CHAPTER ONE

Defining Clinical Competence: An Introduction

"You cannot care for a patient unless you have an idea of what is wrong; an [accurate] diagnostic decision has to be made before you treat." (Barrows & Pickell, 1991)

"A good doctor is one who is shrewd in diagnosis and wise in treatment; but, more than that, he is a person who never spares himself in the interest of his patients." (Sir Hugh Cairns, 1949)

A PROPER DEFINITION of clinical competence and its components is important to serve as a criterion for validating medical educational programs and to assure a minimum level of competency at the end of medical school and beyond during residency. Understanding clinical competence is crucial not only for medical education, assessment, and licensing examinations, but also for society and its responsibility for the quality of health care. Many clinical educators, committees, specialty boards, and expert panels within and outside the medical profession have noticed the importance of defining what is required of a health care professional and have spent time and effort in attempting to describe clinical competence. Webster dictionary defines being competent as the quality of having sufficient knowledge, judgment, skill, or experience for some purpose. It could be reasoned that if one of the primary tasks of a doctor is diagnosing illnesses and providing interventions to improve the condition of patients, then a clinically competent doctor would be someone who has the knowledge, judgment, skill, and experience to diagnose correctly and, in addition, who is capable of providing appropriate treatment interventions (Burg, Lloyd, & Templeton, 1982). A simple definition like this can, however, not function as a thorough framework for clinical competence. A general definition of clinical competence turns out to be not as easy as a dictionary suggests, as the medical profession is already concerned with this issue for many decades (Neufeld & Norman, 1985; Stern, 2006).

This chapter will introduce a working definition of clinical competence. This working definition is not intended to replace any other definitions, but to provide a framework for the subsequent chapters. This thesis consists of a collection of six studies that each focus on a different aspect of clinical competence. In the studies discussed, clinical competence is mostly related to performance or the diagnostic problem-solving process. The studies appear here in three parts: (1) Determinants of clinical competence development, (2) The nature of clinical competence, and (3) The development of clinical competence.

Historical perspectives on clinical competence

White (1959) suggested that competence be conceptualized as effective interaction with the environment. This means that clinical competence manifests itself only in observed

behaviors or practice. A description of competence according to the tasks of the clinical encounter, such as history taking, physical examination, use of laboratory tests, patient management, record keeping, etc. was helpful to get insights on the purpose and consequence of physicians' behaviors. Hubbard and colleagues, for example, described a method developed by John Flanagan and the staff of the American Institute for Research in the early 1960s to realistically define the characteristics of clinical competence (Hubbard, Levit, Schumacher, & Schnabel, 1965). Senior physicians and residents who had direct responsibility for the supervision of students were asked to record good and bad medical practices in clinical situations. It is interesting to mention that the most frequently reported (good) practices in this so called "critical-incident technique" (see for the original description of the critical-incident technique, Flanagan, 1954) were all based on the diagnostic process, such as: taking a history thoroughly and performing a physical examination in an orderly manner; accurately recognizing the patient's condition from observation of clinical signs; including further information in diagnosis; correctly suspecting obscure diagnosis despite the obvious symptoms and signs of another diagnosis; and taking appropriate emergency action when indicated (Hubbard et al., 1965).

