WHP	workplace health promotion



PEROSH
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