

# Feasibility study on the development of a computer-assisted telephone survey to estimate workers' exposure to carcinogens in the European Union

European Risk Observatory  
Executive summary

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## Introduction

Cancer is an important cause of occupational diseases and work-related deaths in the European Union (EU). The disease can have multiple causes, and its causes and their interplay are not fully known. However, it is evident that a number of work-related factors contribute to cancer. It is therefore an important task for employers, safety and health practitioners and regulators to reduce or even eliminate work-related factors likely or known to contribute to cancer.

The prevention of work-related cancer has been an important focus of EU activities in the field of safety and health for years. One of the main aims of the Commission's new safety and health initiative launched in January 2017 is 'to better protect workers against work-related cancer'.

It is known that exposure to carcinogens at work contributes to work-related diseases, including various forms of cancer. The European Commission therefore aims to reduce exposure to carcinogens as far as possible.

For effective, evidence-based policy measures aiming to reduce exposure to carcinogens, reliable data on the occupational exposure of workers are an important prerequisite. Against this background, EU-OSHA launched this 'Feasibility study on the development of a computer-assisted telephone survey to estimate workers' exposure to carcinogens in the EU'. The aim of the study is to assess how far a survey among workers could improve knowledge about exposure to carcinogens at the workplace and to investigate what preparatory steps would be required to run such a survey in the EU.

Five research questions (RQs) were raised and will be tackled in this report:

RQ 1: complementarity of the survey with existing sources on exposure to carcinogens

RQ 2: EU-wide availability of the information required to run the survey

RQ 3: achievable level of reliability

RQ 4: comparability of results across countries and over time

RQ 5: preparatory work required for the implementation of the survey.

## Types of agents considered for the study

The International Agency for Research on Cancer (IARC) classifies carcinogens into five groups. The **IARC categories provide an orientation regarding the likelihood that an agent contributes to cancer**, reflecting the current state of scientific knowledge:

group 1: carcinogenic to humans

group 2A: probably carcinogenic to humans

group 2B: possibly carcinogenic to humans

group 3: not classifiable as to its carcinogenicity to humans

group 4: probably not carcinogenic to humans.

For this feasibility study and a potential worker exposure survey, **only agents of IARC groups 1 and 2A will be considered**. For the remaining IARC groups, there is currently not sufficient evidence as regards their carcinogenic potential.

Not all cancer risks emanate from substances. There are a number of different **risk factors for occupational exposure to carcinogens**. The following major groups of carcinogens can be distinguished:

- gases (for example formaldehyde)
- liquids (for example trichloroethylene, mineral oils, hair dyes)
- solids, including dusts and fibres (for example respirable silica, wood dust, asbestos, lead, bitumen)
- fumes (for example diesel exhaust, welding fumes)

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- pesticides (for example DDT)
- pharmaceuticals
- biological factors (for example bacteria, viruses, certain types of fungi)
- physical factors (for example X-rays, solar radiation, ergonomic factors such as sedentary work)
- other factors (for example shift work involving circadian disruption, stress-related obesity, drinking).

### Information needs

To be able to effectively reduce exposure and protect workers against cancer, it is necessary to know more about the nature and dimensions of the exposure. In particular, it is essential to have information on:

- the overall **number (and proportion) of workers exposed** to carcinogens;
- the **types of workers most exposed** to carcinogens (by age, sex, occupational group, etc.);
- the **exposure situations most prevalent at workplaces** in Europe;
- the **carcinogenic materials and agents** responsible for the most prevalent exposure types.

Further issues of interest are:

- How far are affected workers aware of being exposed to carcinogens?
- What is done to protect workers from the exposure and what are the workers themselves doing in this respect?

More knowledge of these aspects would help to prioritise and better target legislative measures, prevention initiatives or awareness campaigns. With regular updates of this information, changes in, for example, the number and type of exposed workers or in the most prevalent agents could be observed.

### Existing data sources

So far, only some EU countries collect information on carcinogen exposure in a reliable and systematic way. Various data sources can be distinguished:

- National exposure registers, information systems or measurement databases fed by data collected from employers or safety and health organisations and authorities;
- national surveys on working conditions, including questions related to cancer;
- national cancer registers;
- registers of occupational diseases.

Because of large differences in, for example, which diseases are recognised as occupational, these national sources are not comparable. Having this type of information available EU-wide in a harmonised form would, for example, allow the identification of best practice examples as well as sectors where the need for action is particularly high.