Definitions of clinical competence were initially focused on diagnostic problem solving (a major responsibility of a doctor). In time, definitions became more detailed and in line with the fast growing demands and expectations of society on health care delivery. A good doctor was more than a diagnostic problem solver. For example, initially the American Board of Internal Medicine distinguished between four different dimensions of clinical competence, whereby problem solving was the core aspect: (1) abilities (i.e., knowledge, technical skills, and interpersonal skills), (2) problem solving skills (i.e., data-gathering and diagnoses), (3) the nature of the medical illness (the problems encountered by the physician), and (4) the social and psychological aspects of the patient problem, especially those which relate to diagnosis and management (ABIM, 1979). In a later report of the American Board of Internal Medicine, more elements were added: communication skills, professionalism (e.g., ethical practice, understanding diversity, responsible attitude), and system-based practice (i.e., understanding of the health care system to improve and optimize health care), (ABIM, 2002). The Institute of Medicine of the National Academies formulated five core competencies that were also much more than just problem solving: providing patient-centered care, employing evidence-based medicine, applying quality improvement, utilizing informatics, and working in interdisciplinary teams (Greiner & Knebel, 2003). The Canadian Medical Education Directions for Specialists (CanMeds) formulated seven key competencies. (Their mission was to describe essential roles of physicians in the context of global trends towards greater demands for public accountability, rising patient consumerism, rapidly evolving medical science and technology, and fiscal restraints on health care spending.) Only the first competency is directly related to diagnostic problem solving. In addition, the physician must be able to be

a clinical decision-maker, communicator, collaborator, manager, health advocate, scholar, and a professional (CanMEDS, 1996; Frank & Langer, 2003). These later descriptions emphasize that a clinically competent physician is indeed a highly qualified and specialized professional able to function in a society that puts high demands on the professional.

Determinants of clinical competence development

A clear and concise definition of clinical competence seems most pressing for assessment purposes. George E. Miller (1990) distinguished several hierarchical layers of competence to function as a framework for within which assessment might occur (see Figure 1). The different layers in Miller's model represent a developmental sequence of stages, in other words, a horizontally layered hierarchical categorization of clinical competence. All levels are needed and have their own important impact on clinical competence. In his framework for clinical competence a distinction is made between knows (knowledge), knows how (competence), shows how (performance) and does (action). Knowledge is at the base of this triangle shaped framework and action is at the top. A student, resident, or physician needs the knowledge that is required to carry out professional functions effectively, a prerequisite for being clinical competent. The next two layers, competence and performance, which follow upon knowledge, are often used interchangeably; however, competence means that a physician can apply his/her knowledge in concrete situations, while performance is the ability to use this knowledge to perform concrete actions. The final top layer represents what a physician actually does during day-to-day practice.

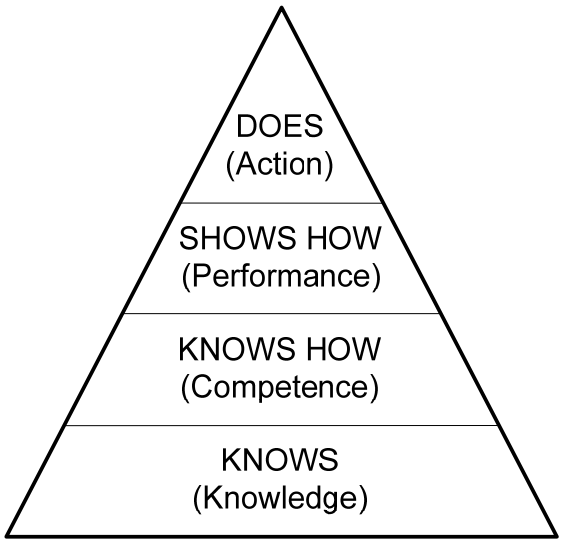

Figure 1. *Framework for clinical assessment by Miller (1990)*

A distinction between competence and performance is often made in the literature. Senior (1976), for example, defined competence as what a physician is capable of doing and performance as what a physician actually does. The former would, in this case, be related to the first three layers of the pyramid of Miller (1990) and the latter to the top layer (See also, Rethans, Van Leeuwen, Drop, Van der Vleuten, & Sturmans, 1990; or, Van der Vleuten et al., 2000). The implication is that (student) performance must be measured in order to assess competence, and many different tests are probably needed. Assessment of medical students

has focused mostly on "knows" and "knows how," the base of the pyramid: recall of factual knowledge and the application of this knowledge in problem solving. However, such examinations may fail to document what students will do when faced with a real patient. To determine someone's clinical competence, observing behaviors in action is needed, and this is represented by the top layer of the pyramid in Miller's model (Miller, 1990; Wass, Van der Vleuten, Shartzer, & Jones, 2001).

