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SUMMARY

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In both developed and developing countries, many workers are confronted with adverse working conditions and work-related health problems. These conditions and problems frequently elicit occupational safety and health (OSH) questions in "workers", which in this thesis include employees, self-employed, managers and OSH supervisors. To answer OSH questions and make improvements in practice when needed, workers seek and apply information or advice stemming from education and training, from OSH professionals or from such sources as informational websites, fact sheets, books or practice guidelines. In general, answering OSH questions is a difficult process that requires specific skills and a well-functioning knowledge infrastructure. It is largely unknown whether workers with OSH questions are able to find and apply high-quality information to formulate correct answers to their questions and to realise improvements in OSH practice. The first objective of this thesis is to investigate the OSH information needs and seeking behaviours of workers (Chapters 2.1 and 2.2). Subsequently, we evaluate two strategies that aim to support workers better in finding and applying answers to their OSH questions: online expert networks and user involvement during knowledge product development. Therefore, the second objective of this thesis is to assess whether and how online expert networks can serve as a useful strategy to supply workers with high-quality information and answers complementary to other sources in the OSH knowledge infrastructure (Chapters 3.1, 3.2, 3.3 and 3.4). An online network is an innovative expert advice facility in which workers with an OSH question can easily find and consult one or more experts on their specific question topic. The third objective of this thesis is to explore which user involvement method or methods may be the most appropriate for providing information that can support the development of high-quality knowledge products and implementation strategies that fit the needs of the intended users, i.e., workers (Chapter 4).

Chapter 2.1 includes a questionnaire study on the occupational safety and health questions of Dutch workers and on their motivation to seek information or advice to solve these questions. It shows that up to 70% of Dutch workers may have at least one question related to safety and health at work per year. Such questions often relate to OSH risks, OSH law and regulations or interventions to improve OSH. The results of the studies in both Chapters 2.1 and 3.2 show that a question is often composed of two or more parts. For example, the worker wonders about a specific OSH risk while he or she also wants to know how to deal with this specific OSH risk. Approximately 40% of the workers with an OSH question actively search for information or advice to solve this question. In doing this, many of them turn to Google (51%) or seek advice from an OSH professional in the company (37%) or from persons in their social or professional networks (35%). We found that workers who perceive their OSH situation as poor have

an OSH question more often than respondents with satisfactory or good OSH conditions. From Chapter 2.1, we learned more about what motivates workers to seek information. A worker is more likely to seek information when he or she believes that solving the question is beneficial or that not solving it is dangerous (OR 2.8; 95%CI: 1.8–4.5), has negative emotions such as fear, stress or anger about the OSH issue (OR 1.8; 95%CI: 1.1–3.0) or is actively encouraged to seek information, for example by a spouse, friend or colleague (OR 1.8; 95%CI: 1.0–3.0). Remarkably, only 50% of the workers who seek information in these facilities indicate that they find the information or advice for which they were searching. Findings from our study presented in Chapter 3.3 suggest that most of the answers that workers find when using common information sources (generally a mixture of information websites) may be incorrect. We believe this may especially be the case for relatively complex OSH questions.

Chapter 2.2 presents a narrative literature study in which we further explore the challenges workers face in the steps from having an OSH question to finding and applying the answer. This chapter shows that many workers may lack the skills, experience or motivation to formulate an answerable question, seek and find information, appraise information, compose correct answers and apply information in practice. At the same time, the available knowledge infrastructures also seems insufficient to support workers in finding complete and correct answers. These findings suggest that further development of the infrastructures is required to support workers in finding answers more easily. In Chapter 2.2, we recommend three potentially attractive strategies: (1) providing courses in which workers learn to ask answerable questions and to find, appraise and apply information, (2) developing online tools or facilities that support workers in completing one or more stages in the process from OSH question to answer, such as online expert networks or other types of expert advice facilities and (3) tailoring information and implementation strategies to the needs of the workers to ensure that the information can be applied more easily in practice. In this thesis, we focused on online expert networks (Chapter 3) and on tailoring information and implementation strategies to the needs of practice by user involvement during development (Chapter 4).

In **Chapter 3.1**, we describe the development of the free-of-charge online OSH expert network ArboAntwoord (www.arboantwoord.com), which is a network for workers with OSH questions. ArboAntwoord includes a network of 80 highly qualified experts, each with expertise on a specific OSH topic. In this chapter, both usability and applicability are assessed prior to its implementation in practice. We observed and interviewed several users while executing eight tasks that involved important features of the network. The users were potential questioners and participating experts. Most features

of the online network were usable, although several could be improved. Most tasks were executed effectively. Some tasks, such as searching stored questions in categories, were not executed efficiently, and participants were less satisfied with the corresponding features. Participant recommendations led to improvements. Potential questioners indicated that ArboAntwoord could be an applicable tool for OSH information; other questioners preferred to also consult a familiar expert. The tool was stated to be especially applicable for non-urgent health problems and for assembling additional information or a second opinion. Participating experts noted that a network might facilitate observing new OSH trends and might stimulate contact between workers and OSH experts. Participants in this study mentioned hosting and support by a trustworthy professional organisation, anonymity and timely answers as important requirements for use. The experimental network was launched in a small-scale campaign in October 2008.

