WORKERS' COMPENSATION CENTER

NEW PERSPECTIVES INTO THE PREVENTION OF OCCUPATIONAL DISEASES FROM THE CONNECTING FACTORS OF THE MOST SEVERE CHEMICAL AND BIOLOGICAL EXPOSURE AGENTS

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What are the currently most severe chemical and biological exposure agents? Have there been connecting factors in their manifestation? Could information on these factors be used to improve the current measures taken by different operators to prevent occupational diseases? Based on the results of a thesis written for TVK on the topic, this analysis provides new perspectives into the prevention of occupational diseases.

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CHEMICAL AND BIOLOGICAL EXPOSURE AGENTS HAVE SIGNIFICANT NEGATIVE EFFECTS

Occupational diseases are immensely harmful for employees and entail costs for employers, accident insurers and the society. New and more proactive measures are constantly being explored to improve the prevention and identification of severe exposure agents. Still, the long latencies associated with occupational diseases pose challenges; many of the most serious diseases, such as asbestos-induced diseases, have a long latency, which may cause the symptoms to manifest years after exposure. Moreover, statistics on occupational diseases usually cover only the registered occupational diseases and suspected cases of occupational disease, which does not enable early intervention in the changes occurring in the exposure process. Along with latencies, changes in work tasks or methods may also result in new kinds of exposure. In addition, there might not be sufficient information or risk awareness of the health effects of neither the new nor the already well-known exposure agents present in the working environment.

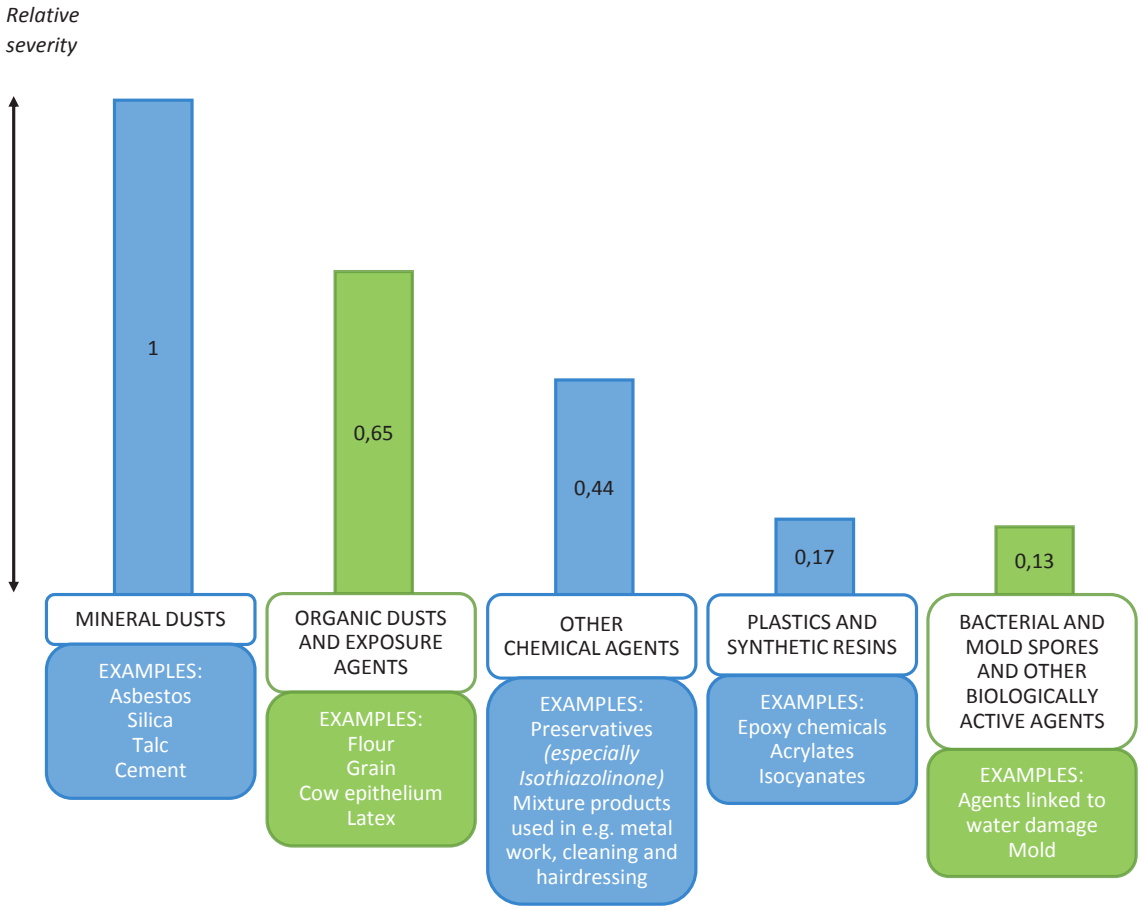
Chemical and biological exposure agents together cause more than half of the cases of occupational disease and suspected cases of occupational disease in Finland. The Finnish Institute of Occupational Health maintains a register of occupational diseases, and the statistics of 2013 show that of the total of 4602 occupational diseases or suspected cases of occupational disease, 2354 (51.2%) were caused by chemical agents and 588 (12.8%) by biological agents (FIOH 2015). Exposure agents can be directly work-related factors, such as raw materials, but also secondary exposure to, for instance, intermediate products or by-products derived from different stages of manufacturing processes may pose risks that are not yet very effectively assessed (Checkoway et al. 2004). Additionally, some exposure agents, such as volatile chemicals or metabolites produced by molds and bacteria, can be emitted into indoor air from building materials used in the working environment.

