From question to answer: information for workers on occupational safety and health

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CHAPTER 2.2

CAN WORKERS ANSWER THEIR QUESTIONS ABOUT OCCUPATIONAL SAFETY AND HEALTH: CHALLENGES AND SOLUTIONS

ABSTRACT

Many workers have questions about occupational safety and health (OSH). Answers to these questions empower them to further improve their knowledge about OSH, make good decisions about OSH matters and improve OSH practice when necessary. Nevertheless, many workers fail to find the answers to their questions. This paper explores the challenges workers may face when seeking answers to their OSH questions. We argue that many workers lack the skills, experience or motivation to formulate an answerable question, seek and find information, appraise information, compose correct answers and apply information in OSH practice. Simultaneously, OSH knowledge infrastructures insufficiently support workers in answering their OSH questions. This paper discusses several strategies for developing and improving OSH knowledge infrastructures: (1) providing courses that teach workers to ask answerable questions and to train them to find, appraise and apply information, (2) developing ICT tools or facilities that support workers as they complete one or more stages in the process from question to answer and (3) tailoring information (i.e., the proposed changes to OSH practice) and implementation strategies to the workers' needs and context to ensure that the information can be used and applied to OSH practice more easily.

BACKGROUND

Many workers and companies have questions and concerns about occupational safety and health (OSH) [1-4]. Answers to these OSH questions may empower self-employed workers, employees, trainees, volunteers, supervisors and managers (referred to as "workers" from this point forward) to improve their knowledge or understanding, make good decisions about OSH matters, and improve safety and health at work when necessary [5-11]. To answer questions and make improvements in practice, workers seek and apply information or advice from OSH professionals, from education and training opportunities and from such sources as informational websites, fact sheets, books or practice guidelines [2,12-14]. Several studies suggest that the information-seeking behaviour of workers, and the available information sources frequently fail to produce answers to workers' OSH questions [1-4,14]. Answering health questions is a difficult process that requires specific skills or health literacy [15-17]. Currently, little is known about the challenges workers may experience when seeking answers to their questions or making changes to their OSH practice.

We believe that the five steps of evidence-based practice (EBP), developed to help health professionals use high-quality scientific information to answer their practice questions, may also be useful for describing the challenges workers face when answering their OSH questions (Figure 1) [16,18]. These stages are as follows:

(1) The worker needs to formulate an answerable OSH question;
(2) The worker needs to seek, find and select information in OSH information facilities;
(3) The worker needs to appraise information for reliability and applicability;
(4) The worker needs to formulate a correct answer by integrating information with personal expertise and a specific context;
(5) The worker may need to apply the information to actually change OSH practices.

The main aim of this paper is to explore and describe these five stages more thoroughly and discuss the potential challenges workers can face during the answer-seeking process. The second aim is to explore potential strategies that may overcome some of these challenges. Where possible, we provide relevant literature and key publications. In this paper, we will use the terms "information", "advice" and "knowledge" (products and tools) as synonyms, although we are aware that these terms may have different connotations. We use these words as umbrella terms for meaningful data that help to answer a question, e.g., a fact-sheet about a particular OSH risk or a potential change, product or intervention to overcome this risk.

Throughout the paper, we will use an example case to illustrate the challenges a worker may face in completing any of the five stages.

