Effectiveness of postgraduate education in occupational medicine
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CHAPTER 1

Introduction

The studies described in this thesis focus on measuring the effectiveness of postgraduate education in occupational medicine in the Netherlands. To give the reader an idea about the context of these studies, I will first describe the status of occupational medicine in the Netherlands and then give an overview of the occupational physician training programme. I will further elaborate on the themes of educational formats and learning styles, because they form a substantial part of the studies in this thesis. I will conclude the introduction with a conceptual model of learning of occupational physicians, the research design and research objectives.

Occupational medicine in the Netherlands

Occupational medicine in the Netherlands is mainly practiced within occupational health services. The organization of occupational health services and therefore the role of the occupational physician differ from country to country. Since 1994 all employers in the Netherlands have been required to involve an occupational health service in their occupational health and safety policy by law. Occupational health services must carry out a minimum of five of the following: pre-employment health examinations, periodical health surveillance, workplace risk evaluation, guidance in return to work after sick leave as well as providing facilities for employees to consult an occupational physician. There is also a legal requirement for occupational health services to be multidisciplinary. The tasks and the position of the Dutch occupational physician have changed. Occupational disability is an important issue in the Netherlands. Disability due to physical problems, e.g. back pain, and mental problems form a major part of the problem. Nowadays occupa-
tional physicians spend most of their time meeting with employees who are absent from work. In this way they contribute to the prevention and management of occupational disability and stimulate return to work. As in Dutch legislation there is no provision for financial compensation for occupational diseases, the prevention, diagnosis and treatment of occupational diseases has a lesser priority. Recently, the Netherlands Centre for Occupational Diseases issued guidelines on the reporting of occupational diseases. Stimulated by these guidelines occupational physicians are getting more involved in this topic. Recently the Dutch association of occupational physicians has also been engaged in the development of professional guidelines. Since 1999 four sets of guidelines have been published of which those on management of employees with back pain (in 1999) and on management of employees with mental health problems (in 2000) are most relevant to this thesis. The guidelines describe the optimal management of return to work of employees and are highly valued by the occupational physicians in general.

**Education of the occupational physician within the continuum of medical education**

To understand the position of the postgraduate occupational health training, a clarification of its place within the continuum of medical education is useful. Table 1.1 shows the current stages in this continuum in the Netherlands.

To work successfully in the field of vocational rehabilitation and prevention of occupational diseases, the occupational physician must be a medical doctor with clinical knowledge and skills, but also with knowledge of work and the work environment. To work successfully in the fields of private enterprise, employers and employees, the occupational physician needs organizational knowledge and advisory skills. Such a doctor also needs skills to cooperate with other health professionals and occupational health and safety experts. To become an occupational physician requires postgraduate medical education. The formal requirement to work as an occupational physician in The Netherlands is that one has to be a MD and to have followed spe-
### Table 1.1. The continuum of medical education in the Netherlands

<table>
<thead>
<tr>
<th>Stage</th>
<th>Duration</th>
<th>Certification</th>
<th>Terminology</th>
<th>Structure</th>
<th>Responsible or accrediting body</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-formal training</td>
<td>Un-defined</td>
<td>Informal or no certification</td>
<td>(post)-graduate</td>
<td>Incidental learning</td>
<td>Participant</td>
</tr>
<tr>
<td>Continuing Medical Education</td>
<td>Short courses</td>
<td>Re-certification</td>
<td>(post)-graduate</td>
<td>Focused training, separate from work</td>
<td>Professional association</td>
</tr>
<tr>
<td>Specialty training</td>
<td>3-5 years</td>
<td>Specialty registration</td>
<td>(post)-graduate</td>
<td>In service training with implied learning</td>
<td>Professional association</td>
</tr>
<tr>
<td>University training</td>
<td>6 years</td>
<td>MD-degree</td>
<td>Under-graduate*</td>
<td>Full time training</td>
<td>University</td>
</tr>
<tr>
<td>High School</td>
<td>6 years</td>
<td>High school diploma</td>
<td>High school</td>
<td>Full time training</td>
<td>School and government</td>
</tr>
</tbody>
</table>

*recent Dutch legislation drafts call all university training after three year of ‘bachelor’ training ‘graduate’. In medical school this would imply a three year undergraduate bachelor phase followed by a three year graduate master training. In this thesis is referred to postgraduate medical education as a medical specialist training programme which follows six years of undergraduate medical education.

