Managing knowledge in occupational health care
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Chapter 10

General discussion
This chapter first discusses the main research findings of the studies included in this thesis related to our two study objectives: to explore in what way knowledge infrastructure facilities can support the evidence-based medicine (EBM) practice of occupational physicians (OPs); and to determine the effect of continuing medical education (CME) interventions on the implementation of EBM with the ultimate aim of enhancing the professional performance of OPs. Secondly, the chapter continues by explaining methodological issues. Following on from this, the implications of the research findings will be discussed. Finally, recommendations for further research for occupational health (OH) practice and the final conclusions of this thesis will be presented.

**Main findings**

**Knowledge infrastructure**

An adequate knowledge infrastructure can facilitate OPs in practising EBM, because the variety of relevant topics for OPs is wide, and available specialized knowledge is mostly not easily accessible. A clear overview of the facilities of the knowledge infrastructure in the OH field can be supportive, but it is difficult to organize the knowledge infrastructure in a convenient way. To meet our first objective, it was necessary to first describe how the knowledge infrastructure in the OH field can support evidence-based practice. Furthermore, meeting our objective required a clear overview of those facilities in the infrastructure needed to disseminate knowledge to support OPs in evidence-based practising. In chapter 2 we tried to distinguish four main elements of the knowledge infrastructure needed. These elements were (1) education and training; (2) research and development; (3) knowledge products and tools; and (4) knowledge access facilities. Starting with the first, education and training facilities include basic professional training and CME, which should be based on the latest findings and have to include training in EBM. Research and development include research activities on occupational health and safety by national and regional scientific institutes, universities, professional associations, and private research and
development organizations. These activities lead to the production of new knowledge, knowledge products, and tools that can contribute to the evaluation and innovation of health practices. Subsequently, there is a need for custom-made knowledge products conceived as purposefully developed prescriptions or recommendations for practice. Examples of these are: threshold limit values, practice guidelines, protocols for measurement and for evaluation. Finally, concrete storage, access, and dissemination facilities for knowledge and knowledge products are needed that can be found in (digital) libraries, literature databases, clearing houses, high-quality websites, congresses, journals, and helpdesks for professionals.

With regard to education and training, we learn from the international study discussed in chapter 3 that OPs received little EBM education during their basic medical curriculum. Therefore, education in EBM during their vocational or postgraduate training is important for them and illustrates the need for CME interventions. With regard to the facilities provided by research and development centres, institutes and universities, it seemed that many OPs in various countries are able to use them. Moreover, these facilities are considered to be important for the evidence-based practice of the OPs. These institutes are also to a large extent involved in developing knowledge products. With regard to knowledge products and tools, we know from chapter 5 that many Dutch OPs are familiar with using the evidence-based guidelines available for daily OH practice. The knowledge access facilities used by almost all OPs are search engines like Google or Yahoo, online or web-based libraries, occupational health literature databases, medical literature databases, and full-text articles. However, from chapter 3 and 7 we learn that most OPs do not have free access to electronic full-text articles, which impedes their EBM practice.

Effect of continuing medical education interventions on EBM implementation
EBM can enable practitioners to give more soundly based advice, and EBM can secure their professional positions as providers of quality assured information. Therefore, EBM is a promising method that may enhance the professional performance of OPs. However, since EBM is relatively new within the OH field, many occupational professionals lack EBM knowledge and skills and EBM is not being practiced frequently. To stimulate its implementation in the occupational health field, EBM can
be integrated into the continuing medical education (CME) of OPs. Furthermore, CME interventions for OPs could be developed for this purpose. To meet the second objective of this thesis - to determine the effect of CME interventions on the implementation of EBM with the aim of enhancing the professional performance of OPs - we developed and evaluated several CME interventions.