Jack, a 33-year-old man with a medium-level education, works as a printer in a medium-sized copy centre with 75 employees. The company has 40 large copy machines that make approximately 600,000 prints a day. He and some colleagues are concerned that toner from the photocopiers and printers may be dangerous to their health.
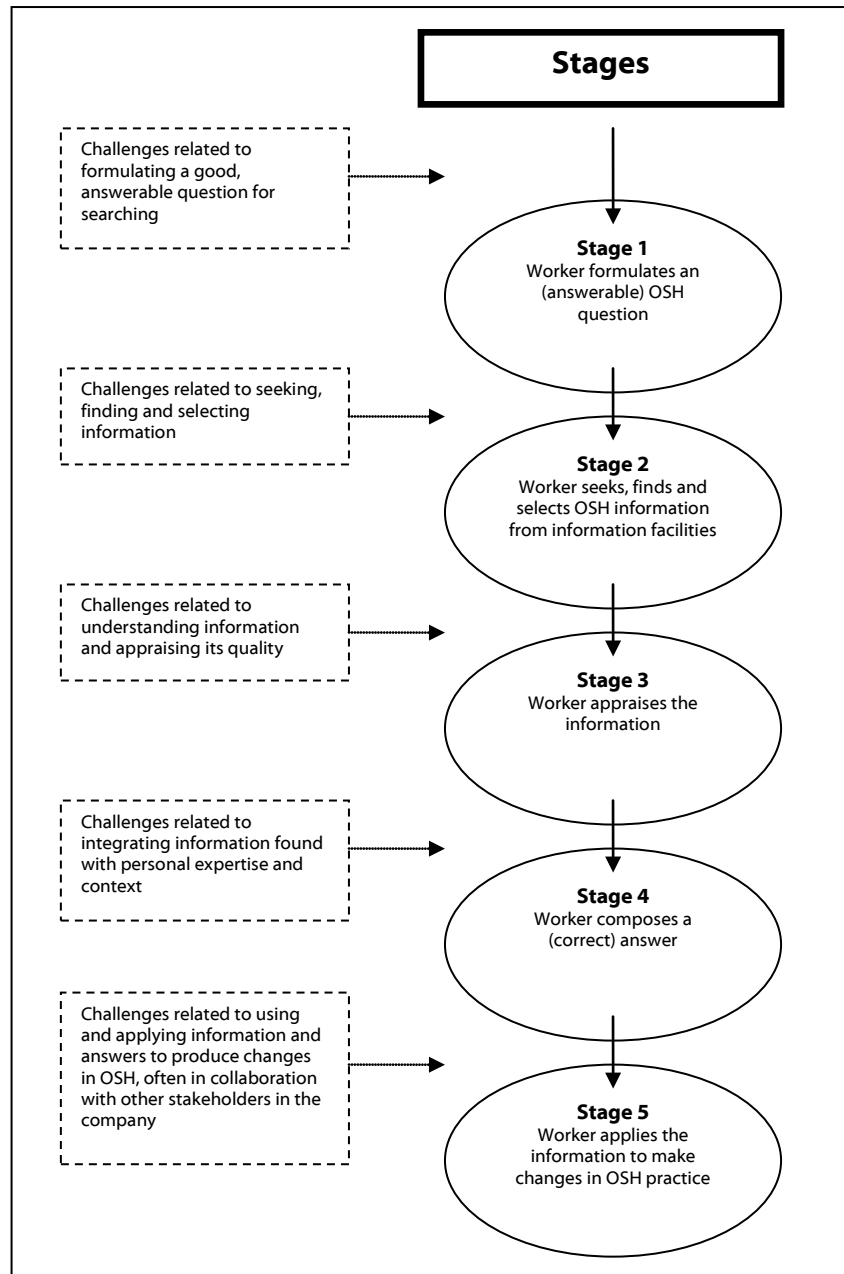
Figure 1 Conceptual stepwise model that describes the five stages in the process from asking a question to applying its answer in OSH practice. The model also illustrates the challenges workers might face at each stage.

STAGE 1

Formulating an answerable OSH question

Despite considerable progress in a number of countries and sectors of industry, many workers are still exposed to serious health and safety risks at work, and many experience disabling work-related health problems [19-22]. These adverse working conditions and health problems often elicit questions and concerns from the workers [1-4,12,14]. Workers' question topics are diverse and range from exposure to chemical risk factors to empowerment from ergonomics to health and safety legislation or how to continue working with diabetes.

To gain insight into workers' information-seeking difficulties and solutions, it can be useful to study how health professionals deal with the problem of formulating and solving health-related questions. Formulating a good, "answerable" clinical question is one of the most important and difficult elements health professionals face when practicing evidence-based medicine [16,18,23,24]. In EBP, answerable clinical questions are often created by specifying and narrowing down the question with the population, intervention, control and outcome (PICO) search terms strategy to perform an adequate literature search [18]. Because health professionals require extensive training to formulate a specific question, it is likely that workers will have difficulty generating good, answerable OSH questions. Moreover, workers will mostly not be familiar with the topic of their question or with the related medical and technical terminology [14,25,26]. As a result, they may need some support when formulating their OSH question. Currently, it is unknown whether workers are able to narrow their OSH problems to a specific, answerable OSH question.

