Work today and in the future

Part three: Work-related fatalities in the Nordic countries
Arbetsrelaterad dödlighet i Norden

Arbejdstilsynet

MINISTRY OF SOCIAL AFFAIRS AND HEALTH

VINNUEFTIRLITIÐ

Norwegian Labour Inspection Authority

SWEDISH WORK ENVIRONMENT AUTHORITY

Table of content

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Project team
Jukka Takala, past President, ICOH, Adj.Prof. Tampere University, Finland
Päivi Hämäläinen, Ministerial Adviser, Ministry of Social Affairs and Health, Finland
Riitta Sauni, Professor, Tampere University, Finland
Wiking Husberg, International OSH Consultant, Finland
Subas Neupane, Adj. Prof., Tampere University, Finland
Yogindra Samant, Chief Medical Officer, Norwegian Labour Inspection Authority

Contributors
Bengt Järvholm, Senior Professor, Umeå University, Sweden
Riku Rajamäki, Senior Specialist, Ministry of Social Affairs and Health, Finland
Hans Magne Gravseth, Head Physician, Department of Occupational Health Surveillance, National Institute of Occupational Health, Norway

1. Abstract

Föreliggande rapport undersöker uppskattningen av arbetsrelaterade dödsfall som är hänförliga till olika arbetsmiljöexponeringar. Dessa sjukdomar uppstår ofta med tiden, förvärras av långvarig exponering för farliga fysiska, kemiska, biologiska och psykologiska miljöer och fortsätter att kräva liv i en bekymmersam takt jämfört med dödsfall som tillskrivs olyckor. Arbetsrelaterad dödlighet skulle kunna minskas genom riktad tillsyn och vägledande åtgärder baserade på solid kunskap.

Rapportens syfte är att genom de slutsatser som kan göras på tillgängliga data ta fram praktiska rekommendationer till de nordiska arbetsmiljömyndigheterna, särskilt om vilka direkta åtgärder som kan vara effektiva.

Expertnätverket Nordic Future of Work är ett litet nätverk av tvärvetenskapliga yrkesverksamma från både arbetsmiljöinspektionen och ministerierna. Gruppen startade sitt arbete redan 2016 och har sedan dess tagit fram olika rapporter som tar upp både specifika utmaningar, men som också tittar på den större bilden av trender som påverkar arbetsmarknaden. Spridandet av den kunskap som sammanställts har framförallt skett genom deltagande på ett flertal internationella konferenser och samarbeten med andra organisationer. I framtagandet av denna rapport har samarbete särskilt skett med FN:s organ International Labour Organisations (ILO) globala koalition Task Groups on Data, Future of Work och Vision Zero.

Detta är den tredje rapporten i serien som publiceras baserat på initiativ från detta nätverk.

2. Preface

Work-related fatalities remain a pressing challenge across the Nordic countries, despite advancements in controlling and preventing workplace injuries. While injury rates have seen a steady decline due to improved safety technologies, better surveillance and trauma management, work-related diseases – including fatalities linked to occupational exposures – present a different and more complex set of challenges. These diseases often emerge over time, exacerbated by long-term exposure to hazardous physical, chemical, biological and psychological environments and continue to claim lives at an alarming rate compared to fatalities attributed to accidents.

The Nordic Future of Work group has been actively exploring solutions to address the evolving landscape of occupational safety and health (OSH) in response to concerns such as these that concern the ever-evolving landscape of work now and in the future. This is the third report in the series that is being published based on inputs and initiative from the Future of Work group.

The foundation for this report was laid at the ICOH (International Commission on Occupational Health) meeting in 2022, where global estimates presented by the ILO and WHO highlighted the significant toll of work-related fatalities worldwide. The discussion sparked among Nordic representatives led to a collective decision to conduct a similar study, focusing specifically on the Nordic region, to understand the scope of these issues closer to home.

The purpose of this report is to assess if current preventive measures in each of the Nordic countries, particularly those implemented by Labour Inspectorates are targeted toward the most important occupational safety and health problems. By examining whether these efforts address the most critical OSH risks, this report aims to provide insight into where resources should be prioritized to make the greatest impact.

This study is commissioned by the Nordic Future of Work group under the direction of the Director Generals of the Nordic Labour Inspectorates, and it seeks to inform future OSH strategies and inspire course corrections where necessary.

The findings presented are expected to initiate a broader conversation about recalibrating OSH policies and resources to address the most pressing work-related health challenges. This report stands as a testament to the shared commitment of the Nordic countries to protect the health and well-being of our workforce and to advance understanding of the critical risks that shape the future of work. We hope the findings of this report inform labour inspections and OSH practice and policy in the Nordic countries, Europe and globally.

Sincerely,

The Nordic Future of Work and OSH group

Magnus Falk, Wiking Husberg, Helena Kalliolinna, Sigurdur Einarsson, Annemarie Knudsen, Cecilia Mobach and Yogindra Samant

3. Executive summary

Labour Inspection in Transition:

The Nordic region has seen significant reductions in occupational injuries and fatalities due to effective safety technologies, enhanced surveillance and targeted labour inspections focused on accidents. However, the leading causes of work-related deaths are no longer primarily from injuries caused by accidents at work but from long-latency diseases such as cancer, cardiovascular issues, and work-related stress. While injury prevention caused by accidents at work remains vital, there is a compelling need to gradually adjust the labour inspection resources towards addressing these chronic work-related diseases and the subsequent fatalities.

Rationale for Change

Work-Related Diseases Dominance:

In 2019 only 1% of fatalities at work were attributable to workplace injuries caused by accidents. The majority stemmed from chemical, physical, and biological exposures causing cancers and circulatory diseases, including cardiovascular conditions exacerbated by prolonged work stress.

Latency and Complexity:

Unlike accidents at work, the effects of hazardous exposures often manifest years later, complicating prevention and mitigation. Effective intervention requires sustained monitoring and strategic long-term measures.

Economic and Social Costs:

Work-related diseases carry significant socioeconomic costs, estimated to consume up to 4% of GDP. For instance, in Finland, the annual cost due to mental health-related disability pensions and sickness absences highlights the heavy toll of psychosocial risks.

Strategic Prioritization of Resources

Enhanced Focus on Disease Prevention:

Allocate greater inspection resources to monitor chemical and psychosocial exposures, prevent work-related cancers, and mitigate cardiovascular risks. Incorporating detailed exposure registries and leveraging the Disability Adjusted Life Years (DALYs) metric can guide prevention priorities.

Balanced Approach to Inspections:

While prioritizing disease prevention, accident prevention measures should not be less emphasized. Inspections must continue to ensure compliance with safety standards that reduce immediate workplace hazards such as accidents, but a more balanced approach of preventive resources should be considered vis-à-vis targeting hazardous exposures leading to work-related deaths and diseases.

Collaborative Efforts and Knowledge Sharing:

Harmonized efforts between Nordic countries, supported by labour inspection data, can optimize prevention strategies and foster the exchange of best practices for addressing both accidents and diseases. Close cooperation with the social partners and other stakeholders, both at the workplace, nationally and regionally remains fundamental in any conversation where a recalibration of resources is to be considered.

Modernized Preventive Frameworks:

Invest in advanced occupational hygiene methods, robust risk assessments, and inspector training to manage emerging hazards and legacy exposures, such as asbestos in infrastructure. There is also a need to pay close attention to how the emerging technologies such as AI (Artificial Intelligence), Drones and Robotics could be utilized for preventive purposes. Utilize the EU's strategic OSH framework, emphasizing long-term disease prevention and readiness for evolving risks.

Policy Pointers

Targeted Inspections: Devote more resources to chemical, biological, and psychosocial risks, aligning with the EU's "vision zero" approach to work-related fatalities.

Data-Driven Decisions: Employ evidence-based inspection planning, leveraging scientific estimates and exposure assessments.

This gradual move toward reprioritization of resources seeks to reduce the long-term human and economic burdens of work-related diseases without compromising essential accident prevention efforts, ensuring safer and healthier workplaces across the Nordic countries.

Disclaimer: The Policy Pointers provided in this report are presented as proposals to the leadership of the Nordic Labour Inspectorates, with the aim of fostering discussion on creating safe, sustainable, and healthy workplaces now and in the future. These policy pointers are non-binding and are not intended to be prescriptive or mandatory. The implementation of any proposed measures remains at the discretion of the respective leadership, authorities, and organizations within each Nordic Labour Inspectorate

4. Objectives of the project

The project was requested by the Director Generals of the Nordic Labour Inspectorates. Its initial objective is to estimate the extent of work-related deaths in the Nordic countries. The recorded and approved numbers of “occupational deaths” depend on the legal definition of “occupational deaths/occupational diseases” in each country, whereas “work-related fatalities” and work-related diseases cover a broader concept. [1]

The number of work-related fatalities represent only a part of the overall work-related burden of disease. Fatal cases alone do not account for illnesses and diseases conditions resulting from musculoskeletal disorders, or factors such as repetitive movements, and psychosocial issues, as these seldom lead to fatal outcomes. Additionally, the various stages of disability and loss of the quality of life are not considered in these calculations.

To provide a more detailed overview of health-related hazards, the project incorporates work-related diseases to better illustrate the loss of quality of life and economic consequences due to work-related deaths and disabilities., This is quantified in terms of Disability Adjusted Life Years (DALYs) estimated for the Nordic countries. DALY is a measure used to quantify the overall burden of disease by combining years of life lost due to premature death and years lived with disability. In work-related contexts, DALYs account for the loss of health from both fatal and non-fatal occupational injuries and diseases, helping to assess the full impact of workplace hazards on workers’ health and lifespan. One DALY represents one lost year of "healthy" life and is a critical metric in occupational health for setting priorities and guiding preventive efforts. The toll of fatalities and injuries affecting young people significantly impact the working population, and this is well captured through the measurement of DALYs.