One of the few existing EU-wide data sources containing information related to the exposure to carcinogens is the **European Working Conditions Survey (EWCS)**, conducted by Eurofound every 4 years. The EWCS is a survey among workers and collects information on a broad variety of working conditions. This includes some information that can be useful for an analysis of the exposure to carcinogens. The **questions** related to these exposures are, however, **mostly rather general, not allowing a clear identification of exposure to specifically carcinogens.**

The **European Occupational Diseases Statistics (EODS)** are another supra-national source of information. The EODS collect data on, among other things, the occupation of the victim and the exposure circumstances leading to the occupational disease, for example cancer.

This knowledge is based on cancer cases and improves knowledge of exposure circumstances likely to lead to cancer. However, there are large differences between countries as regards the recognition of occupational diseases, and not all workers are covered in the EODS. For Germany, Greece and Lithuania, data are even totally missing. Another drawback is that the EODS cannot map the exposure of workers not yet suffering from cancer. Information on their exposure is important because it allows more timely setting up of preventive measures.

In an effort to improve the collection and harmonisation of data, the European Commission, Directorate-General for Employment, Social Affairs and Inclusion, launched **HazChem@Work** in 2014. The set-up and testing of a Europe-wide database with measurement data on occupational exposure to a list of hazardous chemicals was the object of this initiative. So far, the national sources of measurement data on carcinogens differ greatly from each other in terms of the general nature of information, the substances considered, the quality of information and the sources from which the information derived (employers, safety and health institutions, labour inspectorates). The idea was that a harmonised EU-wide register building on the existing national registers could possibly improve this situation. If set up EU-wide according to harmonised standards, HazChem@Work could provide measurement-based information on the number and kind of workers exposed to a broad array of chemical substances, including, to a somewhat limited extent, to carcinogens.

Another possibility to get more and better information on the exposure of workers to carcinogens is the **set-up of a worker survey focused on the exposure to carcinogens**. EU-OSHA's idea of considering setting up such a survey was inspired by AWES-cancer, a worker survey run in Australia on behalf of Safe Work Australia, the Australian government body responsible for safety and health of workers.

## AWES/OccIDEAS: the survey concept in brief

The AWES-cancer survey, conducted in Australia in 2011/2012 among 5,000 workers, is the most comprehensive application of the exposure assessment system OccIDEAS (Occupational Integrated Database Exposure Assessment System), developed by a team of researchers from Curtin University in Australia. Since then, OccIDEAS has also been applied in Malaysia and has been broadened to include further safety and health risk factors such as asthmagens or noise and vibrations.

The basic principles of the OccIDEAS concept are described on the project website ([www.occideas.org](http://www.occideas.org)):

*OccIDEAS is a web-based<sup>1</sup> application which is used to assess occupational exposure in epidemiological studies. It is used to determine whether workers are exposed to various chemical and physical hazards (agents) based on their answers to questions about their work tasks [...]. It provides assessments of the likelihood of exposure to specific agents for each job on an individual basis. The process involves [four] steps:*

- *determining the job category for a person's job*
- *asking a set of questions (a module) about tasks which are specific for that job*
- *automatically assessing exposure to [the] selected agents using preprogrammed algorithms*
- *allowing manual review of those assessments.*

The targeted persons are thus interviewed about their job and asked a number of customised questions related to working tasks performed in this job that can be associated with an exposure to potentially carcinogens. Depending on the tasks actually performed and the protective measures taken when doing them, the likelihood and the degree to which a subject is exposed are estimated on a 3- or 4-point scale<sup>2</sup>:

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<sup>1</sup> Although OccIDEAS is web-based, it has so far been applied not in any online surveys, but only in computer-assisted telephone interviewing (CATI). The term 'web-based' refers not to the survey mode, but to the environment in which OccIDEAS is programmed and made available. For telephone surveys using OccIDEAS, the call centre is linked online to the OccIDEAS questionnaire hosted at Curtin University.

<sup>2</sup> It should be noted that the investigation and assessment of the job history of a person, an essential element of the Expert Assessment Method, is not part of OccIDEAS and the underlying algorithms. The OccIDEAS questionnaire maps only the work currently performed by an interviewee, not the work performed in earlier years. For this, a lot of additional questions would be necessary which in turn would make the survey far too long.

- **probability of exposure** (none, possible, probable) for all agents
- **level of exposure** (none, low, medium or high) for carcinogens.