The symbiosis between assessing and defining becomes clear in this distinction, simply because a proper definition of clinical competence is needed for clinical assessment. Despite the fact that Miller's pyramid is primarily intended to serve as a framework to define and categorize different assessment tools, his model gives a good idea about which characteristics are influencing the development of clinical competence. The layers represent how students build their knowledge during the preclinical years and how competence and performance are shaped in action during the latter years of clerkships and residency, wherein the clinical encounter is crucial.

Chapter two ("The Predictability of Performance in Medical School: A Comparison of Grade Subgroups") focuses on the predictive value of level of pre-university achievement on performance during medical school for an entire cohort versus subgroups. Specifically, it explores its influence on the two distinctive phases of medical education: the preclinical and the clinical phase. Indicators for level of pre-university and preclinical achievement consisted of written knowledge-based assessments (knows and knows how). In the latter clinical years direct observations of professional performance and oral end-of-clerkship examinations are used to assess students' level of competence. Chapter three ("Influence of Clerkship Experiences on Clinical Competence") focuses on the relationship between the nature and volume of patient encounters and the learning outcomes during clerkships. After determining the variation of students' clinical experiences within and across sites, this study attempted to explain the causes of this inter-site variation in clinical experiences and, in addition, to investigate the consequence of this variation in clinical experiences and quality of supervision on clinical competence. Clinical competence is indicated by direct observation of professional performance, a practical end-of-clerkship examination, and a theoretical end-of-clerkship examination.

The nature of clinical competence

Before the 1970s, research on clinical competence was for the most part focused on general observable abilities. For example, Elstein, Shulman and Sprafka (1978) initially discovered that the medical problem-solving process was characterized by generating multiple hypotheses early in the patient encounter. The number of hypotheses generated and the amount of information collected by doctors were essentially the same for all specialties,

which suggested the existence of a general competency that can be applied to different clinical contents (see also, Barrows, Norman, Neufeld, & Feightner, 1982; Barrows & Pickell, 1991; Gale, 1982). However, based on further work from Elstein, it turned out that someone who was able to diagnose one patient's problem was not necessarily able to diagnose a different patient's problem. Therefore, it was concluded that clinical competence is highly dependent on the particular content of the situation. This phenomenon, named "content specificity (Elstein et al., 1978)," emerged in many studies using different kind of assessment methods, such as patient management problems (Neufeld & Norman, 1985), written tests (De Graaf, Post, & Drop, 1987), oral tests (Swanson, 1987), performance-based tests (Van der Vleuten & Swanson, 1990), standardized-patient tests, (De Champlain, Macmillan, King, Klass, & Margolis, 1999), and computer-based clinical performance assessments (Fitzgerald et al., 1995). The ability to solve clinical problems did not seem to be a general, content-independent characteristic of doctors. The reasoning that clinical competence is more than solving clinical problems was replaced by a perspective that knowledge is an essential factor in all competencies (see for example, Van der Vleuten et al., 2000).

Chapter four ("Clinical competence: General Ability or Case-specific?") focuses on whether clinical competence can be considered a general, content-independent ability or whether competence in this area is dependent on case-specific knowledge (Barrows et al., 1982; Elstein, 1972; Elstein et al., 1978; McGuire, 1976). For this purpose, individual oral end-of-clerkship examination scores of students on 10 different clerkships are analyzed in two separate modeling steps using structural equation modeling (SEM) techniques. Chapter five ("Clinical Competence through the Eyes of an Educator: Differences in Perceived Importance of Student Performance on the Wards and on Clerkship Examinations") uses a survey that lists 21 individual competencies. This survey was administrated among clinical educators and physicians of different hospitals and disciplines involved with student learning on clerkship rotations. Our mean point of interest was to determine whether there is a difference between what is important for normal daily performance on the wards versus performance on clerkship examinations.