Jack is concerned: "Several people in my company have concerns about the potential danger of toner from our photocopiers and printers. Are there any risks to my health? And if so, what may be an effective solution to this problem?"

STAGE 2

Seeking, finding and selecting information

What motivates workers to seek for information or advice? Wilson et al. [27] developed and evaluated a general model of information-seeking behaviour, based particularly on the stress-coping theory [28] and the risk-reward theory [29]. This frequently cited model includes numerous factors that can motivate or hinder the information search, including cognitions, beliefs, attitudes, emotions, the social environment, self-efficacy and such background characteristics as gender, age and educational level [30-34]. In one of our own studies, we learned that Dutch workers' information seeking was

particularly motivated by thoughts about the personal benefits or costs of solving the question, negative emotions that accompany the question (e.g., fear or anger) and encouragement by persons in the workers' social environment (e.g., a spouse, friend or colleague) [14]. More international studies are needed to further determine the factors that motivate or discourage workers in this respect.

Although Jack is a proactive man, he has been thinking about this problem for weeks. One day, during lunch, he and two colleagues discussed the issue again. This time, they talked about the risks of toner causing cancer. His concern increases and he decides to look for information on the health risks when he comes home.

Theoretically, workers can find their information in various facilities, sources and services provided by their regional, national or international OSH knowledge infrastructure [13,35]. The sources and facilities belonging to this infrastructure offer workers easy access to the available high-quality information through the following: (1) information or knowledge products, such as fact sheets or practice guidelines provided by (virtual) libraries or high-quality websites, (2) education and training provided by specialised OSH experts or by the workers' own company and (3) professional advice from occupational physicians or other occupational safety and health professionals [13,35,36].

There is some evidence that the internet and company OSH professionals are workers' most common sources of information [2,7,12,14]. Professionals are trained to solve complex OSH questions or issues. They can perform diagnostic or environmental assessments and can instigate concrete health care interventions. OSH professionals are contracted directly or indirectly by the employer [36,37]. This situation might raise a problem, as some workers may believe that these professionals have a possible conflict of interest and may be inclined to take the employer's side [38]. As a consequence, some workers may prefer to seek advice from independent professionals with expertise on specific OSH topics. However, the consultation of independent (external) experts can be hampered by restricted access, high costs and a lack of contextual information [39].

Jack does not want to primarily contact the occupational physician affiliated with his company. He thinks that the physician is inclined to take his employer's side and will not provide valid information. There is no one else in the company or in his personal network with expertise on the topic. He thinks calling his general practitioner for an issue that demands specialised advice is not a feasible option.

For many individuals, the internet is an increasingly important source of health-related information [2,7,14,40,41]. Using such online literature databases as PubMed, the Cochrane Library, or the National Guideline Clearinghouse (USA) that provide access to research articles, systematic reviews or evidence-based professional guidelines is

generally not a good option for workers. Articles, reviews and guidelines are generally not easy accessible to workers and are difficult to read and understand. It is likely that workers will start their online search using a common search engine (e.g., Google or Yahoo) that facilitates selecting and managing relevant informational websites [2,14,41]. The internet offers great advantages but also has several disadvantages. First, the internet provides access to overwhelming amounts of information. Therefore, it is preferable to use specific search engines and exploit a number of well thought-out search terms that lead to relevant information. Several studies have shown that non-health professionals use too few search terms and open only the first few results displayed by common search engines [42-45]. Another problem can be the time needed to perform an extensive information search [14,23,46]. Workers may encounter several challenges in seeking, finding and selecting information. More research is needed to assess how workers realise this stage and which challenges they face.

Back at home, Jack turns on his computer and opens his browser to Google. He first types "Printer" and "Health" and finds 300 million results. With "Photocopier" and "Health", Google provides 2.9 million results. "Toner", "Health" and "Risk" results in 1.2 million hits and "Toner" and "Asthma" 1 million results. Finally, he uses the terms "Toner" and "Cancer" which reveals 1.3 million possibilities. Although he feels a bit discouraged by the number of hits, he decides to investigate the first few results.