The amount of wood dust a carpenter is exposed to might, for example, depend on whether he or she used power or hand tools, whether he or she worked indoors or outdoors, whether or not a dust extraction fan was present and whether or not he or she wore a mask. Based on these criteria, the probability and level of exposure are determined. The level of exposure related to a particular task has been defined ex ante, based on previous research in epidemiological studies and the expertise of a team of experts. The overall exposure situation of a person is determined based on the sum of exposures in all tasks that turn out to be relevant to the person.

The OccIDEAS questionnaire provides more than 50 job-specific modules with customised questions about tasks, materials used and possible exposure circumstances. Assigning a respondent's job to the module that fits it best is key for the success of the survey. The module is assigned on the basis of a sequence of two or three closed questions asking about the sector of activity and main characteristics of the person's job. The questionnaire collects free text descriptions of the sector and occupation in addition, which allow ex post coding of the job in accordance with official classifications such as ISCO-08, the ILO classification of occupations.

Exposure data collected with the OccIDEAS instrument can be analysed from three different angles: by **agents**, by **sectors of activity** and by **occupational groups**. Particularly for the last, however, the number of interviews available for the group puts some limits on the analyses. The roughly 5,000 interviews conducted in AWES-cancer were distributed very unevenly over the job-specific modules, with some modules answered by just one worker and others by a few hundred workers. Modules with only a small number of respondents cannot be used for any occupation-specific analyses.

## Information obtainable from a survey based on OccIDEAS

- A worker exposure survey could significantly fill the gaps regarding harmonised information on the number of workers exposed and their characteristics. It can provide representative information on exposure to carcinogens for all kind of work activities or exposure situations.
- The OccIDEAS survey concept is able to map exposure to any cancer risk factor considered in the questionnaire. The current version of OccIDEAS already maps 38 risk factors currently known to be relevant, including UV radiation, diesel fumes, silica, X-rays and shift work.
- A big advantage of a worker survey mapping exposure is its ability to map multiple exposure situations of individuals. Many other sources, such as those based on reporting by employers (HazChem@Work), can indicate the number of exposed persons only for each agent separately.

However, there is some information which is not obtainable from a survey based on OccIDEAS.

- OccIDEAS can map only exposure situations and circumstances that are already known and included in the questionnaire. It cannot map any exposure the researchers were not aware of.
- In its current form, a survey based on OccIDEAS can provide **only very limited information on the frequency and duration of exposure situations**. In earlier versions of the survey concept, questions related to these time dimensions had been included, but they were abandoned because of measurement problems and annoyance on part of the respondents about the length and repetitiveness of the questionnaire.

In principle, the OccIDEAS concept can be augmented by additional questions, thus further enhancing its added value:

- A few questions related to the respondent's overall awareness of carcinogenic hazards at their workplace would allow comparison of data on the real (estimated) risk situation with awareness data, providing hints on where to best target preventive measures.

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- Questions related to barriers to better protection of workers from carcinogenic hazards could also be useful for the prioritisation and targeting of preventive measures.

Thanks to its objective, fact-based questions on concrete tasks and exposure situations, a worker survey based on OccIDEAS is likely to deliver data with a high degree of cross-national comparability. In contrast to many other surveys on working conditions, the data do not depend on the risk awareness and risk perceptions of respondents. The independence of individual perceptions and risk awareness also ensures generally high comparability of the data over time. A limitation to comparability over time is, however, the lack of questions related to the time dimensions of exposures: changes of frequency or duration of the exposure to a carcinogen over time are not visible if the number of affected workers remains stable.

Provided that the survey instrument is well adapted and tested before its large-scale implementation in Europe, the data quality can generally be regarded as high. The only concern in terms of data quality is that low-skilled workers in some jobs might not always be able to provide the requested information accurately.

Although the worker survey would partly deliver similar information to that of HazChem@Work, the different modes of data collection also lead to some substantial differences. A worker survey provides more information on the characteristics of workers, it allows the analyses of multiple exposures and it is able to cover a broad variety of workers, including e.g. also family workers, self-employed or employees of micro enterprises. Likewise, the exposure survey is able to cover all types of agents, whereas HazChem@Work is limited to chemicals. HazChem@Work could in turn provide more information on the frequency and duration of exposure situations and possibly more detailed information on agents and materials. Because of how the data are collected at the national level, these would, however, be less homogeneous and less representative.