THE MOST SEVERE EXPOSURE AGENTS INCLUDE BOTH WELL-KNOWN AND UNEXPECTED STATISTICAL GROUPS

Identifying the most severe chemical or biological exposure agent groups can help promote effective targeting of preventive actions against occupational diseases as well as shed light on the current exposure situation. The five most severe exposure agent groups were determined from the registers maintained by TVK (figure 1) by comparing the accident insurers' total compensations and reservations allocated for the different exposure agents. The exposure agents in these groups were determined with the help of literature and interview research. The severity of the different exposure agent groups can be compared using the relative severity rates calculated for the groups from the compensation and reservation totals.

Some of the exposure agent groups are widely recognized as severe, but some of them consist of rather unexpected combinations. As expected, the group of mineral dusts was identified as the most severe group, especially due to asbestos, which still cause exceptionally serious occupational diseases after a long latency. Other two groups known for their severity are organic dusts and exposure agents, and plastics and synthetic resins, especially in connection with occupational skin diseases.

Figure 1. Five most severe statistical groups of chemical and biological exposure agents in 2000–2009. Chemical groups are marked with blue and biological groups with green. The group names are shortened from the official names appearing in the statistics (statistical groups: see TVK Julkaisusarja X/17, liite 1). Source: The Finnish Workers' Compensation Center, statistics on occupational accidents and diseases.