STAGE 3

Appraising information

To appraise information, it must first be understood correctly. This is a problem for many workers, as most medical, technical and scientific information is difficult to read, especially for workers with low education levels or without knowledge of medical, technical or scientific terminology [25,26]. Another obstacle is the actual appraisal of the information's reliability. In line with the EBP approach, reliable information can be seen as information that corresponds with conclusions or recommendations based on the best available evidence from research and practice [16,18]. Research has shown that the reliability, not only of the information found on internet [47-50], but also of professional advice, may vary substantially [51]. This becomes problematic when information seekers do not (correctly) appraise the quality of the information. One of our studies suggests that workers in general cannot critically appraise the information they find [52]. Fox [53] concluded that 75% of American health-information seekers do not consistently check quality indicators, such as the source and the date of health information they find online. Eysenbach & Kohler [42] found that most people do not judge the quality of a website by checking out its owners or reading its disclaimers. Although more research is needed, workers seem to need help with finding high-quality OSH information or appraising the quality of the information they find.

The first Google result is a sponsored link to a company selling cartridges. Jack has to try the second link, which refers to a question asked in a web forum or expert facility with anonymous experts. The expert refers to a trustworthy website that mentions that carbon black can cause lung cancer. The amount of useful information provided on the second website is limited and thus he returns to the search results. The third Google result is a link to Yahoo!Answers, where a similar question is asked. The expert answering the question states: "IARC (the International Agency for Research on Cancer) has classified toner as a Group 2B carcinogen". This expert says that one experimental study in animals showed that carbon black can cause cancer in rats. Jack is starting to get worried again, especially after opening the fourth trustworthy result: a Wikipedia page on laser printers. This page mentions that, depending on particle composition and exposure, a printer may cause "respiratory irritation or more severe illness, such as cardiovascular problems or cancer". Other potentially dangerous substances, such as styrene, xylenes, ozone and pentanol are mentioned. Jack is not familiar with some of these terms, and it would take him a lot of time to look up the risks of these individual substances.

STAGE 4

Composing a correct answer

Composing a correct, evidence-based answer to a context-specific OSH question from the information found often requires skills. Again, this process is comparable to the EBP paradigm, which involves the integration of three essential elements into the answer formulation process: (1) professionals' expertise and experience, (2) the patients' (workers') needs, expectations, preferences and context and (3) the best available research evidence [16,18]. Workers do not possess the OSH experience and expertise (e.g., about exposure levels and measurement protocols) that are needed to compose an answer. Some evidence suggests that workers indeed have difficulties composing their answers [14,45]. In our recent questionnaire study of 500 Dutch workers, almost half of the respondents searching for information mentioned that they could not find the answer they were looking for because they had difficulty applying information to their specific question [14]. More research is needed on how workers compose their answers, especially on how they integrate the information they find into their specific context.

Jack has found a lot of information on the potential dangers of ink and toners. Jack believes in the accuracy of Wikipedia, so there must be a good chance that working unprotected can cause cancer. Nonetheless, he does not know the composition of and exposure to the used ink and toners in his own company. Jack concludes that he should share his findings with his colleagues and boss. He collects all the information and writes a short letter highlighting the possible dangers. He proposes an evaluation of the health and safety risks and refers to several precautions that could be taken to prevent the risks.

STAGE 5

Applying information in OSH practice

The last stage, the actual application of high-quality information and answers in OSH practice, is a complex and time-consuming process [54-58]. It often requires changes in the beliefs, culture, behaviour, practices and policies of different stakeholder groups, such as management and OSH professionals [57]. Several aspects have been shown to facilitate or hinder the application of information into practice. These aspects are related to the following: (1) the actual content of the proposed change, solution or intervention, (2) the context of the change and (3) the implementation strategies used to realise the proposed change [59-61]. For example, the proposed change is less useful to the worker if it interferes with his work process, if management finds it too expensive or if colleagues are not efficiently instructed or motivated about how and when to use the proposed change. Table 1 presents an overview of potential challenges workers may face during each of the five stages of the process from formulating a question to applying its answer to OSH practice.