5. Background

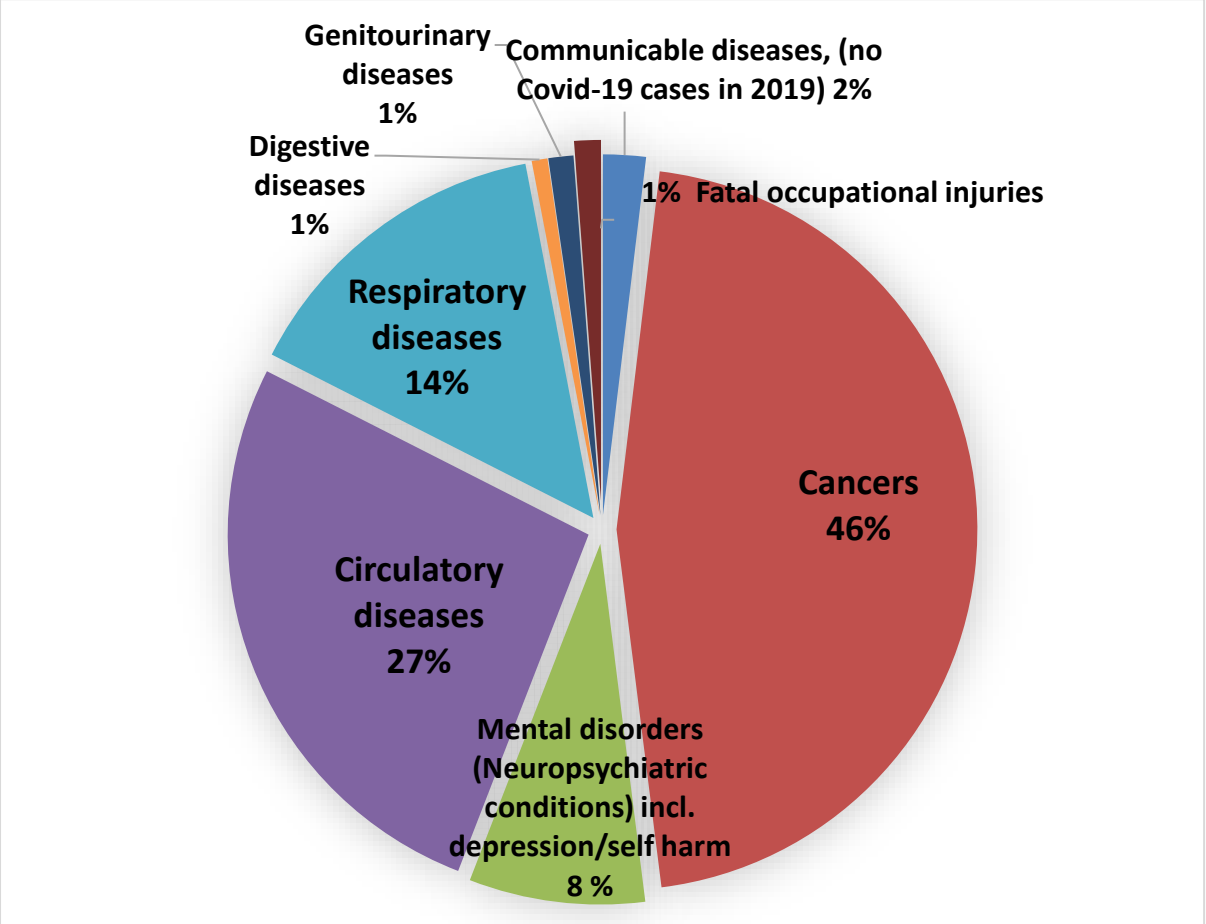
The effectiveness of Occupational Safety and Health (OSH) preventive efforts and labour inspection is generally assessed through the reporting and recording of occupational injuries and diseases in both absolute numbers and rates.
In Nordic countries, fatal occupational injuries are well-documented and closely align with the overall estimates of the International Labour Organization (ILO). However, in most countries, the reporting and recording of occupational injuries are unreliable, with the Nordic countries being an exception to great extent. Consequently, the ILO has employed scientific estimation methods for occupational injuries and work-related diseases over the past decade.

[1]1 ILO criteria for including diseases as an occupational disease are listed in the ILO List on Occupational Diseases

There have been other efforts to better estimate work-related diseases such as the Nordic Dimensions Partnership on Public Health and Social Well-Being report that revealed significant underreporting of work-related diseases.[2]

6. Causes of work-related fatalities

In 2019, an estimated total of 11 730 work-related fatalities occurred in the Nordic countries, with only 143 (1 %) were attributed to injuries caused by accidents at work. The leading causes of work-related fatalities were cancers and circulatory diseases, the latter encompassing cardiovascular diseases caused by work-related stress and prolonged working hours.



Fatal work-related diseases and injuries in all Nordic countries (2019). Fatal occupational injuries per country and work-related diseases per Nordic country, see Annex 1. Source ICOH Global Estimates 2019.

The estimate indicates that fatal occupational injuries account for just 1 % of the total, with chemical, physical and biological exposures being the predominant contributors. Notably, these exposures are responsible for a significant number of cancer related deaths (46 %), followed by circulatory and respiratory diseases.

[2] Better-prevention-project_report.pdf (See annex 3)

Despite the substantial percentage of work-related (non-accident) fatalities attributed to diseases, labour inspections and the media attention primarily focus on occupational injuries and fatalities caused by accidents. While attention to occupational injuries is valid and necessary due to their immediacy and preventability, exposures with long latency periods necessitate sustained, long-term efforts and strategies. Drawing from inspection practices in Finland, the majority of inspections (57%) concentrate on preventing accidents, followed by 24% on chemical agents, 12% on biological agents, and 7% on physical workload (see chapter Focus of inspections: Case Finland and details in Annex 2). The annual report (2023) from labour inspections in Norway also shows a similar distribution of its OSH inspections with almost 60% of OSH inspections focusing on accidents.

Since these disease conditions also occur in the general population without occupational exposure, research has been conducted to estimate the fraction attributable to workplace exposures. [4,5] Generally, 5-20% of such cases can be linked to occupational factors. Mesothelioma is an exception, with an attributable fraction of 80-95%. The high percentage allows mesothelioma incidence and mortality to serve as proxies for asbestos exposure and, by extension, other asbestos-related cancers.

These attributable fractions are determined through numerous scientific studies that compare two similar populations — one exposed to risk factors and the other unexposed. The fraction represents the percentage of adverse outcomes, such as fatalities or diseases, that could have been prevented by eliminating or reducing the exposure.

7. Validity of the cancer estimate

The largest proportion of work-related deaths is linked to cancer. Most cancers have a relatively long latency period, meaning that the exposures leading to the development of cancer occurred many years ago. While it is impossible to prevent past exposures, some exposure still occur today, others have decreased, and new potential carcinogen exposures are emerging. The responsibility for monitoring retired workers with past exposures has moved from labour inspectors to the healthcare service, where the exposure history should be taken seriously, especially considering the expected 20% increase in cancer fatalities from 2020 to 2035 in Finland. Additionally, new suspected carcinogenic chemical and biological agents have replaced old known carcinogens among the thousands of new chemicals in use. The impact of these substances on workers is not fully understood.

While reduced exposure in some cases (such as smoking and passive smoking) is decreasing the risk, longer life expectance is expected to result in higher proportional cancer fatalities in the short term. Research studies suggest that the number of work-related fatalities caused by cancer are likely to continue increasing in the next ten to

[4] Nurminen M, Karjalainen A. Epidemiologic estimate of the proportion of fatalities related to occupational factors in Finland. Scand J Work Environ Health 2001;27(3):161—213.

[5] WHO and ILO. "Joint Estimates of the Work-related Burden of Disease and Injury." 2021.

twenty years, with a gradual decrease over a longer period. [6]

Cancer prevention requires a long-term approach, and the current degree of chemical exposure is more diverse. Workers are now exposed to a wider array of chemicals, both at work and leisure time, making the exposure more complex than in the past. For example, asbestos is still present in infrastructure (and could be released during demolition and repair work. Although asbestos exposure will be lower, more people will be exposed in urban surroundings. Airborne particles from burning wood, long-term exposure to silica dust for workers, and the confirmed carcinogenicity of diesel exhaust fumes, established only a decade ago despite over a century of use, highlight the ongoing importance of labour inspectors focusing on occupational exposures.

Moreover, there is insufficient information about the cumulative effects of multiple chemical exposures, but often different exposures can reinforce each other giving serious or even fatal outcomes.

8. Asbestos exposure

Asbestos exposure has been and remains the highest single factor causing work-related deaths. Despite public belief that past bans on asbestos have resolved the problem, this is not the case. For instance, Sweden banned the use of new asbestos products approximately 40 years ago. However, recent data from the Global Burden of Disease 2019 (published in *The Lancet*) shows that the total number of asbestos-related deaths in Sweden, particularly in the Stockholm area, continues to rise.[7] Although the number of younger victims is decreasing, this positive trend is overshadowed by the massive exposure caused by asbestos during infrastructure activities, especially in renovations and demolitions related to housing, piping, and roofing materials.

The continuous need for building renovation releases asbestos fibres into the air. While installation workers in the 1970s faced heavy exposures to asbestos, today a vast number of workers and the general population are exposed to relatively low levels. In many European cities, the number of fibres often exceeds the new EU occupational exposure limit of 2000 fibres/m^3 (cubic metre) inhaled in an hour.[8] The risk of cancer caused by asbestos is linear without a lower limit. Therefore, the resulting exposure of 2000 fibres/m^3 by 100 persons equals the risk of one person exposed to 200 000 fibres/m^3, as was the case in the 1970s. This trend in Sweden is likely to be mirrored by countries that banned asbestos later.