The development of clinical competence

Studies into the nature of this knowledge, its application and development started to dominate the field of medical education research in the 1980s and 1990s (Boshuizen & Schmidt, 1992; Chi, Glaser, & Rees, 1982; Norman, Tugwell, Feighter, Muzzin, & Jacoby, 1985; Patel, Evans, & Groen, 1989; Patel & Groen, 1986a, 1986b; Schmidt & Boshuizen, 1992, 1993a). Much of this research was focused on the transition from theory to practice and the consequences for knowledge development and its structure. A well-known and useful example of a theory that used the development of medical knowledge as the

cornerstone of clinical expertise is the knowledge encapsulation theory proposed by Schmidt and Boshuizen (1992). They reasoned that knowledge acquired during the first years of medical school integrates with clinically relevant knowledge in the latter practical years of medical school. Basic biomedical science knowledge of the first years becomes encapsulated into clinical concepts by repeated exposure to real clinical problems. Theories based on the integration of biomedical and clinical knowledge were not only successful in explaining such well documented phenomena as the above mentioned content specificity of problem solving (Patel et al., 1989; Schmidt, Norman, & Boshuizen, 1990), but also in explaining the often found "intermediate effect" in clinical case recall. This robust phenomenon often documented in the medical expertise literature consists of the finding that medical students of intermediate levels of expertise outperform both experts and novices in clinical case recall after diagnosing cases (e.g., Boshuizen & Schmidt, 1992; Patel et al., 1989; Schmidt & Boshuizen, 1992, 1993b; Schmidt et al., 1990).

Chapter six ("Inducing Expertise Effects in Clinical Case Recall through the Manipulation of Processing") is directed at the distinction between the "intermediate effect" and expertise effect in clinical case recall. Despite the consistent finding of intermediate effects in clinical case recall, in some instances, expertise effects are found (Norman, Brooks, & Allen, 1989). The current study manipulates case processing to explore under what conditions a shift occurs from an intermediate effect in recall towards an expertise effect. Chapter seven ("Effects of Level of Expertise on Data-gathering Behavior during different Stages of the Diagnostic Process") relates to previous research in medical problem solving that has been plagued by inconsistent findings about data-gathering behavior. There is uncertainty about the amount of information needed to mentally represent and solve a diagnostic problem and whether this is related to level of expertise. Some studies have proven that experts are more efficient in data-gathering (Rimoldi, 1955, 1961), while others relate expertise to spending more time and selecting more information (e.g., Chi, Feltovich, & Glaser, 1981; Van Gog, Paas, & Van Merriënboer, 2005). This study attempts to explain these findings and consideres how the amount of patient-data gathered differs during subsequent stages of the diagnostic problem-solving process and how it is related to the level of expertise.

Proposed categorization of clinical competence for this thesis

A categorization of clinical competence will be proposed here to function as a framework. As said, this framework is not intended to be a replacement or improvement of any other existing model, but is intended to serve as a model for the understanding of the subsequent chapters. The format of the categorization is derived from an often used division of competence into knowledge, skills, and attitudes (e.g., Rice & Sinclair, 1995) and further specified according to a categorization of clinical competence given by Norman (1985).

"Diagnostic Problem Solving and Clinical Judgment," a component of clinical competence (see Table 1), is subdivided into "the stages of the diagnostic process." These stages are derived from the study of Hubbard et al., (1965) and modified according to studies of Brug and Lloyd (1983) and Epstein and Hundert (2002).

Table 1. *Categorization of clinical competence and its application*

Cognitive Abilities
Biomedical and clinical knowledge and the ability to apply it to concrete situations
Diagnostic Problem Solving and Clinical Judgment
a. Obtaining sufficient information from clinical history and patient notes
b. Performing a focused physical examination
c. Utilizing and applying laboratory tests methods correctly
d. Utilizing and applying medical procedures correctly
e. Arriving via a reasonable differential diagnoses at a final diagnosis
Interpersonal Skills
Effective communication with patients and colleagues
Professional Qualities
Respectful and professional relationships with patients and in the provision of health care

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