According to European Directive 2001/19EG, formal qualification as a medical doctor comprises six years of under-graduate medical education after high school and postgraduate medical specialty training take a minimum of three to five years. Specifically, occupational medicine requires a minimum duration of four years. The objectives of the six years of undergraduate medical education in the Netherlands are well described. The programme includes a two year clinical period or internship in hospitals and also in general practice and social medicine. Undergraduate education is a full time programme undertaken by the universities. After graduation as a medical doctor, one can choose to go on to
postgraduate medical education in order to become a hospital specialist or to go into general practice or social medicine. For most hospital specialists, postgraduate medical education takes the form of three to five years of working and learning in hospital, under the direct supervision of a specialist. The education of general practitioners takes three years, two of them under direct, one-to-one, supervision. Social medicine in the Netherlands has two main specialist branches: community health and occupational health. The education and training for community medicine specialists is a 4-year programme, consisting of coursework and practical experience. The registrars work under supervision. In the field of occupational health, which includes occupational medicine and social insurance medicine, the physician in training works for 4 years in practice under the formal supervision of an experienced physician. It is a dual structure: working and learning at the same time. The responsible or accrediting body is the professional association.

In the continuum of medical education, professional learning continuing after postgraduate education is known as life-long learning. For continuing registration as an occupational physician, re-certification every five years is now obligatory. Therefore it is necessary to follow formal continuing medical education in both occupational medicine and occupational health related topics for a minimum of twenty hours each, each year. This type of education can also be organized under the supervision of the employer in the form of in-company training. All training courses have to be approved of by the certifying body of the association of occupational physicians. The training is integrated into the daily working situation.

Apart from these formal professional learning activities, many situations in daily practice can lead to non-formal professional learning. One of the objectives of the evidence-based medicine movement is to stimulate the non-formal learning process in clinical medicine.

**Postgraduate education in occupational medicine**

The occupational medicine training programme in The Netherlands consists of four main parts:

- Educational programme carried out at a School of Occupational Health.
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- Working in an Occupational Health Service.
- Several specific training periods.
- Carrying out a project or research in practice.

The educational programme consists of 96 days of education spread over a period of four years. The training aims to fulfill the formal requirements of the professional association and the specialty registration board of the Royal Dutch Association of Physicians, which is officially recognized by the Ministry of Health. Apart from these official requirements, the course organizer takes into account the needs and demands of participants, the occupational health services (employers of the participants) and the professionals (the Dutch Association of Occupational Physicians).

Working in practice is under the formal supervision of an experienced occupational physician. In spite of their status of being supervised, occupational physicians-in-training have the same responsibilities during the four years of education as a fully-qualified occupational physician. Supervision is often limited to a weekly or monthly consultation. It can be argued that the occupational medicine training programme can be characterized, in the continuum of medical education (table 1.1), as in between specialty training and continuing medical education.

The first postgraduate educational courses for occupational physicians in The Netherlands were organized in the early 1950s. It is now a medical specialty programme that complies with European legislation. As the legislation and practice of occupational health has changed over the years, the subject matter which makes up this programme has changed as well. Originally, the course consisted of basic training in social medicine, toxicology, epidemiology and so on, and was characterized by traditional, lecture-based education. Objectives were formulated in terms of knowledge. Recently developed courses also cover basic medical, advisory and organizational skills and competencies. The education aims at interaction between theory and practice (experiential learning), interaction between participants (small group) and co-operation with other disciplines (multidisciplinary).

The Netherlands School of Occupational Health collaborates with
Figure 1.1. Years of experience as a doctor of 117 physicians in their first year of postgraduate education in occupational medicine. Mean 7 years (median 6 years)

other members of the European Association of Schools of Occupational Medicine (EASOM) in the formulation of European core competencies of the occupational physician. The implementation of these core competencies requires a 'total quality' strategy, and includes evaluating the participants to see if they have acquired these skills and are putting them into practice.

The participants in postgraduate education in occupational medicine
Thirty years ago many of the participants of the occupational health course had already worked as medical practitioners e.g. in general practice. In the 1980s and 1990s this situation changed. More younger participants with little medical or curative experience began to enter the profession. Recently this trend has slowed down, probably due to a shortage of physicians. More doctors are now able to choose their first, curative, orientation. And more doctors are becoming an occupa-
tional physician as their later and second choice or as a second career. This means that some of the participants of the occupational medicine programme already have a number of years experience as a doctor, are older or maybe less motivated for the training. For example, in the experiment described in Chapter 5, the mean experience of the participants as a doctor was 7 years. (Figure 1.1) They were in the first year of their occupational training. At the start of training the mean time from graduation was 6 years.