The first intervention combined a didactic EBM course with peer group case method learning sessions and compulsory search assignments. We studied the effectiveness of the intervention using a cluster randomised controlled trial design and using semi-structured interviews in a qualitative study. In Chapter 4 we described that the intervention was successful in implementing EBM as it improved the EBM knowledge and skills of OPs. Furthermore, the intervention effectively improved the EBM behaviour of the OPs, which can be considered as the first step in enhancing their professional performance. OPs in the Netherlands spend much of their time advising the employee and employer about fitness for work after sick leave and return to work. Consequently, a next step in determining whether the intervention enhanced the professional performance was to study whether the actual use of EBM improved the quality of evidence-based advice during sickness absence episodes. Therefore, in chapter 5 we evaluated the quality of the advice given to sick-listed employees by OPs in the same RCT. Also, the quality of the evidence-based sources provided by the OPs was evaluated. This study showed that better return-to-work interventions were advised directly after the intervention period by OPs in the intervention group compared to OPs in the control group, but the difference had decreased four months after the intervention period. In addition to these measures of professional performance, the self-reported effect of the intervention on the professional performance, occupational self-efficacy, and job satisfaction of the OPs were deemed to be important outcomes of the intervention. These outcomes were considered potential determinants for successful (further) implementation of EBM in the OH field. Therefore, we combined a quantitative study (chapter 6) with a qualitative study (chapter 7) that both focussed on these outcomes. Chapter 6 showed that the EBM intervention enhanced the self-reported professional performance of OPs. However, it appeared to have little impact on their self-efficacy and job satisfaction. This was probably caused by the ceiling effect of the scores on these two outcome measures.
Conversely, in the qualitative study OPs (chapter 7) explained that searching for and sharing evidence made them feel more self-secured in their performance. This especially altered their interaction with clients and medical specialists in a positive way. Furthermore, they stated that the intervention resulted in a more critical attitude towards their practice and that they became more accustomed to sharing knowledge. However, time constraints remain an important barrier for EBM implementation as the intervention was regarded as being very time-consuming.

E-learning
To try to overcome the time constraints of OPs, we searched for another, less intensive and time-consuming CME tool to support the EBM education of OPs. E-learning has many advantages, including advantages concerning time. It enables OPs to educate themselves in EBM at the time and place of their choice, determining their own pace, and repeating the course whenever they choose. Furthermore, since there are no geographical boundaries, it is possible to use an e-learning course internationally. However, up till now, no postgraduate e-learning courses tailored to the OH field have been developed and evaluated. Therefore, we first studied the effect of e-learning on knowledge on mental health issues as compared to lecture-based learning in a CME programme for Dutch OPs in chapter 8. The study showed that the effect of e-learning on OPs’ mental health care knowledge is comparable to a lecture-based approach. However, this finding with Dutch OPs does not necessarily imply that an e-learning course is also suitable for teaching EBM, or that it is applicable for OPs across various countries. Therefore, we developed an electronic EBM course, based on the findings in chapter 8 and on the content of a recently published international practical guide on EBM for occupational health. Chapter 9 demonstrates that the EBM e-learning course is applicable for OPs in different countries. Furthermore, the study showed that the course enhanced their EBM knowledge. However, it did not improve their EBM skills and attitude. In accordance with the ASE–model, the social context, perceived self-efficacy, and intention to perform EBM behaviour as determinants of actual EBM behaviour were included in the study. The electronic EBM course enhanced only the perceived self-efficacy towards practising EBM.
Methodological considerations

The methodological strengths and limitations of the studies in this thesis have been discussed in the previous chapters. However, a selection of methodological issues in relation to the study design, the outcome measures, and the generalisability of the research findings warrant further explanation.