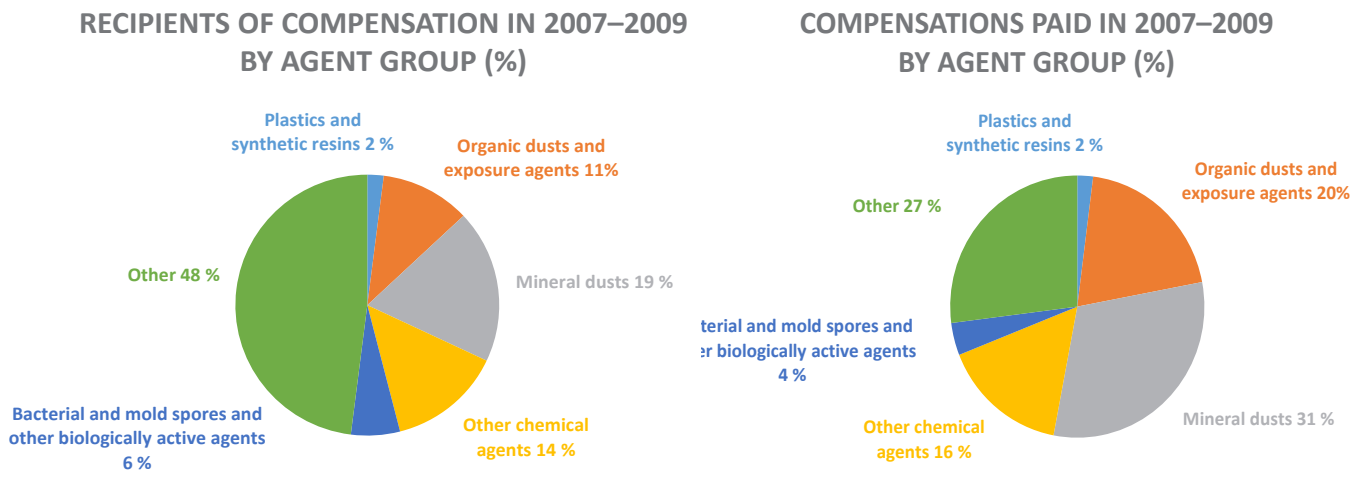


Other chemical agents is a surplus category, which contains records of cases caused by those chemical exposure agents that do not naturally fall into any other category. Research shows that certain chemical agents, such as preservatives and mixture products, usually end up in this category. The results place this exposure agent group, originally intended as the surplus category, among the five most severe groups. This indicates a need to improve the examination and classification processes of multi-factor exposure and exposure to mixtures used especially in risk industries, such as metal work, hairdressing and cleaning, to prevent the different exposure agents belonging to the group from disappearing among the multitude of recorded cases.

The group of bacterial and mold spores and other biologically active agents has often surfaced in connection with diseases caused by exposure to water damage. Still, its place among the five most severe exposure agent groups can be considered unexpected, since the majority of the cases caused by the agents in the group are suspected cases of occupational disease instead of recognized occupational diseases. The determined severity of the group mainly highlights the significance of those agents that cause suspected cases of occupational disease to especially accident insurers, but to other operators as well.

The extent of the harm caused by the most severe agent groups can be estimated by comparing the total compensations and the number of recipients of compensation (figure 2). The data used as the basis for the comparison contained the total compensations paid between the years 2007–2009, with the reservations excluded. 52% of the recipients of compensation and 73% of the paid compensations were connected to the five exposure agent groups under examination, which makes the groups particularly significant both from a quantitative and an economic perspective. The larger percentage of the compensations compared to the percentage of recipients of compensation indicates that the cases have been exceptionally severe, or that they have included, for instance, extensive medical examinations or follow-up care. The severity of these groups is emphasized especially in the case of mineral dusts, but also the agents in the second and third most severe groups, the organic dusts and exposure agents and other chemical agents, cause a large amount of compensations.