### Prerequisites for setting up an EU-wide Worker survey

Before implementation in the European Union, OccIDEAS would have to be thoroughly checked on any need for adaptations. Example research done for two job-specific modules ('farmers' and 'construction painters') indicate that substantial differences between Australia and Europe regarding tasks, agents and materials are rather unlikely. Nevertheless, all questionnaire modules would have to be scrutinised on possible differences. Some jobs and exposure circumstances not relevant to Australia and therefore not included in OccIDEAS might, for example, be relevant to Europe.

The feasibility study has also shown that some agents relevant to Europe are not covered by OccIDEAS and thus need to be added. For this, new questionnaire modules and assessment algorithms have to be developed.

Sources with descriptions of job-specific tasks and exposure circumstances have been identified in the feasibility study. The ISCO-08 job descriptions or the job profiles from the International Hazard Datasheets on Occupations (HDOs) issued by the International Labour Organization (ILO) could, for example, be used for this purpose. In addition, sector-specific experts with good knowledge of tasks, materials and health hazards need to be consulted.

In a further step, relevant differences between the EU Member States need to be assessed for all modules. Although sample research has not shown any major differences between EU countries, this needs to be verified for all jobs and questionnaire modules. If substantial differences exist between EU countries, the questionnaire needs to take account of this.

### Required sample sizes and survey costs

Although national samples of just 1,000 to 1,500 interviews would allow reasonably precise conclusions on the overall exposure situation in a country to be drawn, it is strongly recommended that the survey be launched with a considerably larger sample size in order to allow national analyses by sectors or occupational groups. A good compromise between survey costs and quality requirements would be 3,000 interviews per country.

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Fieldwork for an EU-wide exposure survey conducted with 3,000 interviews per country is estimated to cost roughly EUR 4 million to EUR 5 million, depending on the average interview duration. The cost estimate includes translations and a large-scale pilot of the survey in up to five countries. It does not include the preparatory work for an adaptation of the survey to Europe. This work would have to be done in close cooperation between a European team of researchers and the OccIDEAS team at Curtin University, Perth, Western Australia.

**Table ES1: Required sample sizes, duration and survey costs for different variants**

Variant	Interviews per country	Interviews in total (EU-28)	Average duration (minutes)	Estimated price (2017) (EUR)
1	1,000	28,000	15	2,400,000
2	1,000	28,000	20	2,600,000
3	2,000	56,000	15	3,300,000
4	2,000	56,000	20	3,700,000
5	3,000	84,000	15	4,100,000
6	3,000	84,000	20	4,800,000

The costs relate to a CATI survey with a dual frame sampling approach, that is with a sample including both landline and mobile telephone numbers in a representative way. The dual frame approach will ensure better representation of groups that are usually underrepresented in telephone surveys – for example young, unskilled or migrant workers. For adequate coverage of migrant workers, additional measures such as the offer of multilingual interviewing would be worth considering.

Although OccIDEAS has so far been conducted as a CATI survey only, it is recommended that its implementation as a mixed-mode survey be tested, offering both the telephone and the online (CAWI) mode to respondents. In this way, the applicability of the survey as an online survey could be tested. Most EU countries do not currently have representative address registers listing email addresses of individuals, so a genuine online survey is not an option EU-wide. However, if mixed-mode applications of the survey do not show any significant mode effects, future survey waves could be conducted online in countries where an adequate sampling frame exists for this.

## Final conclusions and recommendations

An EU-wide survey following the OccIDEAS model would be able to deliver highly relevant, harmonised and representative information on the exposure of workers to carcinogens. The fact-based questionnaire concept is largely independent of the expectations and awareness of respondents. The data would therefore have a high degree of validity and cross-national comparability. A thorough adaptation of the survey to the situation in the European Union and the consideration of intra-EU differences in jobs or tasks are, however, essential for achieving high data quality.

The research team recommends the implementation of a worker survey on exposure to carcinogens in Europe, closely following the OccIDEAS concept and adapting it only in details (Scenario 1). OccIDEAS has reached a high degree of maturity, has been extensively validated and is constantly being further improved. The lack of questions related to the frequency and duration of exposure would, however, have to be taken into account in this scenario.

The alternative would be to set up a new exposure survey from the scratch (Scenario 2). This would be a huge task, requiring much higher investments in terms of time and money. The main benefits could be greater resulting harmonisation of job-specific modules with the ISCO-08 classification and the introduction of an additional time dimension. However, these modifications might endanger the practicability of the survey concept by leading to a much larger number of questionnaire modules and to a very lengthy, repetitive questionnaire.



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