Study design

The first methodological issue is our use of a randomised controlled trial (RCT). An RCT is generally considered as the ‘gold standard’ for evaluation research because it is less susceptible to selection bias and confounding than other designs. In the main study of this thesis (chapters 3 through 6), we conducted a cluster RCT. An important part of the intervention took place during peer group sessions that already existed or were formed by the researchers on a geographical basis. Peer group sessions were set up to assure that OPs could practice applying the EBM method together, using their own cases. Although our primary outcomes were measured at the level of individual OPs, we did not want to split participants up by randomisation at individual level, since this could decrease their willingness to participate in our study. However, by choosing the group as the unit of randomisation, outcome measures at the level of the OP could be influenced by characteristics of the group and could therefore be correlated. This resulted in a hierarchical structure in the data, and neglecting this hierarchical structure could have caused an overestimation of the effect of the intervention. Therefore, to take this dependency in the hierarchical structure of the data into account, we performed a multilevel analysis. This analysis showed no significant effect of the groups on the outcome measures, which means that there was no overestimation of the effect of the intervention. An additional advantage of using a multilevel analysis was that we were able to get a maximum amount of data (data from T0, T1, and T2) from a minimum number of tests. Dropout is a common phenomenon associated with longitudinal data and it complicates statistical inference. The linear mixed effects model we used was able to fit the longitudinal data in the presence of dropout.
For the self-assessed outcomes of professional performance, job–satisfaction, and occupational self-efficacy, concentrating only upon the randomised controlled trials which evaluate the effectiveness of the intervention by means of pre-structured questionnaires was considered to be limited. Therefore, alongside the cluster RCT, we conducted a qualitative study to obtain a richer and more comprehensive picture of the effect of the intervention under investigation. The findings of the qualitative study provided further insights and explanations of the outcome measures from the quantitative study. The qualitative study was also able to yield unforeseen outcomes of the intervention and other themes important for expanding implementation of EBM in the OH field.

Outcome measures
The researchers created an overview of clusters of knowledge infrastructure facilities important to supporting the evidence-based practice of OPs presented in chapter one. From this overview we developed our own questionnaire to measure the availability and perceived importance of these knowledge infrastructure facilities by OPs (chapter 3). The outcomes measured are therefore limited to the viewpoint of the researchers and do not represent a broader consensual viewpoint of, for instance, key persons in the OH field and OPs themselves. However, since research or information available on the knowledge infrastructure for (occupational) health care is scarce, the overview we created and the questionnaire that was used should be regarded as a first attempt to enter this unexplored territory.

The study on enhancing the evidence-based advice of OPs (chapter 5) used real cases from daily practice, which resulted in a difference in the case files handed in by the intervention group and control group. The control group handed in more case files for which evidence-based practice guidelines existed, compared to the intervention group that handed in more complex cases with a broader variety in disorders. The use of case vignettes would probably have increased the internal validity of the study. However, by using real cases from the OPs’ daily practice, the ecological validity of the study was high.
In both the RCT among Dutch OPs and the international study on e-learning, we used OPs’ self-assessment measurements. Although assessment in the practice setting is considered the best method to measure changes in EBM use and EBM behaviour, it is not always feasible. In those cases researchers have to depend on the accuracy of participant self-assessment by the use of - ideally validated – questionnaires. However, the use of self-assessment for obtaining outcome measurements could have led participants to give desirable answers. Especially as the OPs were trained in EBM, it most likely enhanced their attention to the use of EBM in their daily practice and this may have increased positive answers on outcome measurements used in our studies. Next to measurements through self-assessment, for the RCT we were also able to measure changes in EBM behaviour in a more objective way, by evaluating the quality of the OH advice given by the OPs. Unfortunately, in the international study, assessment in the practice setting to measure changes in EBM behaviour was not feasible.

Furthermore, in chapter 3 and chapter 9, we used the Fresno test for measuring the EBM knowledge and skills of OPs. The Fresno test includes fill-in-the-blank questions and uses a standardized grading rubric. It is an instrument that evaluates all EBM steps (formulating an answerable question, searching for evidence, critically appraising the evidence, and applying it). In a recent systematic review on instruments for evaluating education in evidence-based practice, the Fresno test met the highest instrument level (level 1). Therefore, we considered this test to be the best available to evaluate EBM knowledge and skills.