It takes Jack a while to convince his supervisor about the possible dangers of the situation. The supervisor first presents Jack's information to his human resource (HR) manager who, after some insistence, introduces the information to management. Subsequently, the company's occupational health service conducts an investigation and evaluation of the health and safety risks. The results of the health and safety evaluation show that the emission of carbon black is high and that local exhaust ventilation in the floor may be needed to provide sufficient protection. Nonetheless, an expensive ventilation system that costs 50,000 Euro is not considered a feasible option for the company. Therefore, management decides to provide workers with respirators, which is a more affordable option. Because Jack believes these masks might not protect the workers adequately, he decides to notify the workers council and the trade union.

Table 1 Overview of challenges workers may face during each of the five stages in the process from asking a question to applying its answer in OSH practice.

Stages	Potential challenges
(1) Formulating answerable questions	o Unfamiliarity with the question topic o Inability to specify the question
(2) Seeking, selecting and finding information	o Lack of motivation to seek information (e.g., no urgent situation, no encouragement to seek information) o Lack of time to seek information o Inability to compose a good search strategy (e.g., not knowing relevant information sources, using only a few search terms, opening only the first results presented by common search engines) o Challenges related to (thoughts about) information facilities (e.g., untrustworthy and biased experts, inaccessible experts, experts with high consultation costs, inconvenient amounts of information presented by the internet, questions about the reliability of the internet)
(3) Appraising information	o Inability to understand information (e.g., understanding medical, technical or scientific terminology) o Inability or lack of motivation to appraise the reliability of information (e.g., not checking the source or date of information) o Challenges related to the actual reliability of information facilities (e.g., information provided by the internet or by professionals is often unreliable)
(4) Composing correct answers	o Inability or lack of motivation to interpret and combine several pieces of information or to combine this information with several contextual aspects o Inability to apply information to a specific question
(5) Applying information in OSH practice	o Challenges related to the content of proposed changes or solutions in OSH practice (e.g., the particular change is not useful or is too complex for the worker) o Challenges related to the context to which a proposed change is to be applied (e.g., the proposed change is too expensive according to management) o Ineffective methods are used to implement the proposed change (e.g., ineffective worker education or motivation)

STRATEGIES TO SUPPORT WORKERS

Supporting the stages from question to answer

Workers face several challenges when answering their OSH questions and implementing changes in OSH practices (Table 1). We suggest two main strategies for supporting workers in the stages from question to answer: (1) providing education and training and (2) developing information and communication technology (ICT) tools or facilities.

Like traditional evidence-based practice courses provided to professionals [16,18,62], courses that aim to teach non-health professionals to formulate answerable health questions, find and appraise information and compose answers seem an attractive strategy [49,63]. Even if workers only occasionally have one or two OSH questions [14], our current online information era makes the further study of this educational strategy worthwhile. Workers may use this EBP course knowledge for other health questions as well.

A second strategy to help workers in the process from question to answer is by providing them with supporting (online) ICT tools or facilities. One such tool is an online question builder. An example of this is provided by the Agency for Healthcare Research and Quality. It helps patients formulate answerable questions when communicating with their doctors (www.ahrq.gov/questions/qb/). Furthermore, independent, non-commercial online libraries, depositories and portals may provide workers with useful, high-quality information (e.g., www.hse.gov.uk/, www.arboportaal.nl/onderwerpen or www.cdc.gov/NIOSH/). These may include fact sheets, decision aids, learning materials, guidelines, research summaries for practice and good practice guidelines developed for specific user groups. To guide workers to relevant information, software developers should create intelligent search engines that facilitate finding information. Search engines may especially focus on information quality and usefulness. An attractive method for providing easily accessible, high-quality information is by frequently asked questions and answers (FAQs). An example of this strategy has been developed by the Canadian Center of Occupational Health and Safety (www.ccohs.ca/oshanswers/). Thousands of OSH questions and their answers can be accessed online.