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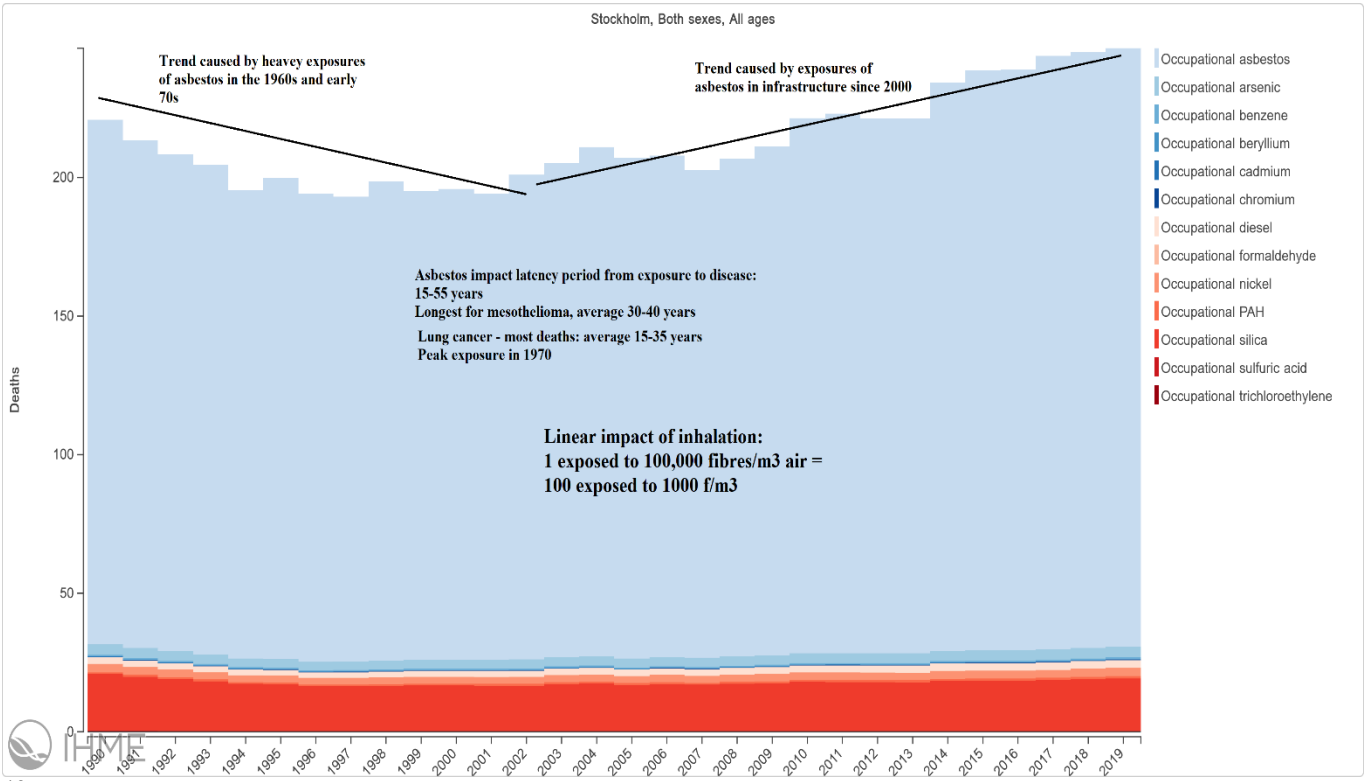
[6] Takala J, etc. Global-, regional- and country-level estimates of the work-related burden of diseases and accidents in 2019, Scand J Work Environ Health, 2023. Supplementary pdf-files and excel-files have the latest death and disability data on all work-related diseases and injuries of all Nordic countries – including also EU Member States, and 181 countries and regions.

[7] VizHub - GBD Compare

[8] The new EU Directive was adopted on 22.11.2023 and came into force 20 days later. There is a long implementation period until 2029 for the OEL of 2000 fibres/m^3 or 0.002 fibres/cm^3. The occupational exposure limit before 2029 is 10 000 fibres/m^3 or 0.01 fibres/cm^3, see the new EU Directive

WHO's latest estimates were 25,372 mesothelioma deaths in 2022 and according to WHO this estimate will go up to 52,961 or 108% by the year 2050. Mesothelioma mortality is strongly linked to asbestos exposure, with up to 95% of mesothelioma cases caused by asbestos.[9] Researchers from IARC/WHO have demonstrated that mesothelioma mortality can serve as a proxy for asbestos exposure, which is also a significant cause of other common cancers, such as lung cancer. Consequently, current asbestos-related mortality suggests an increased burden of other asbestos-related cancers as well. In the Nordic countries, present asbestos exposures primarily stem from asbestos still present in infrastructure, especially during renovation and removal processes.



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9. Psychosocial risks

Psychosocial risks arise from poor work design, organization, leadership and management, as well as a poor social context of work. These risks may lead to negative psychological, physical and social outcomes, such as work-related stress, burnout, or depression. In addition to psychological and mental disorders, psychosocial risks are associated with cardiovascular diseases that may have lethal consequences, such as myocardial infarction or stroke.

Excessive stress can adversely affect the cardiovascular system by accelerating harmful cardiovascular processes, including atherosclerosis, clot formation and by

[9] IARC Cancer Tomorrow

[10] Figure 1. Trend of Asbestos-related death risk among male and female of all age in Stockholm from 1990 to 2019. A massive amount of asbestos in infrastructure is a major factor.

contributing to triggering a cardiovascular event. [12] The mechanisms underlying the increased risk of developing cardiovascular disease among individuals experiencing stress can also be indirect, via adverse lifestyle or lifestyle changes that speed up atherosclerosis and metabolic dysregulation.

The primary negative outcome of psychosocial risks is long term disability, including lost workability that may extend throughout one's life. Work-related fatal cases attributed self-harm and suicides are also being increasingly reported.[13]. In addition to ischemic heart disease and stroke, psychosocial factors contribute to an average population attributable fraction of 16.6 % for depression. The range of attributable fraction is 9 – 25 %, with the Nordic countries situated at the lower end.[14,15]

10. Fatalities due to mental and neuropsychiatric disorders

These diseases and deaths may arise from mental disorders covering diseases related to "Vascular and unspecified dementia" and "Depressive episodes",
The exposures vary from

a) Job strain including high levels of psychological demands, low levels of decision latitude, and low levels of social support for mental disorders at work. Suicides caused or contributed by job strain are included here.
b) Pesticides (herbicides and insecticides) and fertilizers for vascular dementia.

Neuropsychiatric disorders at work are caused by diseases of the nervous system and spinal muscular atrophy, Parkinson's disease and Alzheimer's disease. The exposures are mainly due to pesticides (herbicides and insecticides).[16]

[12] Links-exposure-work-related-psychosocial-risks-at-work-and-cardiovascular-diseases_EN.pdf

[13] Work-related suicide: Evolving understandings of etiology & intervention - LaMontagne - 2024 - American Journal of Industrial Medicine - Wiley Online Library

[14] EU-OSHA – European Agency for Safety and Health at Work, The links between exposure to work-related psychosocial risk factors and cardiovascular disease, 2023.

[15] Kivimäki, M., Bartolomucci, A., & Kawachi, I. (2022). The multiple roles of life stress in metabolic disorders. Nature Reviews Endocrinology. Advance online publication. doi:10.1038/s41574-022-00746-8

[16] See further. https://www.sjweh.fi/article/4132 and related Supplementary materials 1- 2 https://www.sjweh.fi/article/download_online.php?abstract_id=4132&file_nro=1

11. Work-related fatalities: Case Sweden[17]

In 2019, Swedish authorities released a report detailing the number of work-related deaths attributed to selected exposures (see the table). This report encompasses noise and long term heavy physical work, where the relationship to work and associated risks is less reliable. Some individuals may have been exposed to more than one factor, preventing the direct addition of numbers to estimate the total work-related cases in Sweden. However, the order of magnitude is roughly similar to the estimates provided by the ICOH.

Factor	Number of work-related deaths per year		
	Women	Men	Total
Accidents	4,0	33,0	37,0
Stress	360,3	412,2	772,4
Shift work	280,9	446,8	727,7
Dust (COPD)	246,6	174,8	421,4
Asbestos	45,0	222,5	267,5
Quartz	9,0	116,2	125,2
Engine exhaust	222,7	324,7	547,4
Passive smoking	75,2	119,6	194,8
Welding fumes	32,0	39,0	71,0
Ionizing radiation	1,0	3,8	4,8
Uncertain connections			
Noise	338,4	439,0	777,4
Physical heavy work	0,0	1 548,8	1 548,8

The Swedish study identifies work exposures leading to premature deaths, with estimated numbers surpassing those of fatal occupational accidents. Stress and shift work contribute to the highest number of work-related fatalities, and frequently occurring diesel exhaust exposure is also a significant cause.
The fatal outcomes are primarily concentrated in occupational cancer, cardiovascular, and respiratory problems.

According to the ILO, Sweden recorded 4250 work-related fatalities in 2017. The latest data indicates approximately 4407 deaths based on 2019 data. The increasing numbers of deaths are largely attributed to long-latency diseases at work, which continue to rise with increasing life expectancy. For the latest data on Sweden and other Nordic countries, refer to the EU-OSHA Barometer (ICOH Estimates): and the document state and trends report 2023 published by EU OSHA[18,19]

[17] Arbetsmiljöverket, Arbetsrelaterad dödlighet – delrapport 1, Beräkning av antalet dödsfall 2016 uppdelat på olika exponeringar i arbetet

[18] OSH Barometer | Home

[19] osha.europa.eu/sites/default/files/OSH_in_Europe_state_trends_report_2023_en.pdf

12. Discussion in Parliament on deaths by work-related diseases: Case Denmark

A question regarding work-related deaths has been discussed in the Danish Parliament.[20] In response, the Danish Working Environment Authority noted that the Danish register of notified occupational diseases does not include records of deaths. Estimates of mortality from occupational diseases were evaluated in a Danish report from the National Institute of Public Health in 2006, based on a Finnish model. This assessment resulted in approximately 2000 cases in Denmark caused by occupational diseases each year. The ILO's past data for 2015, released in 2017, was notably higher at 2445. The Danish report further estimated that around 1400 deaths can be linked annually to mental health issues at work, although it did not provide detailed information on the exact cause of these fatalities. According to a 2005 report from the Danish Cancer Society, an estimated 1,300 cancer cases per year may be attributed to the working environment.
The current best estimates provided by the NMR project for the detailed questions are:

a) **How many fatalities occur annually due to poor working environment in Denmark**

- 2472 fatal work-related diseases; occupational cancer has the biggest share of this or 1153 deaths.
- 39 fatal occupational accidents
- 197 fatal work-related mental disorders or neuropsychiatric conditions (64 suicides linked to depression are included for work-related self-harm cases/depression.)