In **Chapter 3.2**, we evaluate the quality of answers that qualified experts provided in two online OSH networks; the online network ArboAntwoord and the Helpdesk of the Netherlands Center for Occupational Diseases. A random sample of 600 answers was assessed with a nine-item answer quality checklist that we developed from the literature. The checklist had a high inter-rater reliability. In general, the measured quality of the answers provided by the experts was high in both networks. The quality of the given answers was independent of the job function of the questioner (workers vs. OSH professionals) and the affiliation of the expert (university vs. non-university affiliated). We found that answer quality increased substantially when more than one answer was provided (OR 4.9; 95%CI: 2.7–9.0). Approximately 90% of the answers in both networks were sufficiently relevant, objective, readable and polite, and did not contain excessive, redundant or unnecessary details. Nonetheless, approximately 30% of the answers was determined to be too concise, lacked sufficient information to answer every aspect of the question or included insufficient references and sources. Finally, we assessed whether the answers were evidence-based by asking a group of reviewers to perform evidence searches on a random sample of questions and answers. Although more than half of the answers in both networks were in complete agreement with the best available evidence, imperfections such as not providing additional elements to an answer or having a slightly different focus in an answer, led the answers to be classified as being in partial agreement. Overall, 86–93% of the answers in both online networks were in partial or complete agreement with the best available research or practice evidence.

Chapter 3.3 further reports on whether workers could find correct, evidence-based answers *with* or *without* using an online expert network. This chapter describes a quasi-experimental study in which two groups of workers were randomly provided with two

standardised OSH questions from a pool of 16 standardised questions. The experimental group was asked to solve these questions using the online expert network ArboAntwoord; the other group could use all common information facilities available to them. We evaluated which group was able to find correct, evidence-based answers more often. The differences between the results in both groups were substantial. We found that workers who used the online expert network found a correct answer significantly more often (62%) than the group of workers who used other sources of information, which generally included online information found through Google (19%) (Rate Difference 43%; 95%CI: 30%–54%). This effect was independent of the difficulty of the question (easy vs. complex), the topic of the question (OSH content vs. OSH laws and regulations) and the structure of the question (single vs. double question). The standardised questions included one main answer conclusion on the main question that could be answered with "yes", "no" or "possibly". A subgroup analysis showed that the rate of correct answer conclusions in the group who used the network was significantly higher (90%) than in the group of workers who used other sources of information (61%) (Rate Difference 29%; 95%CI: 19%–40%).

In **Chapter 3.4**, the experiences of the questioners and the potential impact of online networks on workers are explored. Over a two-year study period, a web-based questionnaire was sent every three months to every (new) user who asked a question in the previous 90 days. In total, 851 questions were received from 460 questioners. The response rate of the questionnaire was 45%. Although there was room for improvement, the findings show that 71% of the questioners was satisfied overall with the ArboAntwoord network. Most questioners perceived ArboAntwoord as user-friendly (81%), easily accessible (75%) and easy to handle (67%). The majority judged the information received as complete (69%) and applicable (70%), and almost all questioners indicated that they received information on time (84%). The overall satisfaction of the questioners was most strongly associated with the applicability of the received information to the specific context of the question(er) (OR 16.0; 95%CI: 7.0–36.4), although the completeness of information (OR 3.0; 95%CI: 1.3–6.8) and the user-friendliness of the network (OR 3.3; 95%CI: 1.3–8.6) also influenced satisfaction. The received information often had an impact on the questioners. For 74% of all questioners, the information increased their knowledge and understanding of the OSH topic. Of all questioners, 67% had the intention to actually apply the information to their work situation. For 25% of the questioners, the information changed their work, work functioning or health. Our findings indicate that information provided often had an impact beyond the individual level of the questioner, mostly on working conditions at the company level.

In **Chapter 4**, we explore which user involvement method may be most appropriate for providing information useful for developing new high-quality knowledge products and implementation strategies that fit the needs of intended users. We compared three common involvement methods (i.e., focus groups, interviews and questionnaires) in an on-going scientific study aiming at developing a genetic test for the susceptibility to hand eczema for student nurses. In this context, it was determined that all three methods revealed barriers and facilitators that could potentially influence the use of the genetic test. Interviews with the intended users were most efficient in revealing barriers and drivers for using a new genetic test, followed by focus groups and questionnaires. On average, interview participants produced approximately two times more relevant barriers or facilitators per participant than focus groups and three to four times more relevant barriers or facilitators compared to questionnaires. After data-saturation, the focus groups yielded a similar output as interviews, while questionnaires provided significantly less relevant barriers and facilitators.

In **Chapter 5**, the final part of this thesis, we summarise and discuss the main findings. Recommendations for future practices and research are provided. It is clear that while many workers have OSH questions, their information-seeking behaviours and the OSH knowledge infrastructure are often insufficient to provide them with complete or correct answers. This thesis illustrates that there are many good reasons to assume that workers with OSH questions need and appreciate more support in the process from question to answer. Despite several good initiatives, neither employers nor authorities live up entirely to their responsibility of providing workers with high-quality information, consultation and training on OSH. In addition, nowadays, many employers, health providers, knowledge institutes and governments choose to offer OSH information through websites. Our findings show that simply providing online information without considering the barriers for workers is not effective for answering workers' questions. Which topics of questions or which groups of workers would require more support than others, needs more study.

Workers, employers and governments can all benefit from providing high-quality information and advice on safety and health at work. Moreover, incorrect answers to workers' OSH questions may lead to serious safety and health problems and increased costs. Findings from the studies presented in this thesis show that workers who consult qualified experts in advice facilities or online networks will find better answers than workers who use more common information-seeking strategies, mainly a mixture of informational websites. Online expert networks have the potential to improve safety and health at work, against relatively low costs, especially because the information provided often has an impact beyond that of the individual questioner. Methods or

tools that encourage the dialogue between questioner and expert can contribute to further improvement of online expert networks. Combining network features with popular new mobile or computer application software should be stimulated to further increase the accessibility and usability of an online expert network. Online expert facilities and other strategies aiming at supporting workers in the process from OSH question to answer deserve more attention and careful evaluation published in international peer-reviewed journals. Impact evaluation studies on the effects of high-quality OSH information and advice on work, work functioning or health are recommended.