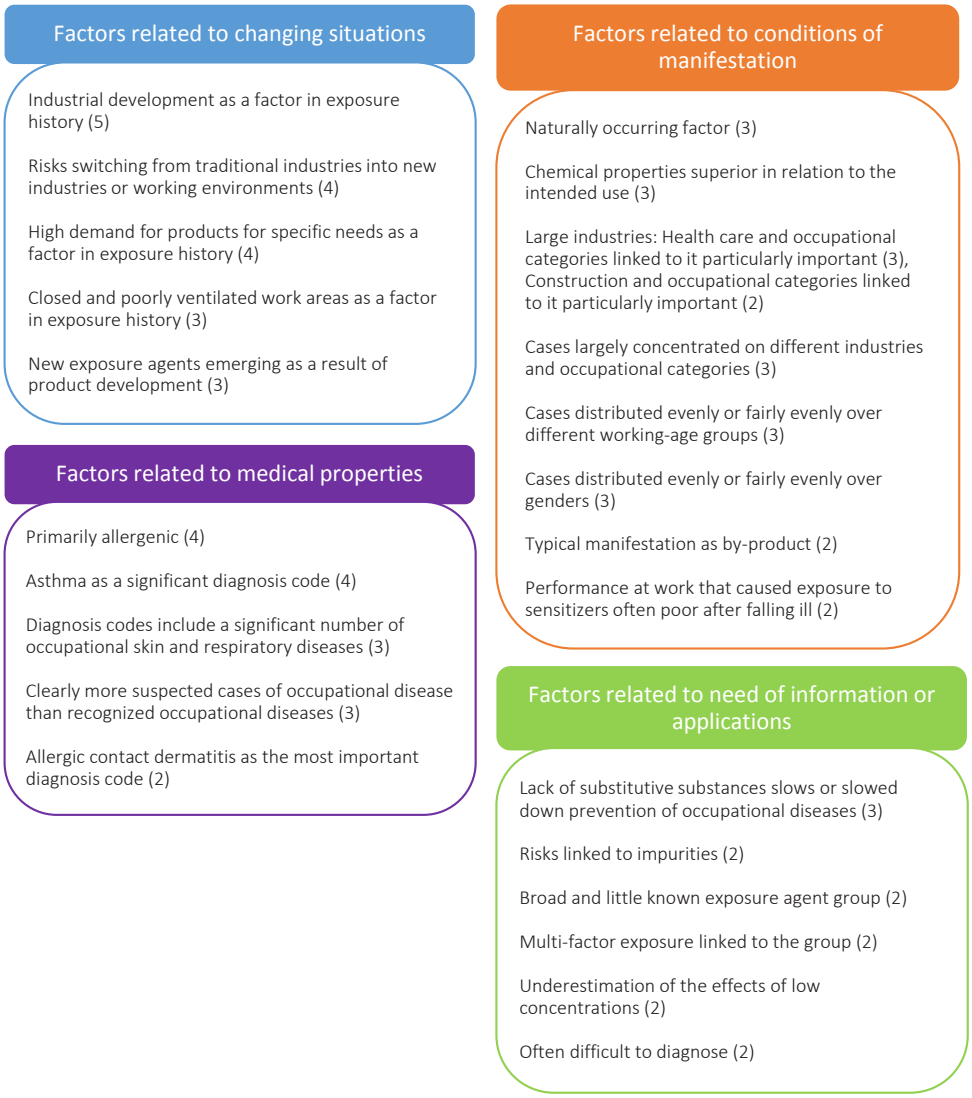
Figure 2. Recipients of compensation and paid compensations for occupational diseases and suspected cases of occupational disease in 2007–2009 by exposure agent group.
Source: The Finnish Workers' Compensation Center, statistics on occupational accidents and diseases.



THE MOST IMPORTANT COMBINING FACTORS LINKED TO INDUSTRIAL DEVELOPMENT

The historical manifestation of the five most severe agent groups was examined by research carried out as a combination of literature, statistical and interview research. The aim of the examination was to identify features and developments related to the properties of the exposure agents, external factors and manifestation of occupational diseases and suspected cases of occupational disease, which could be interesting from the perspective of the prevention of occupational diseases. A comparison was made between the factors related to different exposure agents, which resulted in an account of the combining factors connecting the exposure agent groups (graphic 1). The results show that the most central combining factors are linked to changing situations, and each of them is connected to the majority of the five exposure agent groups. All of the factors related to changing situations are strongly linked to industrial development, which in itself is the single most important factor connecting the exposure agent groups. Besides the risks associated with new exposure agents, additional risks caused by agents already in use were also discovered. Based on the results, these well-known exposure agents may present new kinds of risks, especially when taken into use in another industry or working environment, by means of development of new applications, or in exceptional situations, for instance in the context of quality tolerations due to high demand.