These are the latest available data based on the source year 2019.
Negative outcomes caused by the psychosocial work environment were estimated in Denmark to have resulted in 1,400 occupational diseases, encompassing both fatal and non-fatal cases. However, it is important to note that the project lacks detailed data to confirm these estimates. The consequences of poor psychosocial work environment include circulatory diseases, depression, and even suicides. Separate tables for each Nordic country provide information on deaths and disabilities, as measured by DALYs.

b) **Assessment of the size of underreporting, so that one could possibly provide a minimum number**

The confidence intervals (CI) for both upper and lower levels were calculated to be in the range 20-30 % in both directions, varying on the region and the specific disease under consideration. However, the reporting of mortality levels for diseases and accidents may vary significantly, with some countries reporting their data poorly. While this is not the case for Nordic countries, detailed country-level confidence intervals have not been estimated for these reasons.

[20] https://www.ft.dk/samling/20131/almdel/beu/spm/84/index.htm

c) What is the corresponding number for Sweden

- 4407 fatal work-related diseases; occupational cancer accounts for the largest share with 2056 fatalities.
- 36 fatal occupational injuries caused by accidents.
- 924 fatal work-related mental disorders or neuropsychiatric conditions (including 118 suicides linked to depression in work-related self-harm cases)

These are the latest available data based on the source year 2019.

A separate table has been created in Sweden and published by the Swedish Work Environment Authority. The classification is different and is based on exposure rather than the cause of death.

d) How can the differences between Denmark and Sweden be explained, when the numbers are corrected according to population?

The data are matching well when the Labour force data are taken into account between Denmark (3023904) and Sweden (5081363.)

13. Top ten hazardous work exposure tasks and occupations: The Case of Finland

A new Finnish survey from 2017 has identified the highest hazardous work exposures and occupations. [21] The project examined the exposure of chemical agents at workplaces based on the registry data from the early 2000s and identified hazardous work tasks and occupations where exposure levels exceeded 50% of the occupational exposure limit values. It is possible that exposure levels were even higher in workplaces not included in the registry, where measurement data was not obtained.

The top ten hazardous work tasks and occupations were:

1. Work with reinforced plastics.
2. Dusty tasks in construction.
3. Dusty tasks in metal ore mining and quarrying.
4. Floor layering.
5. The manufacture of concrete products.
6. Car painting.
7. The use of formaldehyde adhesives in the wood industry.
8. Welding and flame cutting of metal products.
9. Aluminium welding and flame cutting.
10. Bakery work.

According to the calculated risk of the disease burden caused by work, lung cancer cases were most often found in welding and flame cutting, as well as in welding acid-proof and stainless steel. However, the highest risk of lung cancer was in the mining and quarrying of metal ores, particularly increased by exposure to diesel exhaust gases.

The disease burden caused by asthma, chronic obstructive pulmonary disease (COPD), and silicosis in hazardous occupations revealed that dusty tasks in construction, such as building demolition, are the primary contributors to respiratory diseases in all three categories. The next highest number of respiratory diseases was estimated in welding and flame cutting. Exposure to dusts, sensitizing, or irritating agents represent the most common work-related hazards for respiratory diseases. Dusty tasks in construction, as well as welding and flame cutting work, pose the largest disease burden and risk of diseases.

Occupational skin diseases and respiratory allergies occur most frequently in bakery work, hairdressing, stainless steel welding, and welding and flame cutting. The highest lifetime risk of occupational disease was identified among automotive painters. Recommendations from the survey include incorporating the following factors into the chemical agents' management model:

[21] Kemikaaliriskien hallinta kuntoon - Rekisteritietoon perustuva selvitys kemikaaleille altistavista riskitöistä ja -ammateista, FIOH, 2017. (Registry-based survey on high-risk tasks and occupations involving exposure to chemicals, FIOH, 2017.)

1. Organizational factors (organization and its activities)
2. Chemical legislation
3. Risk assessment
4. Risk management
5. Education and skills
6. Communication and information within a company, and occupational health services.

Small businesses require more expertise in occupational safety at work, and certain approaches have been designed to assist these companies in controlling chemical and other risks in the work environment.
In the management and control section, the project proposes a set of control and enforcement practices targeting existing measures or lack of measures related to eliminating and reducing exposures using an established hierarchy of control. This set requires systematic long-term management efforts, exposure control structures, assigning responsibilities, training, record-keeping, enterprise-level surveys and questionnaires, and cooperation with occupational health providers.
A check list for workplaces/employers to control the chemical hazards was provided:

- Gather and update all chemical fact sheets and the list of workplace chemicals.
- Recognize all chemical risks and worker exposures.
- Assess and prioritized the chemical risks.
- Decide and carry out all needed preventive measures.
- Ensure adequate instructions and guidance for workers.
- Continuous surveillance.
- Training.
- Be open about the risks and commit yourself to prevention.

In risk assessments, it is important to consider the combined effects of different, but similarly acting substances, as well as combined exposures from multiple sources, such as work-related exposures and exposure related to nutrition and consumer products. This supports the EU's "one substance one assessment" goals.

A synergistic effect occurs when the combined effect of exposures is much greater than the sum of the individual effects. Examples include the synergistic effect of carbon tetrachloride and ethanol on liver toxicity and the synergistic effect on the lungs due to smoking and exposure to asbestos.

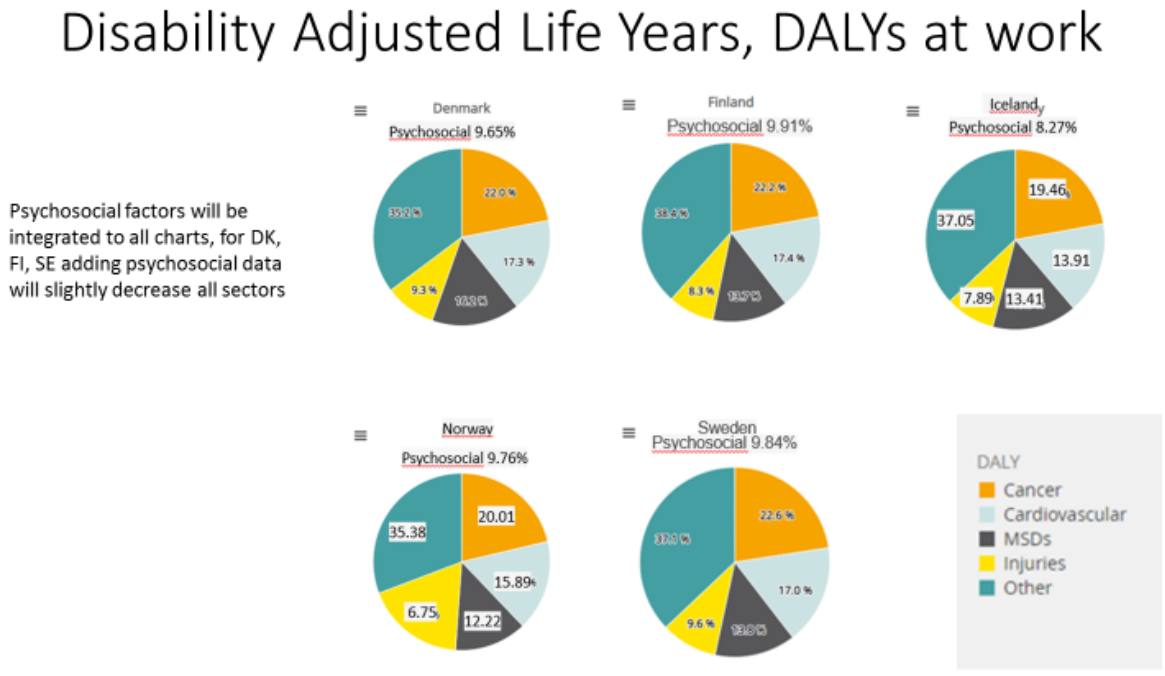
Regulation of PFAS (per- and polyfluoroalkyl substances) is currently under discussion. PFAS, resistant to heat, water, and grease, are used in everyday products like packaging, clothing and cosmetics. Termed “forever chemicals”, due to their non-biodegradable nature, PFAS have been linked to multiple health issues, including cancers, high cholesterol, thyroid disease, liver damage, decreased fertility, low birth weights, asthma, allergies, and reduced vaccine response in children. Even rainwater and soil across the globe are likely to contain unsafe levels of PFAS.

14. The Causes of DALYs in the Nordic Countries

Disability Adjusted Life Years (DALYs) is an important indicator for assessing the level and duration of disability. While death cases are concrete and easily comprehensible for preventive purposes, disability level and duration are broader key indicators encompassing both Years of Life Lost (YLL) caused by deaths and Years Lived with Disease (YLD) due to permanent or temporary disability suffered by workers. The “adjustment” process is an internationally agreed-upon procedure that considers the severity of diseases or injury outcomes. For instance, a three-days disability is considered less significant than a loss of limb, blindness, or permanent mental incapacity to work, and DALYs distinguish between such cases.