**Working and learning**

Participants in postgraduate occupational medicine training work within an occupational health service. The main part of the ‘market’ for occupational health is in the hands of a small number of large occupational health service companies, each of which employs more than a hundred occupational health physicians. These companies want to have a say in the objectives of the postgraduate education and training of their employees. In addition, these companies provide favourable conditions for the application of acquired competencies. From this point of view the postgraduate training of the physician resembles in-company training. If the objective of postgraduate training is a change of performance in practice of the doctors, the goals and objectives of the companies should also be considered prior to designing the programme. The literature on implementation of medical guidelines shows that not only is the organizational context important for learning, but also the social context, for example the doctors’ network and the presence of opinion leaders.

Learning while working appears to be the ideal combination for specialist education. Practical experience can be used in learning situations and can be applied immediately. This assumes a mutual adjustment of work and learning, which is not easy to establish. However, working in ‘real’ practice is surely an advantage. Occupational health is the part of public health which deals with the interaction between medicine and society. As the role of the occupational physician changes under the influence of political and social developments, the educational content has to follow ‘real’ practice. This puts the programme for postgraduate occupational medicine education on the horns of a dilemma. On the one hand we have the
core competencies of the occupational physician as educational objectives, which are not usually practised to their full extent by the course participants, but on the other hand we want to use clinical and other practice problems, in the context of the occupational health service, for effective learning.

Educational formats

Undergraduate medical education in the Netherlands is moving towards a more problem-based approach. High schools are also encouraging independent study instead of traditional class teaching. The changes in both secondary school and in undergraduate medical education will

| Table 1.2. Practical characteristics of problem-based versus teacher-based learning. |
|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| **Characteristic**              | **Problem-based learning**      | **Teacher-based learning**      |
| Stimulus material               | Problems                        | Systemized knowledge representation |
| Group size                      | Small group (5-12)              | Not determined                   |
| Source of educational objectives| Participant-generated           | Teacher determined               |
| Dominant teacher activities     | Guidance                        | Lecturing                        |
| Dominant participant activities | Self-direction in learning and group work | Written knowledge test          |
| Testing                         | Appraisal of applying problem solving skills |                         |
| Dominant educational Format     | Interactive group               | Lecture                          |
| Information sources             | Diverse, not prescribed         | Specified in required books, readers and lecture notes |
| Dominant goals                  | Knowledge application (in practice) and interactive learning skills | Knowledge |
| Prepared educational materials  | Problems, tasks and hint for information sources | Readers and oral lectures |
bring about a greater emphasis on independent learning.22 One of the questions that arises is can these concepts also be applied to the dual structure of postgraduate education in occupational medicine? Educational formats are not easy to describe. Problem-based learning is the most discussed educational format in the medical education literature, but is remarkably ill defined.23 In no generally accessible source a circumspective definition of necessary characteristics of PBL can be found.24,25,26 In Table 1.2 a practical definition of distinguishing characteristics of PBL is given, next to teacher based learning. The issues form a spectrum of extremes.27 The teacher-based format is the one traditionally used in occupational medicine education. Groups are medium-sized, about 25 participants.

Problem-based learning has been advocated as active learning and promoting self-directed learning skills.28,29,30 The authors of an extensive review of the claims of the advantages of problem-based learning made by its proponents conclude that:

1 there is no evidence that PBL curricula result in any improvement in general, content-free problem-solving skills;
2 learning in a PBL format may initially reduce levels of learning but, over a period of several years, may foster increased retention of knowledge;
3 some preliminary evidence suggests that PBL curricula may enhance both transfer of concepts to new problems and integration of basic science concepts into clinical problems;
4 PBL enhances intrinsic interest in the subject matter; and
5 PBL appears to enhance self-directed learning skills, and this enhancement may be maintained.31

Learning styles

It is important to gain an insight into how doctors learn and how and why they change their methods of practice.32,33 Information about learning styles is essential for educators in order to facilitate learning. Learning styles are categorized in different ways. Vermunt describes four main categories of qualitatively different styles of learning in
Table 1.3. Learning styles of Vermunt and Kolb.

<table>
<thead>
<tr>
<th>Learning styles of Vermunt</th>
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<tbody>
<tr>
<td>Undirected learning style</td>
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<tr>
<td>Reproduction directed learning style</td>
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<tr>
<td>Meaning directed learning style</td>
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<tr>
<td>Application directed learning style</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Learning styles of Kolb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Converger (abstract / active)</td>
</tr>
<tr>
<td>Accommodator (active / concrete)</td>
</tr>
<tr>
<td>Diverger (concrete / reflective)</td>
</tr>
<tr>
<td>Assimilator (reflective / abstract)</td>
</tr>
</tbody>
</table>

university students. He calls them proto typical styles, which means that a student can manifest features of each of the different styles. However, every student has a dominant style. Kolb describes experiential learning as a cyclical process that includes four stages:

1. the learner has a concrete experience,
2. this experience is observed and reflected upon,
3. the result of this observation and reflection is abstracted, conceptualized and generalized and
4. the generalization is tested in new situations which in turn leads to a new concrete experience.