Another attractive option is an online or telephone OSH expert service. Such services may support workers in the first four stages. OSH experts are supposed to be able to provide workers with high-quality tailored information and advice, especially when they are trained in evidence-based medicine and practice [23,24]. Recently, similar services have become available in several countries, including Canada, Scotland, Norway, Germany and the Netherlands [1,3,4,64,65]. Telephone expert services provide workers with information and advice directly and offer the opportunity for a dialogue between workers and OSH experts. This may be especially useful for formulating relevant and answerable questions. Another possibility for providing expert service is an online expert network [65-68]. Online networks may help workers contact several OSH experts with expertise in different OSH issues (www.arboantwoord.com). Online expert networks support the storage and reuse of information and answers. A similar tool can support the question-asking and answering process by sending an email notification to the expert (when questioned) and the questioner (when answered). This

technology has also been applied in such organisations as Boeing, ABN AMRO Bank and Philips [68].

An advantage of online tools in general is that they are easy to access, especially by using such recent mobile technology developments as smartphones and tablet PCs. Innovative application software (an "App") may further increase the accessibility and usability of high-quality information [69]. Future research could compare the effectiveness of new strategies with common information sources in terms of their rate of correct answers and impact on workers knowledge, perceptions, decision-making or actual changes in OSH practice.

Supporting the application of answers to OSH practice

Sometimes, the information workers find can directly improve their OSH-related knowledge or OSH practice. More often, substantial changes in OSH practice must be organised and accomplished in collaboration with or organised separately by other OSH stakeholders in the company, i.e., the employer, manager, HR professional or OSH supervisor [36]. A worker can present his or her information and the corresponding OSH practice changes to the responsible stakeholders, who will take the lead in implementing these changes.

Many theories and models exist that aim at facilitating the application of information [55,57,59-61,70,71]. The theory of diffusion of innovations [61] and the framework for participatory ergonomics (for reducing the burden of work-related musculoskeletal disorders) are among the important and frequently used models in the OSH field [55]. A new, upcoming model is the knowledge-to-action framework developed by Graham et al. [70]. Using a systematic review of action theories and knowledge application frameworks and models, Graham et al. created a framework specifically for promoting the application of high-quality research information in healthcare practice. The authors identified several actions essential to the application of quality information. These actions, which can take place in sequence or simultaneously, are:

(1) Assess the actual problem and select information (i.e., potential changes, solutions or interventions for OSH practice).
(2) Adapt to the local context.
(3) Identify barriers to the use in practice.
(4) Develop and tailor the implementation strategies.
(5) Monitor the actual use in practice.
(6) Evaluate the outcomes of use.
(7) Sustain the use.

In general, realising these actions requires tailoring information and implementation strategies to the needs of both the intended users and the context. Research suggests that tailoring information and implementation strategies is beneficial to the application in practice [72-75]. Involving different stakeholder groups, in particular the intended users, is essential for this tailoring process [57]. Although the knowledge application framework of Graham et al. [70] is largely analytic in nature, this way of framing may also be useful for OSH, in which knowledge application projects will probably be led by HR managers or OSH professionals working in or for the company. For example, the leading OSH professional should collaborate with all stakeholders, particularly the workers, who can identify the specific problem, help to recognise specific barriers and tailor the implementation strategies [73,76-78]. Future research may focus on further refining and validating this framework for the OSH field.

CONCLUSIONS

Although many workers have OSH questions, they may often lack the skills, experience or motivation to formulate an answerable question, seek and find information, appraise information, compose correct answers, or apply these answers in OSH practice. Simultaneously, OSH knowledge infrastructures insufficiently support workers in answering their OSH questions. Because a good OSH knowledge infrastructure aims to provide workers with high-quality information and training facilities, further development of these infrastructures seems necessary. Attractive strategies could include the following: (1) educating workers in formulating answerable questions and finding, appraising and applying information in a way similar to that of evidence-based practice courses developed for professionals and (2) developing ICT tools or facilities that help workers complete one or more stages in the process from OSH question to answer. An example of such a facility is an online network of OSH experts providing workers with answers. Finally, tailoring information and implementation strategies to workers' needs and context is likely to facilitate their use and application in OSH practice. This requires the collaboration of all stakeholder groups in the company, including workers. Both the challenges workers face in the OSH question-to-answer process and the effectiveness of the strategies described in this paper require further study.

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