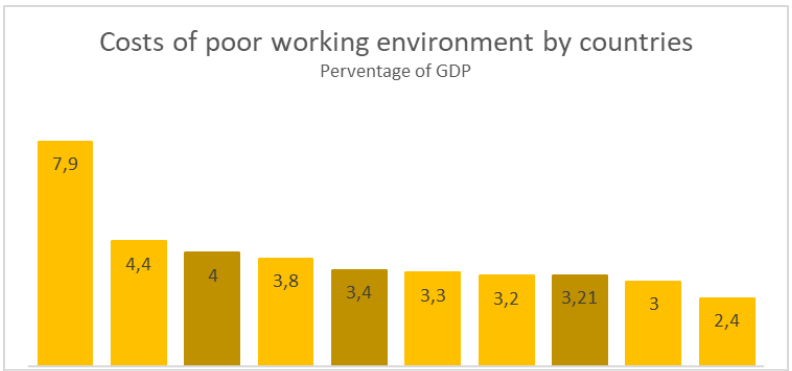
The estimation methodology known as “Disability Adjusted Life Years” (DALYs) has been developed by WHO to provide a comprehensive view of the disease burden. One DALY represents the loss of the equivalent of one year of full health. By using DALYs, the burden of diseases causing premature death, as well as less serious disabilities, can be calculated and visualized with a single indicator. This also explains the higher share of accidental injuries (in DALYs) compared to the share of numbers of deaths only – represented by the yellow slice of the pie chart. This difference is due to the fact that occupational accidents cause the deaths of much younger workers, typically in their 30s, while victims of occupational cancer often pass away towards the end of their working career or later.

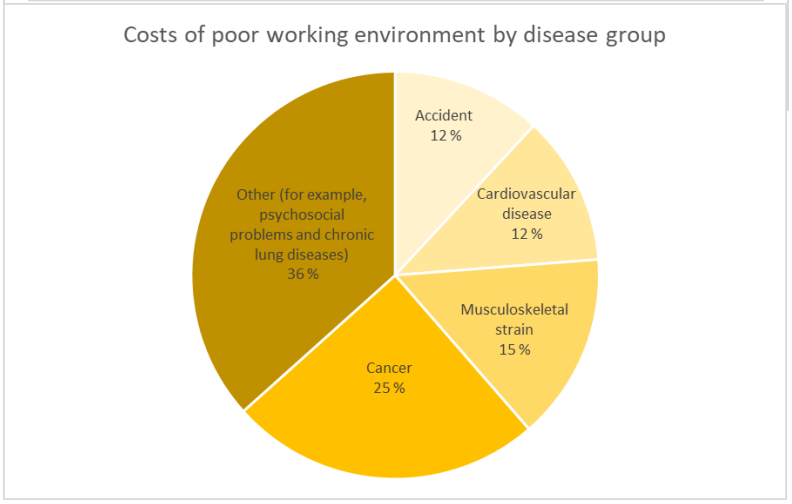
The DALY concept is based on life disability which is different from work disability used by workers’ compensation bodies. Workers may be not be able to work for a short term or for a full working life in their respected jobs while they could continue to live, for example, through their full life expectancy. Work disability may be much stricter depending on the compensation rules and practices. When measuring productivity losses due to poor work environment the DALY concept provides considerably lower losses as compared to using Work disability measurements.



15. Costs of work-related diseases and deaths

On average, research estimates that the cost of poor working conditions is approximately 4 % of a country's GDP. In Finland, the estimated cost of lost labour input is 2 billion (milliards) euros per month, totalling 24 billion euros annually.





Examining the sources of these overall costs attributed to work-related injuries and diseases, the research indicates that occupational injuries caused by accidents at work account for 12 % of the total, while cancer incurs a cost of 25 %. [22] Heart and coronary diseases also contribute 12 %, musculoskeletal injuries contribute 15 %, and psychosocial issues and chronic lung diseases are grouped under 'Others'. That sector covers also occupational skin diseases, hearing loss, allergies and asthmatic conditions at work etc.
In Finland a major part of the loss of labour input relates to psychosocial risks at work and mental health issues leading to disability pensions and sickness absence:

- Almost ¾ of all *work disability pensions* (of varying length) in Finland are caused by mental health disorders/psychosocial factors and 3% of these pension receivers in the workforce are diagnosed as having a *permanent (lifelong) disability* (corresponding to 3 % of the total sum of salaries paid in Finland), and
- Shorter or longer *sickness absence days* caused by mental health/psychosocial factors corresponding to an additional 5% of the total sum of salaries paid in Finland. Today the highest economic losses for the society are from mental health disorders and followed by musculoskeletal disorders.

[22] Source: Arbetarskydd 11/2017, data from European Agency for Safety and Health at Work, International Commission on Occupational Health, ICOH, and ILO.

According to the Finnish Institute of Occupational Health about two life-long work disabilities are diagnosed every day and a high share of the victims are relatively young – in their 30's - and more often women than men.

Two Norwegian reports reviews the costs of work-related diseases and deaths. In 2016, the research institute SINTEF estimated that work-related diseases and injuries had an annual cost of about NOK 30 billion (milliards) (approximately 2,6 billion (milliards) Euro, according to today's exchange rate).[23] However, this is a conservative estimate, as neither mental nor circulatory disease is included. Lumbar disease is the only musculoskeletal disease included. The other report was published by Oslo Economics in 2018. One conclusion here is that the annual socio-economic costs linked to a non-optimal working environment are calculated to about NOK 75 billion (milliards) (approximately 6,5 billion (milliards) Euro, according to today's exchange rate). [24] Some of the difference from the SINTEF report can be explained by the fact that they have used a different value for a year of life lost. In addition, the loss of health associated with mental disorders is included.

16.Focus of labour inspections (Finland)

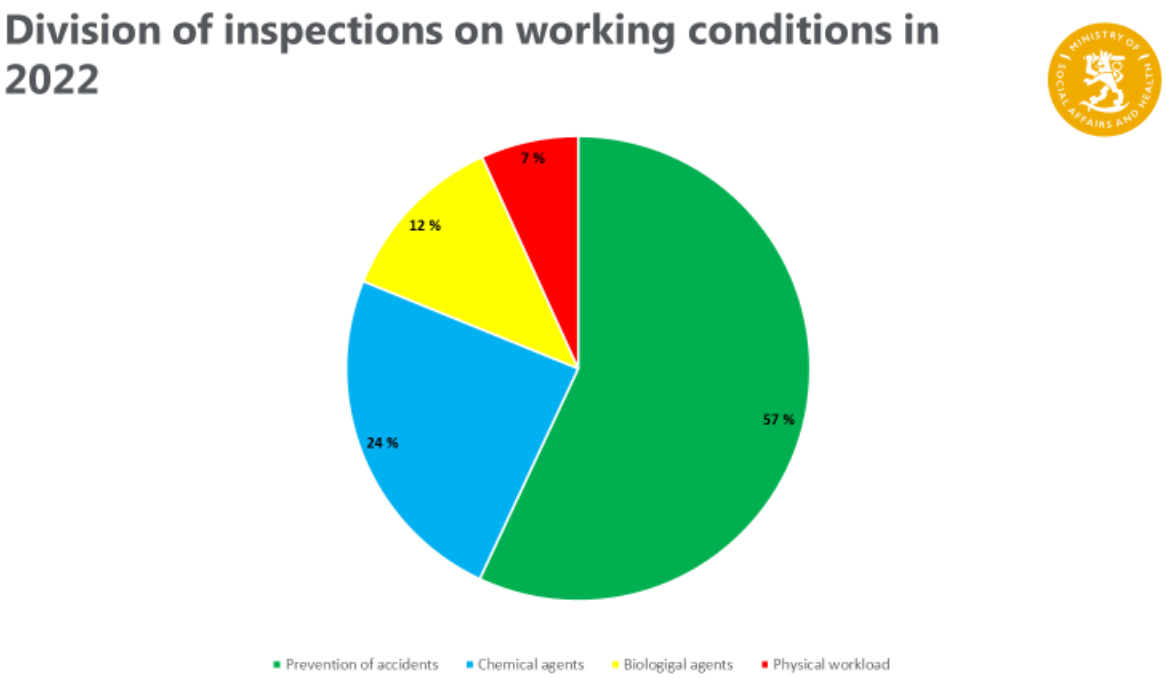
Labour inspections in Finland concentrate on three main areas: working conditions (50 %), fragmented working life (33 %) and psychosocial workload (17 %). Regarding the inspection of psychosocial workload, the emphasis is on identifying factors contributing to psychosocial workload and assessing the associated risks.

The highest number of deficiencies was observed in the investigation and assessment of work hazards, the provision of occupational health care services, and the workplace survey conducted by the occupational health care provider. Employers should strive to prevent harmful workloads rather than merely managing their consequences, emphasizing proactive measures to eliminate or minimize the risk and harmful effect of work-related strain.

Inspections in the area of working conditions place a significant focus on accidents prevention (57 %), with a lower percentage allocated to chemical agents (24 %) and biological agents (12 %).

[23] SINTEF: Rapport A27430, Kostnader ved arbeidsrelaterte sykdommer og skader, 2016.

[24] Osloeconomics: Samfunnsnytten av bedrifthelsetjenten, 2018.



Considering the work-related burden of disease described in the previous chapters, it can be noted that the focus on prevention of accidents seems to have been successful, it is notable that the emphasis on preventing accidents appears successful, reflected in the decreased proportion of fatal occupational injuries to 1 % of the overall fatal work-related diseases and injuries in the Nordic countries.

In the implementation of the EU strategic framework on health and safety at work for 2021 – 2027, particularly the second focus on work-related diseases, additional efforts by labour inspection may warrant consideration. As work-related diseases are closely linked to various exposures, a resurgence (increase) in occupational hygiene measurements could contribute to understanding chemical and biological exposure levels, potentially reducing work-related diseases and fatalities.