Generalisability
Most studies in this thesis had a study population consisting of Dutch OPs (see chapters 4-8). Occupational health care in the Netherlands mainly concentrates on sickness absent management and, as a result, the EBM interventions in these studies are related to this. For instance, the advice for the cases used in the study on the quality of advices all focussed on sickness absence episodes. However, in other countries occupational health care can demand different competencies of OPs, such as competence in occupational hazards or prevention. The results of the studies
with Dutch OPs may therefore be limited in generalisability to other topics relevant in other countries.

The OPs in most of the studies (chapters 3-7, 9) were most likely motivated OPs with an already positive attitude towards EBM, since they volunteered to participate in the studies. The positive attitude towards EBM measured in chapters 4 and 9 appear to confirm this. Since the EBM intervention, described in chapters 4 till 7, required much time and effort from the participants, we needed motivated participants who were willing to make the effort to learn the EBM method. Because EBM is relatively new within the OH field, these OPs can be regarded as innovators in the adoption of EBM in the OH field. Up till now, the impact of EBM interventions on the knowledge and performance of OPs had not been studied. By including this specific population of OPs in our studies, we made a first step in evaluating the effectiveness of EBM for the whole OH field. In addition, these OPs can function as potential local opinion leaders who can successfully promote evidence-based practice among the rest of the OP population. However, the selection leads also to cautiousness in the generalisation of our study results towards less motivated OPs.

**Implications for practice**

Knowledge infrastructure facilities to support the EBM practice of OPs

Knowledge infrastructure facilities are available for OPs in our studies, and OPs consider these facilities as important for their evidence-based practice. Although OPs seem to have good access facilities, the study shows that they use mainly traditional information sources, such as textbooks and asking colleagues, rather than evidence-based sources, such as the Cochrane library and reviews and articles in international journals. A possible reason for this is that they are still unaware of the evidence-based sources available and useful for occupational health care. Second, for some OPs, access to evidence-based sources is not easily available due to costs related to entering most literature databases and full-text articles. Furthermore, many evidence-based sources are in English, which can be an obstacle for OPs who are not familiar
with the English language. Most of all, OPs are busy practitioners for whom knowledge products containing ‘consolidated’ knowledge are most useful, since they do not have the time to search for evidence extensively. Consequently, in order to enhance the use of evidence-based sources, a knowledge infrastructure solving the barriers for OPs described above is essential to support EBM practice. Efforts can be made on the local, national, and international level.

On a local level, it is the task of occupational health services to facilitate OPs by offering, for instance, information and communication technology (ICT) facilities to guarantee good access to various digital knowledge sources. Management has to promote organizational conditions and human resource development, such as a reward system for being up-to-date, to support professionals wishing to work in an evidence-based manner, and to assure this. Professionals can organize regular meetings to discuss daily practice, to maintain evidence-based quality and to prevent colleagues lagging behind.

On a national level, knowledge infrastructure facilities are important, such as a well-designed virtual library for occupational health, and a network of expert groups which can be consulted by OPs and other experts when necessary. Currently, within the basic medical curriculum, EBM probably already holds a more prominent position than in the past and future OPs will most likely be more acquainted with EBM. We have to take into consideration that EBM has only ‘existed’ for about the past 20 years, and was introduced into the medical curriculum in the last decade in most countries. Consequently, training in EBM within the CME context of OPs is crucial at the moment, since many practising OPs have not been trained in EBM. Ministries of Labour and of Health Care, national institutes for occupational health and safety, occupational or public health departments at universities, and professional organizations are key actors in the context of promoting EBM. They can contribute to the creation of research and education programmes, and to the access to knowledge sources. They can support media appropriate for advanced knowledge transfer like national congresses, professional journals, and websites. Research and development institutes and other knowledge institutes should become more and more involved in developing tailor-made knowledge products and tools essential for occupational health care.
On an international level, more international collaboration on the development of evidence-based practice guidelines, as has been initiated between the UK and the Netherlands, can be rewarding, especially for countries that do not have a long tradition of developing guidelines. International collaboration can help in the further improvement of new facilities like question-and-answer facilities or help in building (virtual) networks of experts. Key institutions such as the International Commission on Occupational Health (ICOH), the World Health Organization (WHO), the International Labour Organization (ILO), and the Occupational Health Field in the Cochrane Collaboration can facilitate networks and the exchange of knowledge, knowledge products, and educational material. In addition, there are a number of regional institutes such as the European Agency for Safety and Health at Work in Bilbao, the University of Occupational and Environmental Health (Japan), the National Institute for Occupational Safety and Health (NIOSH, USA), the Finnish Institute of Occupational Health (FIOH, Finland) and the Canadian Centre for Occupational Health and Safety (CCOHS, Canada) can contribute to the development and dissemination of OH knowledge all over the world.