Graphic 1. Combining factors connecting the five most severe agent groups. The number of the groups connected by each factor follows in parentheses (2-5).



Of the factors related to conditions of manifestation, especially the factors that are related to the industries in which manifestation occurs are linked together. This highlights the importance of the exposure agents that are widely concentrated on different industries or on specific large ones, for instance health care or construction, to the prevention of the most serious consequences. Moreover, the research shows that small occupational categories, such as metal work and hairdressing, expose workers to an abundance of exposure agents. In these cases, investigating the multi-factor exposure is challenging due to the small number of employees and the difficulty of classifying the exposure agents. The results also indicate that the natural manifestation of an exposure agent and its superior chemical properties form, especially when combined, a potential sign of an exposure agent that will spread fast to industrial use, which consequently makes the exposure agent more hazardous.

The results present two phenomena emerging from the factors related to medical properties. First, allergenic exposure agents and especially agents causing skin and respiratory diseases account for a large proportion of the most severe agent groups. Second, the most severe group, mineral dusts, is completely different from the other groups, since it does not share any of the factors connecting the agents in the group with the other groups under examination. These observations illustrate the need for the prevention of also those allergenic exposure agents that have typically been considered milder as well as for preventive recognition of the exposure agents that are completely deviant from the typical occupational disease profile.

The main factors related to the need of information and applications concern especially the exposure situations that are difficult to assess; impurities, multi-factor exposure and exposure to chemical mixtures as well as low concentrations. Major needs for application development were found to be creating new replacements for synthetic exposure agents currently in use and developing new work methods as a tool for interrupting the case development of long-term exposure agents.

LONG-TERM RISK ASSESSMENT, MONITORING OF EXPOSURE AGENT SITUATION AND CROSS-INDUSTRY COLLABORATION CRUCIAL FOR PREVENTION

The factors connecting the exposure agent groups were used as a starting point when looking for central means to prevent occupational diseases. Many of the discovered preventive actions are related to anticipatory work supported by research. Based on the results, many Finnish operators were provided with proposals for preventive measures (graphic 2). In addition to operator-specific measures, collaboration between different sectors and the important role of specialists in supporting prevention and risk management are also crucial for effective preventive work.

According to the results, workplaces as well as different organizations participating in the prevention of occupational diseases should focus on the long-term risk assessment, and the development thereof, of new materials to be taken into use. It would also be important to study the former use of industry-switching materials or applications in other industries, and to examine the solutions provided for possible problems linked to their use. In addition, workplaces should adopt an active role and demand safer solutions. Occupational health care, various industry-specific organizations and other operators have a central role in monitoring the developments in work and reporting on possible new exposure agents. Operators carrying out research into, compiling statistics on or monitoring occupational diseases are able to improve risk management with the help of, for instance, research into emerging industrial-scale materials, development of the ways of detecting early signs of them and compiling statistics on them. In addition, research into multi-factor exposure, exposure to chemical mixtures and the corresponding risk industries as well as putting effort into the development of safer materials and work methods are considered necessary.

The original research paper along with a more detailed description of the materials and research methods used (only in Finnish): Tapaturmavakuuttajien kannalta vakavimpien kemiallisten ja biologisten ammattitautialtisteiden yhdistävät tekijät sekä ennalta tunnistaminen. Tapaturmavakuutuskeskuksen julkaisusarja X/17. ISBN: 978-952-68664-1-3. Available at www.tvk.fi/tietopalvelu-ja-julkaisut/tvkn-julkaisusarjat/ (in Finnish)

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The opinions expressed in this analysis are those of the author.

The analysis was completed in February 2017.

Graphic 2. Actions for the prevention of occupational diseases proposed to different operators based on the research results.

SOURCES

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