17. Prevention of work-related diseases and injuries

EU strategic framework on OSH

The EU strategic framework on health and safety at work for 2021-2027, titled "Occupational safety and health in a changing world of work", is centered around three key focuses: 1) anticipating change, **2) work-related diseases,** and 3) preparedness for future crises. A significant proportion, one third of the focus is dedicated to addressing work-related diseases. Here is an excerpt from the EU framework

Chapter 2.2., titled "Improving **Prevention of Work-related Diseases and Accidents,** places a strong emphasis on the challenge of work-related deaths. The Commission calls for the following actions:

 Work towards fulfilling the 'vision zero' approach to work-related deaths in the EU.
 Address occupational risks related to circulatory diseases.
 Promote the European Code against Cancer among workers to improve their health literacy and reduce cancer risks.
 Assess and address risks with a particular focus on groups most affected by the pandemic, such as persons with disabilities.
 Actively support reintegration, non-discrimination and the adaptation of working conditions of workers who are cancer patients or cancer survivors.
 Promote gender considerations in design, implementation and reporting.
 Actively address hazards in the healthcare sector by putting in place and implementing safe working procedures and providing appropriate training.
 Provide improved guidance and training for the risk-assessment and prevention measures, in particular to micro-enterprises and SMEs. .
 Provide training to farmers via Farm Advisory Services to increase their skills and awareness on the health and safety rules on farms, including safe use of chemical substances, in particular plant protection products.
 Develop a guidance for the health care sector focusing, among other things, on workers protection from the exposure to hazardous medicinal products, paving the way for developing the online interactive risk assessment (OiRA) tool specifically for the health care sector in collaboration with the EU-OSHA

18. Main work-related exposures and inspection advice

Priority items for inspectors and inspectorates: Questions to workplace stakeholders, including selected individual workers.
Prevention of Occupational Cancer

1. In workplaces where there might be asbestos in structures: Do you have a comprehensive workplace-wide record confirming that a check has been conducted for possible asbestos exposures, both in infrastructure – walls, floors, ceiling, piping and insulation in heating or energy saving systems? Has any work taken place or been planned that could result in exposures to asbestos fibres?
2. Is there any record of potential exposure and related preventive actions for other key carcinogens, such as shift/nightwork, mineral oils, solar radiation causing occupational skin diseases, silica dust, diesel exhaust, polyaromatic hydrocarbons, painting and welding processes, external tobacco smoke, radon, and more? (A more comprehensive list is provided at the end of this paper in annexes)

Circulatory Diseases at Work: Cardiovascular Diseases and Stroke

3. What control measures are in place to reduce long working hours, shift and night work combined with strain?
4. What control measures exist to reduce noise, engine exhaust (including carbon monoxide), and external tobacco smoke (carbon dioxide, nicotine)?
5. What control measures are in place to address harmful psychosocial factors, including job strain, effort-reward imbalance, job insecurity, sexual harassment and bullying?

Work-related Respiratory Diseases (Chronic Obstructive Pulmonary Disease, Asthma)

6. What control measures are in place related to:
   - Welding fumes, oxides of nitrogen, and ozone, chromium, nickel,
   - Dusty work in manufacturing industry, construction work, and farming (e.g., organic dust, microbial dusts, endotoxins, textile dust),
   - Occupations such as bakers (flour dust), food manufacturing workers, painters and lacquerers, floor layers, farmers, plastic product workers, animal husbandry workers (grain dust, hay dust, animal epithelia, hairs or secretions, fodders),
   - Spray painters and lacquerers (epoxy resins or paints, isocyanates),
   - Hairdressers and beauticians, etc. (hair, acrylic monomers, resin, phthalates, persulfate salts, hair dyes, and colorants)

Occupational Injuries (Caused by Accidents) and Work-related Diseases in General

7. What is the existing occupational safety and health management system at the workplace? What reports and records exist, who are involved, and is there any certification or other evidence of the system's functioning?

Work-related skin diseases

8. Are there exposures to solar and ultraviolet radiation at work which causes skin diseases such as melanoma and non-melanoma skin cancer? Are there sources that can cause irritant and allergic contact dermatitis cases? Hand and other skin dermatitis can be caused by work-related allergens due to several substances such as resins and plastic-related chemicals (rubber latex). Occupations of particular interest are bakers, chefs and cooks, farmers, veterinarians, gardeners and hairdressers.

Other Risk Exposure Factors Causing Further Work-related Diseases

9. What control measures are in place related to metal dust, wood dust, lead, chromium, quartz (sand dust), oxygenated hydrocarbons? What measures have been taken to prevent neuropsychiatric diseases and mental disorders, such as controlling pesticide (herbicide and insecticide) and fertilizer exposures leading to dementia and Parkinson's disease?

10. What inspectorate actions have been taken, in general, for working out checklists and guidance on risk assessment and management in:
    - Industry and economic sectors, such as primary sectors, manufacturing and construction industries,
    - Specific occupations, such as nurses, hairdressers, welders, painters,
    - jobs, such as those exposed to shift work, night work, and long working hours.

19. Validation seminar of the Report with Invited Nordic and International Experts - October 11, 2023

The project organised a validation seminar with selected Nordic and international labour inspectors, occupational health professionals, and experts. Twenty-four OSH experts attended the online seminar on October 11, 2023.

The presentations and ensuing discussion helped to refine the findings, confirm presented facts, and especially refine the suggested advice to Nordic labour inspections. The dialogue between the labour inspectors, occupational health professionals, and international experts was particularly fruitful in ensuring common understanding between practitioners and researchers. The content and formulations in the report were edited to enhance mutual understanding between the two groups.

Additionally, experts from European and international organisation were asked to provide short comments on the report in general and specifically on how the Nordic report could be applied in other countries or in an international context. A few comments are presented below.

William Cockburn, EU-OSHA

“I would say that the information produced is essential for other countries. Estimates of the burden of work-related injuries and diseases on society should lead to more resources being directed towards OSH. Those that are sufficiently detailed, such as presented in this research, allow priorities to be set in terms of where is action most needed and which levers are likely to have the greatest impact. However, resources will only be increased, and priorities acted upon if the information is communicated effectively. This is a big challenge when the key target audience is in another policy area and doesn’t speak our language. Fatal injuries are easy to comprehend; DALYs and PALYs not at all. So, to build on this excellent work, I would say that we need to find a way of communicating the findings and the needs.”

Balint Nafradi, ILO

” I firmly believe that securing reliable information, both actual data and estimates, regarding work-related exposures, diseases, and injuries is an essential initial step. However, the key to success in redirecting resources towards OSH lies in effective communication. To achieve this, we must speak the language of decision makers, which is often grounded in economic data. It is crucial to convey not only what they understand but, more importantly, what they deeply care about.
In my view, resources can be found within the realm of public health financing. On average, governments allocate approximately 5-10% of their GDP to finance public health. Their primary concern, though, is not merely the number of deaths DALYs; it predominantly the cost of treating each case. By demonstrating to decision makers that preventing worker hospitalizations through effective OSH is more cost-effective than treating resultant diseases or injuries, we can prevent significant suffering within the workforce.

Another group worth targeting is employers themselves. In 2022, the global OSH market amounted to 4.5 billion USD, and it is projected to expand to 5.9 billion USD by the end of the decade. However, to influence any of these groups, in my opinion, we must use a carrot rather than a stick."

Matthias Fritz, European Commission

"In my personal opinion, the Joint Estimates of WHO/ILO of fatal is a very important project, because it gave us for the first time an estimate for some important occupational causal agents and disease pairs concerning fatal cases and DALYs. I agree with William that the concept of fatal cases is easier to comprehend by decision makers.

- In order to direct resources to labour inspections and preventive measures, it is indeed a big step forward to know the number or percentage of occupational disease / accident fatal cases due to different causal agents. We all know that the difficulty concerning some occupational diseases is that the outcomes may manifest only many years later (cancers have often a latency period of 20-40 years to develop), and that the causal link is somewhat weaker than for accidents. However, we also know that the costs of occupational disease and in particular cancer is much higher.
- I think it will simply need more time and awareness raising among all actors (labour inspector, employers, workers, their representatives, occupational doctors, health insurances, labour ministries, etc.), maybe we also need a new generation of involved actors to concentrate on the factors that are most relevant for the lives of workers as opposed to those which were important in the past. It may be that awareness is not yet as high as we would like it to be but such awareness raising processes can take time, depending on how hard the data evidence is. I think we are on a good way. However, we should not decrease but rather increase our awareness raising effort at all levels - hard data is among the most important tools in this. This project of the Nordic countries, offering better and richer data, is for sure a contribution to that end.
- All advances in science to estimate the number of cases or to proof (with medical technology) that a case is indeed work-related will help. This would include the interdependencies and estimations between different factors that may contribute to an occupational disease (such as chemicals, stress at work, influence of private factors etc.).
- I was impressed by the Austrian approach to use (anonymised) data of public health insurances to calculate the real (administrative) absence days of workers from work due to ICD-10 diagnoses in specific Austrian regions and economic activity sectors. The Austrian labour ministry can use such anonymised data to target inspections to those regions, sectors and diseases which have the highest number of absence days. This may not be ideal for cancer which develops sometimes only after retirement but for many other diseases, the public health insurances have a lot of unused data, which - in case or Nordic countries - may also be often linked with (employment) registers which could give similar

information. Unfortunately, access to public health insurance data is often subject to strict data protection rules and linking it with information about the company or sector of the victim may be lacking in many countries. Nevertheless, in public health there are efforts to get hold of (anonymised) public health insurance data, which should anyway be a right of information of all citizens as it concerns their contributions, which would contain a treasure of information also for occupational health if the link to the economic sector or other employment data could be achieved.

- An comparison of all major cost items between the many different areas of labour inspections (employment contracts, bogus self-employment, working time issues, OSH etc.) and also of different areas of employment and social policy (unemployment benefits, poverty alleviation, social work, early school leavers etc.) may help to prioritise overall resources better. If we would know what all these items cost society individually, we could know which size the budget for OSH should have and then we would be able to determine which costs should also be applied within the area of OSH. If there is a question mark on how high the overall costs for dealing with OSH at national level should be (ideally), there will always also be questions marks on how to distribute the resources within OSH (labour inspection etc.). Of course this would mean estimating the costs of all the different policy areas, which could be done in a joint effort in (the European Commission department) EMPL or within national ministries / budgets of employment and social affairs policies, but I think such a project would be worth the effort and could in fact also be done in the Nordic countries before possible spreading it to other Member States.
- I wonder whether it is possible to create "severity profiles" per occupational disease / causal agent pair to estimate less severe outcomes from fatal ones (characteristic numbers of cases of non-fatal outcomes, such 4 days - 1 month, 1-3 months of absence, 3-6 months of absence, permanent incapacity to work etc., based on fatal cases). This would facilitate estimations of the total burden of a disease, on the basis of fatal cases."

Yuka Ujita, ILO/Bangkok

"Allow me to add two points from my experience covering 25+ middle- and low income countries in Asia and the Pacific.