Effective CME interventions to enhance EBM implementation

A didactic EBM course with additional peer group case method sessions can be recommended as an effective method to increase OPs’ EBM knowledge, skills, attitude, and behaviour. Since numerous OPs work separately without many opportunities to learn from each other, CME interventions that include peer meetings can be a constructive manner for OPs to share explicit and implicit knowledge and discuss their professional stance. However, one bottleneck is that peer group meetings are time-consuming and OPs state they lack the time to attend these meetings frequently. Therefore, we recommend lowering the frequency of the meetings to e.g. once a month, instead of once every two weeks as we used in our intervention. However, a disadvantage can be that outcomes will not improve to an appropriate level. On the other hand, a lower frequency of the meetings might enhance the chance of less motivated OPs attending the meetings.
In addition, preconditions for the realisation of these kinds of meetings are the tangible support from management of OH providers and OPs’ own awareness of the added value for their professional performance and their motivation to change. One of the consequences of OPs working separately for much of the time, is that in some cases they feel no urgent need to account for their actions to their peers. Pressure to improve and account for their actions should also be emphasized by stakeholders like employees and employers and their organizations, insurers, and government.

To initiate changes in practice, an intensive CME intervention will most likely attain better results than an introductory e-learning course alone. On the other hand, e-learning is an effective and efficient way for OPs to become acquainted with EBM, to increase EBM knowledge and to refresh existing knowledge. An advantage of e-learning is that it can be a first approach to spreading the EBM concept over a wide variety of countries and regions, especially where other facilities for the spreading of knowledge and education materials are poor or non-existent. An introductory e-learning course on EBM can be useful for OPs in overcoming potential timidity about EBM. Through e-learning, they are able to learn about EBM in their own time and at their own pace, and they are able to revise difficult parts when necessary. Therefore, we recommend both approaches: e-learning for a preliminary exploration of the topic of EBM, and the integration of e-learning in blended learning approaches where technology-based education and face-to-face education with peers and a teacher are used in combination.

**Recommendations for research**

The knowledge infrastructure for the OH field needs further exploration. We have made a first step by distinguishing essential clusters of facilities within the infrastructure. However, concept mapping on (clusters of) knowledge infrastructure facilities in relation to practising EBM in the OH field would have been helpful to gain more insight into the concepts, and into how these are interrelated. Concept mapping is a step-wise structured process, focussed on a topic or construct of interest, and
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involves input from different participants. Ultimately, it produces an interpretable pictorial view (concept map) of their ideas and concepts and the interrelationships. Subsequently, these new insights can be used to conduct a larger-scaled international study on knowledge infrastructure facilities in the OH field, the practice of EBM by OPs, and the relation between them. Inclusion of OPs should then not be limited to OPs who are ‘innovators’ to the adoption of EBM, but should include a sufficient and random sample of OPs from different countries. Furthermore, differences in required competences of OPs in the various countries and the availability of local facilities and organizational conditions should be the object of the study. For instance, it is possible that OPs who mainly focus on prevention of occupational and work-related diseases will require a different kind of evidence-based sources to practice EBM. More knowledge on the use of sources by OPs in various countries is needed.