There are two opposite elements in this process model of learning: concrete experience (feeling) versus abstract conceptualization (thinking) and active experimentation (doing) versus reflective observation (watching). The quadrants of these axes represent a learning style. Kolb assumes that individuals have a dominant style, but operate in all modes and will do so during the learning cycle.

The learning cycle of Kolb is widely used and discussed in postgraduate medical education. Kolb's theory of experiential learning is a theory of learning and working. I used the learning styles of Kolb as a potential influential factor of learning.
Figure 1.2. Matrix of learning styles of Kolb.

Outcome parameters

To gain insight into the effects of our educational programme, we had to define outcome parameters. Increase of knowledge alone was not seen as appropriate. Using a framework for clinical assessment, Miller's pyramid, (figure 1.3) we formulated two outcome parameters: participants' knowledge and participants' performance in practice. Knowledge tests are a way of assessing the lower layers of the pyramid. Using performance indicators one can try to gain insight into the real performance of the participants in their day-to-day practice i.e. the upper layer of the pyramid. A traditional evaluation cri-
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Criterion is the level of satisfaction of the participants with the course. This is not an outcome parameter in the real sense. However, in the actual practice of designing education it is considered important. For this reason, level of satisfaction with the programme also became an 'outcome' criterion in this study. In some studies, the outcome of postgraduate and continuing medical education has shown not only a better performance by the doctors, but also a better health outcome for their patients.\(^\text{43}\) In our studies we considered this outcome parameter to be difficult to assess.

\begin{figure}
\centering
\includegraphics[width=\textwidth]{conceptual_model.png}
\caption{Conceptual model of the learning process.}
\end{figure}
Conceptual model underlying this thesis

Following the line of thinking in the foregoing, I constructed the following conceptual model of factors that are potentially influential in the learning process. (figure 1.4) The model underlies this thesis and contains the following components:

- Postgraduate medical education programme.
  Educational design in the restricted sense: learning objectives, global content, educational format and assessment criteria.\textsuperscript{44}
- Participants - physicians in training and their personal characteristics.
- Work and learning environment.
- Outcome parameters.

Aims and study design

The aim of the studies in this thesis is to gain more insight into factors determining the effectiveness of the postgraduate medical education of occupational physicians. I have explained the important outcome measures for a postgraduate medical education programme in the preceding paragraphs. However, evaluation of educational programmes remains problematic. Many authors describe only a programme and the level of satisfaction of its participants. In my opinion evaluation should go beyond the descriptive design only. At a minimum the design should include outcome measurements both before and after the

\begin{figure}
\centering
\includegraphics[width=\textwidth]{figure5.png}
\caption{Preferred design for the evaluation of medical education.}
\end{figure}
educational interventions. Preferably, there should also be a control group. The design that would yield the best evidence is a randomized controlled design in which course participants are randomly allocated to the control- or experimental group. (figure 1.5)

We used several types of study design, all based on these fundamental principles. What it gradually developed into was this preferred and feasible design: the randomized controlled trial.

**Main research objectives and overview of the chapters**

The central focus of this thesis is the effectiveness of specific courses of postgraduate education in occupational medicine. We investigated several aspects of this.

The main research objectives of the studies described in this thesis were:

- To determine the effectiveness of problem-based learning in postgraduate and continuing medical education, by a systematic review of the literature. (Chapter 2)

- To evaluate the educational programme on the ‘Guidelines for work rehabilitation of patients with low-back pain’ in one group of participants, using a non-controlled design. (Chapter 3)

- To evaluate the quality of the educational programme on ‘Guidelines for work rehabilitation of patients with low-back pain’ with two groups of participants, using a controlled quasi-experimental design. (Chapter 4)

- To study the effectiveness of problem-based learning compared with lecture-based learning in an educational programme on ‘Guidelines for occupational health management of patients with mental health problems’, using a randomized controlled design. (Chapter 5)

- To study personal and contextual factors predictive for successful outcome of postgraduate medical education. (Chapter 6)

- The thesis ends with a general discussion, with answers to the questions of this thesis, followed by an evaluation of the main results and methodological considerations. In addition the implications of our findings will be discussed. (Chapter 7)
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CHAPTER 1


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