1. Interests of decision makers in the estimates are high.

I always start my presentation with the estimates by ICOH and WHO/ILO. Often, they seek more information and want to be involved. This clearly demonstrates the strong demand.

2. Engagement of social security/insurance institution would be a key.

They have data, resources and power, more than ministries. In some countries, MOL (labour inspectorate) has established agreements with SECSOC on data sharing and

ILO is supporting such initiatives. They have capacity in cost analysis and severity profiling, which Matthias proposed.”

20. Annexes

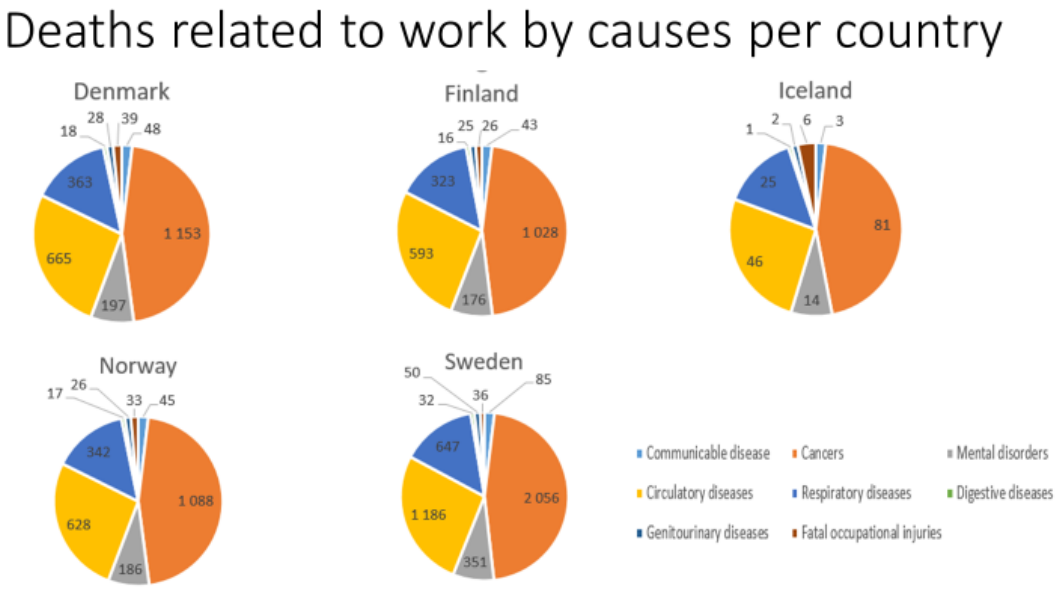
Annex 1: ILO Global Estimates of occupational injuries and fatal work-related diseases in the Nordic countries

The ILO Global Estimates are based on employment data from year 2019. These are used as a first estimated on the scope of the problem. The data will be amended based on data received directly from fresh national sources during the progress of the project.

	Occupational injuries (2019)					
	Project estimates		Reported by Nordic countries			
	Fatal injuries	**Absence of 4 days or over**	**Fatal injuries**	**Absence of 4 days or over**	**Fatal work-related diseases 2019 Project estimates**	**Occupational diseases (2020) reported to Eurostat***
Denmark	39	50 227	39	50 179	2 472	2 410
Finland	33	42 500	33	43 126	2 203	1 186
Iceland	2	2 576	2	1 410	173	
Norway	33	42 500	33	40 000	2 332	
Sweden	36	46 364	34	36 795	4 407	107
Total	**143**	**184 167**	**141**	**171 510**	**11 587**	

The table indicates that the reported occupational accidents by Nordic country correspond to the estimates calculated by the project. The project estimates of absence of at least four days are based on the number of fatal injuries reported to Eurostat.

An Occupational disease database does not currently exist at the European level. The objective of a European Occupational Diseases Statistics (EODS) pilot project is to gather national data in a unique database and provide trends on the most recognized occupational diseases in the European Union. Information from Iceland and Norway is not available.



25

The attributable fractions give a first estimate of the prevalence of work-related diseases. The project will collect more representative data going deeper into economic sectors, occupations, gender and age.

[25] Source: EU-OSHA Barometer

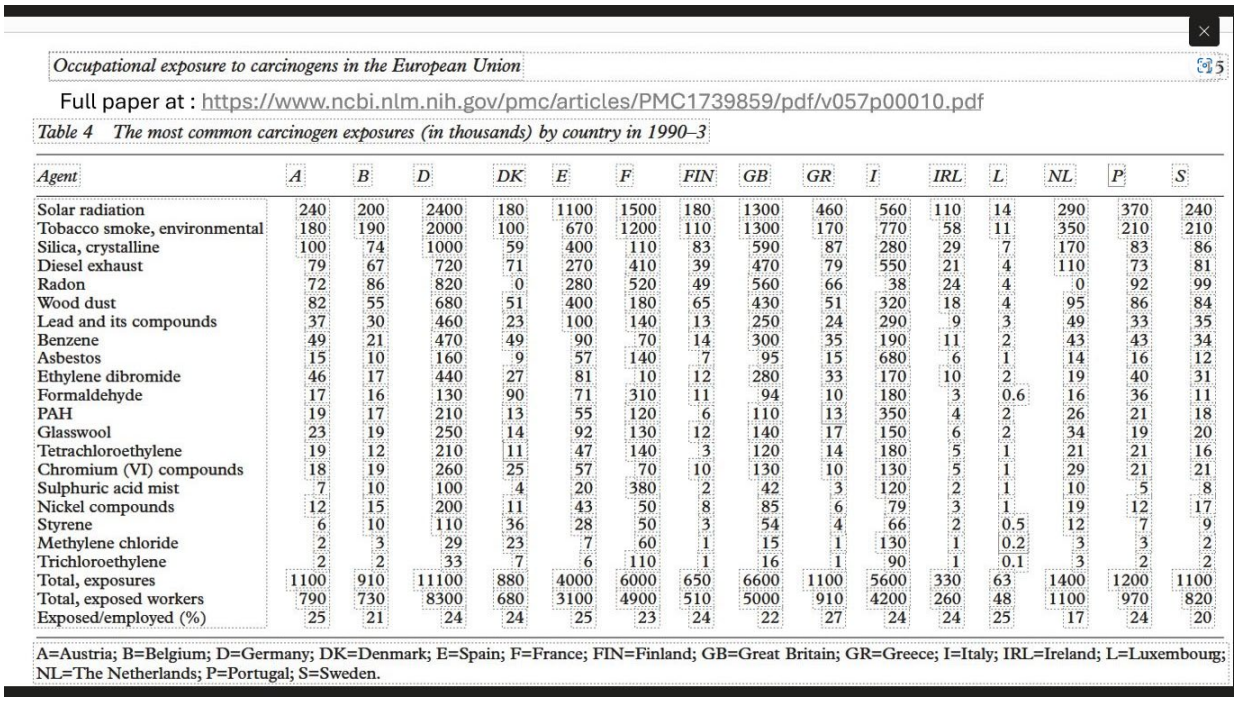
Attributable fractions (due to workplace exposure) of diseases not classified as occupational diseases.

	Attributable fraction									
	Nurminen and Karjalainen (2001)		Rushton et al. (2008)		Steenland et al. (2003)		Morrel at al. (1998)[a]		Leigh at al. (1997)[b]	
Causes	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
Communicable diseases	4.8	32.5								
Cancers	13.8	2.2	8.0	1.5	3.3-7.3	0.8-1.0			6-10	
Respiratory diseases	6.8	1.1							10[c]	
Circulatory diseases	14.4	6.7			6.3		1.0	1.0	5-10	
Mental health disorders	6.6	1.8					1.0	1.0	1-3	
Digestive diseases	2.3	1.5								
Genitourinary system	3.0	0.4					1.0	1.0	1-3	

[a] Covers only deaths due to occupational exposure to hazardous substances
[b] Pneumoconiosis are not included in the figure of Leigh at al.
26,4

[26] Sources: Nurminen M, Karjalainen A. Epidemiologic estimate of the proportion of fatalities related to occupational factors in Finland. Scand J Work Environ Health 2001;27(3):161—213.

Occupational exposure to carcinogens in the European Union (CAREX EU)



Occupational exposure to carcinogens in the European Union 5

Full paper at : https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1739859/pdf/v057p00010.pdf

Table 4 The most common carcinogen exposures (in thousands) by country in 1990–3

Agent	*A*	*B*	*D*	*DK*	*E*	*F*	*FIN*	*GB*	*GR*	*I*	*IRL*	*L*	*NL*	*P*	*S*
Solar radiation	240	200	2400	180	1100	1500	180	1300	460	560	110	14	290	370	240
Tobacco smoke, environmental	180	190	2000	100	670	1200	110	1300	170	770	58	11	350	210	210
Silica, crystalline	100	74	1000	59	400	110	83	590	87	280	29	7	170	83	86
Diesel exhaust	79	67	720	71	270	410	39	470	79	550	21	4	110	73	81
Radon	72	86	820	0	280	520	49	560	66	38	24	4	0	92	99
Wood dust	82	55	680	51	400	180	65	430	51	320	18	4	95	86	84
Lead and its compounds	37	30	460	23	100	140	13	250	24	290	9	3	49	33	35
Benzene	49	21	470	49	90	70	14	300	35	190	11	2	43	43	34
Asbestos	15	10	160	9	57	140	7	95	15	680	6	1	14	16	12
Ethylene dibromide	46	17	440	27	81	10	12	280	33	170	10	2	19	40	31
Formaldehyde	17	16	130	90	71	310	11	94	10	180	3	0.6	16	36	11
PAH	19	17	210	13	55	120	6	110	13	350	4	2	26	21	18
Glasswool	23	19	250	14	92	130	12	140	17	150	6	2	34	19	20
Tetrachloroethylene	19	12	210	11	47	140	3	120	14	180	5	1	21	21	16
Chromium (VI) compounds	18	19	260	25	57	70	10	130	10	130	5	1	29	21	21
Sulphuric acid mist	7	10	100	4	20	380	2	42	3	120	2	1	10	5	8
Nickel compounds	12	15	200	11	43	50	8	85	6	79	3	1	19	12	17
Styrene	6	10	110	36	28	50	3	54	4	66	2	0.5	12	7	9
Methylene chloride	2	3	29	23	7	60	1	15	1	130	1	0.2	3	3	2
Trichloroethylene	2	2	33	7	6	110	1	16	1	90	1	0.1	3	2	2
Total, exposures	1100	910	11100	880	4000	6000	650	6600	1100	5600	330	63	1400	1200	1100
Total, exposed workers	790	730	8300	680	3100	4900	510	5000	910	4200	260	48	1100	970	820
Exposed/employed (%)	25	21	24	24	25	23	24	22	27	24	24	25	17	24	20

A=Austria; B=Belgium; D=Germany; DK=Denmark; E=Spain; F=France; FIN=Finland; GB=Great Britain; GR=Greece; I=Italy; IRL=Ireland; L=Luxembourg; NL=The Netherlands; P=Portugal; S=Sweden.