Although we have made a first attempt to study the effectiveness of CME interventions in implementing EBM in the OH field, more research is desirable. We have identified a number of barriers that OPs face when practising EBM. These barriers are useful to take into account when developing CME interventions. The main obstacles are in accordance with other medical domains. Crucial obstacles are time constraints and a lack of EBM knowledge and skills. Although the argument of time constraints with regard to engaging in EBM is at odds with the characteristics of a professional and an ethical obligation to keep up-to-date, OPs can be assisted in simplifying the use of evidence. First of all, medical databases still lack high-quality systematic reviews concentrating on occupational health care outcomes. In addition, there is a need for good-quality evaluation studies, like RCTs, in the OH field. Furthermore, increasing the number and variety of products and tools containing ‘consolidated’ up-to-date knowledge would be helpful. OPs are already acquainted with the use of practice guidelines. The availability of a helpdesk and the assistance of librarians, especially for the searches for evidence in literature data bases, might also be beneficial for OPs. More evaluation studies on the effectiveness of the implementation of guidelines and the assistance of clinical librarians on health care outcomes are desirable. Besides the obstacles described by the highly motivated participants in our study, a lack of motivation may be an obstacle for broad implementation of EBM in the OH field. In addition, it is necessary to learn more
about incentives for OPs and other OH professionals to implement evidence-based practice. In this thesis we have only included OPs who were presumably already motivated to enhance their evidence-based practice. We did not conduct a non-response analysis, nor interviews with OPs who attended the peer group sessions infrequently. Studies on OPs’ perceived barriers when practising EBM, using a random sample of OPs and including non-responsive analysis, can be valuable for further implementation of EBM.

Finally, OPs in chapter 7 stated that they informed their patients about the results of their searches for evidence and OPs received positive feedback. Although there are physicians who advocate the trend towards patients’ informed or shared decision-making, there are also some physicians who feel that this might threaten their authority. Moreover, possible legal consequences have to be carefully investigated. Before promoting informed or shared decision-making, therefore, we recommend further research on opportunities for, and the impact of, EBM in shared decision-making and possible consequences within the context of occupational health care.

To study all these new developments and further attempts for EBM implementation in the OH field, we suggest combining qualitative and quantitative research methods. Qualitative research methods can be helpful in determining needs of OPs for evidence-based practice, and can provide useful insights by evaluating the implementation process. In addition, quantitative studies can determine the effectiveness of new tools and facilities to assist in the implementation of EBM in the OH field. Synthesizing knowledge gained from both research methods can provide ‘decision support’ for policy makers in occupational health care.
Final conclusions

In this thesis four clusters of knowledge infrastructure facilities that can support OPs in practising EBM were described: education and training; research and development; knowledge products and tools; and access facilities. These facilities are available for most OPs who are already engaged in practising EBM. Expanding these facilities, such as the development of knowledge products and tools and access to full-text articles in journals, can be suggested. In general OPs regarded these facilities as being important to practice EBM. Education and training in EBM was not a sufficient part of the basic medical curriculum of OPs, which increases the need for CME interventions to implement EBM in the OH field.

To implement EBM in the OH field with the aim of enhancing the professional performance of occupational physicians, a CME intervention consisting of an EBM course combined with recurrent peer group sessions is effective. In addition, OPs themselves regard this intervention as being useful for enhancing their professional performance, and the intervention resulted in raising feelings of self-confidence when performing their practice. To enhance OPs’ knowledge and, to a lesser extent, skills of EBM, an introductory e-learning course is an effective CME intervention. Since many OPs currently lack EBM knowledge and skills, but also have to deal with time constraints, e-learning courses on EBM can be a useful and efficient method for reaching a wide-spread population of OPs and getting them acquainted with the basics of EBM. However, e-learning does not seem to change actual EBM behaviour. Therefore, we recommend the integration of EBM e-learning with face-to-face education with peers and an instructor.
Reference List