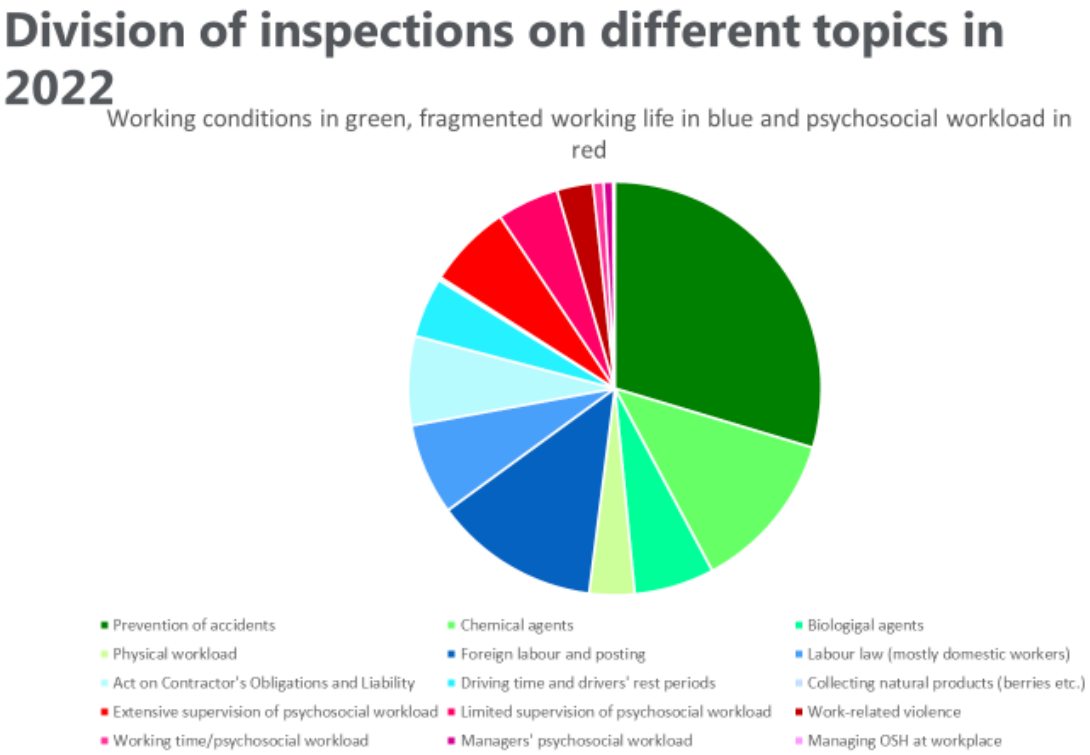
While this Table[27] needs updating it provides a rough idea of the magnitude of exposures leading to occupational cancer cases and deaths in selected Nordic countries. Roughly 20-25 % of workers are exposed.
For preventive action the number of negative outcomes is not sufficient, rather each individual exposures at places of work must be identified and using the hierarchy of control eliminated and reduced continually. Individual workplaces should work out a list of exposures and present a plan – e.g. to inspectors – how these can be gradually limited and eliminated.

[27] Occupational exposure to carcinogens in the European Union. Authors: T Kauppinen, J Toikkanen, D Pedersen, R Young, W Ahrens, P Boffetta, J Hansen, H Kromhout, J Maqueda Blasco, D Mirabelli, V de la Orden-Rivera, B Pannett, N Plato, A Savela, R Vincent, M Kogevinas,..

Annex 2: Focus of labour inspections in 2022, Case Finland

The labour inspection in Finland focusses on three areas: working conditions, fragmented working life (employment issues) and psychosocial workload.

An in-depth review of the Finnish labour inspection shows a broad variety of topics targeted for inspection, including working conditions (including chemical and biological exposure), conditions of employment (driving time, domestic work, berry picking, etc.) and psychosocial workload. See slide below for details.



The inspections and other activities (2022) in numbers, from which the above percentages have been derived are presented below. Source communication from the OSH Department in the Finnish Ministry of Social Affairs and Health.

Inspections and other activities by the Finnish Labour Inspectorate in 2022

- 23 100 inspections
- 18 800 separate workplaces inspected
- Over 48 700 obligations (written advises and improvement notices) given at inspections
- Almost 1100 serious occupational accidents investigated
- Over 1000 demands for investigation or statements on ongoing investigation to police
- Over 1000 applications handled
- More than 41 600 statutory notifications received
- Over 34 300 customer initiatives/contacts received
- 1,4 million users of OSH administration national website

Annex 3

Abstract from multi-country EU supported NDPHS research on "Reporting Identification Work-Related and Occupational Diseases"

The purpose of the "*Better prevention, identification and reporting of work-related and occupational diseases and emerging risks - Prevention Reporting Identification Work-Related and Occupational Diseases"* project was to improve the understanding, identification and reporting of work-related diseases in the Northern Dimension Partnership in Public Health and Social Well-being (NDPHS).

The conclusion of the project was that traditional national registries of occupational diseases have major shortcomings for the provision of information for preventive policies on occupational diseases (OD) and work-related diseases (WRD). The registers do not provide reliable figures.

In general, a legally defined national list of diseases accepted for compensation is the basis of reporting OD. A few countries have more or less open lists, such as Finland and Norway. For example, in Finland the list is neither exhaustive nor limitative, and diseases not included in the list can be identified as occupational diseases, if causality between the illness and a physical, chemical or biological factor present in the work, can be established with sufficient probability. Sweden has no official list of occupational diseases, so that in practice the OD system is open in Sweden. However, the lists of the participating NDPHS countries contain more or less the same categories of diseases, but all countries have their own lists, which differ on details. Finland, Norway and Sweden maintain the principle of evidence-based medicine for recognition of OD. In none of the countries, WRD are registered systematically.

Despite these shortcomings, estimates of the number of OD was made in the participating countries. A rough estimate of the incident rate of OD is 5.5 cases per 10,000 workers. Rough estimates of WRD has been made on the basis of the rate between OD and WRD, which resulted in a coefficient of 67[1], meaning that the number of OD must be multiplied with 67 to get the estimate of WRD.[28]

Country	Reported number of OD	Calculated number of OD	Degree of under-reporting [2]	Calculated number of WRD
Estonia	158	384	0.59	25 728
Finland	1 489	1 489	0	99 763
Germany	18 042	23 807	0.25	1 595 069
Latvia	1 154	539	-1.14	36 113
Lithuania	437	725	0.40	48 575
Norway	920 [3]	1 517	0,39	101 639
Poland	2 094	9 496	0.78	636 232
Sweden[4]	12 088	2 960	-3.08	198 320
Total	**23 374**	**40 917**		**2 741 439**

[28] **Figure:** Calculated estimates of the number of ODs and WRDs in some of the NDPHS countries. Denmark and Iceland were not members of the NDPHS at the time.

Notes: [29]

1) One of the few databases that collect figures on WRD is the Health and Safety Executive (HSE) in the UK. HSE provides good quality statistics on work and health. The figure of HSE in the UK can be used to calculate the coefficient for the estimation. The total number of work related diseases in the UK is estimated at 1.3 million workers in 2016. As the working population was 31 million workers in that year, the percentage of the working population suffering from work related diseases is 4%. For the Finnish situation that would mean that the number of work related diseases would amount to 108,280 workers/year. The estimated number of OD in Finland is 1,489. The coefficient is therefore: 108,280/1,489 = 67.

2) The estimated degree of underreporting is calculated as follows: [1- reported number/ calculated number]. A negative number means that there might be over reporting, e.g. because WRD are also accepted in the registry. A degree of underreporting of 0.85 means that 85% of the OD is not reported.

3) 920 cases were compensated on average per year in the period 2004-2007 in Norway

4) The trends for Occupational Disease (OD) and Work Related Disease (WRD) are difficult to estimate for Sweden. The national statistics are based on filed claims instead of approved OD and WRD. The system is open and not based on the ILO list nor any fixed criteria for diagnosis other than International statistical classification of diseases and related health problems (ICD). The economical compensation for workers with sick leave is not different for an OD or WRD compared to diseases of other causes.

   More details are available in the full report.

[29] **Source:** Better prevention, identification and reporting of work-related and occupational diseases and emerging risks - Prevention Reporting Identification Work-Related and Occupational Diseases, EUROPEAID/132633/C/SER/MULTI Framework contract Beneficiaries – Lot n°8 – Health; Contract for services: RfS 2016/380168/1; ECORYS Health Consortium. "(Full report available through the project report.)

21. Abbreviations

AI - Artificial Intelligence
DALY - Disability-Adjusted Life Year
EU - European Union
EU OSHA - European Agency for Safety and Health at Work
FIOH - Finnish Institute of Occupational Health
GBD - Global Burden of Disease
ICOH - International Commission on Occupational Health
ILO - International Labour Organization
OD - Occupational Disease
OIRA - Occupational Injury Risk Assessment
OSH - Occupational Safety and Health
WRD - Work-related Disease,
WHO - World Health Organization
YLL - Years of Life Lost
YLD - Years Lived with Disability

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