Understanding Junior Doctors' Learning and Performance in Clinical Practice

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Abstract

As medical schools can only in a limited way prepare physicians for the multitude of challenges they face at the beginning of their career, physicians need to learn in everyday clinical practice. The aim of the thesis at hand is to develop a better understanding of junior doctors' learning and performance in clinical practice. The theoretical part of this thesis contains a review of current literature on junior doctors' clinical practice and learning in clinical practice. From the literature, organizational knowledge, task mastery, and role clarity were identified as challenging factors contributing to the complexity of junior doctors' clinical practice. The learning needs associated with these challenges were put in context with theories on residents' learning in the workplace. The empirical part of this thesis is concerned with the description of the two conducted studies and the development of the two clinical vignettes which are used in the second study to research junior doctors' clinical performance. In the first study, 12 experienced physicians elaborated their perspective on junior doctors' learning in the workplace in standardized interviews. The experienced physicians emphasized personal knowledge, social relations, and working conditions as crucial elements in junior doctors' clinical learning and suggested the interrelatedness of these factors. In the second study, 23 junior doctors described their social relations at the workplace, filled in a questionnaire about their perceived working conditions, and answered two clinical vignettes. These clinical vignettes were developed in a four step approach and applied to assess the junior doctors' clinical performance in regard of organizational knowledge, task mastery, and role clarity. The results of the second study indicate differences in the assessed factors due to personal characteristics and confirm the interrelatedness of junior doctors' social relations, their perceived working conditions, and their clinical performance. From the combination of the studies three themes struck as pivotal elements in junior doctors' clinical learning and performance: the task dependency of junior doctors' clinical learning and performance, the structural patterns in junior doctors' clinical learning and performance, and the individual capabilities of junior doctors and their teachers.

Keywords: workplace learning, socio-cultural learning, social network analysis, postgraduate medical education, junior doctors

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1 Introduction

1.1 Relevance and Research Focus

In recognition of the high demands physicians are confronted with on a daily basis, undergraduate medical education underwent far-reaching reforms in the last decades, aiming to better prepare medical students for the complex challenges of clinical practice. Competency frameworks for undergraduate medical education have been established (Frank, 2005; Medizinischer Fakultätentag der Bundesrepublik Deutschland e.V. & GMA Gesellschaft für Medizinische Ausbildung e.V., 2015) which provide curriculum developers and medical educators with some orientation on how to prepare their students to meet these clinical challenges. High-fidelity simulations, trainings of communication skills, and practical procedures were integrated in medical education in order to equip medical students with the practical skills necessary on their first day as a doctor. In Germany, money was granted by the federal governments to medical faculties of several federal states, allowing them to join forces in developing ideas to improve medical education as well as share examples of best practice. In the scientific community for medical education intensive research can be observed regarding domains such as undergraduate medical education, the educational strategies applied, the educational outcomes achieved, or the feeling of preparedness the students report.

Nevertheless, undergraduate medical education can only be the basis for physicians' medical practice with postgraduate medical training being the consequent next step in the physicians' professional development. However, although almost all medical graduates enter residency training, this phase of medical education so far has received a lot less attention in research and curriculum development. Currently massive discussions are ongoing, at least in Germany, on how postgraduate medical education should be organized (Berberat, Harendza, Kadmon, & Gesellschaft für Medizinische Ausbildung, 2013; David et al., 2013; Hallek & Schröter, 2012).

Should we orientate postgraduate medical education on competencies as well or rather focus on the concept of entrustable professional activities (Cate & Scheele, 2007; Cate, Snell, & Carraccio, 2010)? How can a competency based postgraduate medical education be systemized and organized in a way that fits the competency frameworks of undergraduate medical education and the official regulations of the Chambers of Physicians? These questions and more are dis-

cussed with intent but what seems to come a bit short in the discussions about what junior doctors have to learn in order to gain a specialty degree is the process of postgraduate medical education. Still pending remains the question of how junior doctors learn, what they need to know in order to perform efficiently in everyday clinical practice. Dornan (2012, p. 19) concluded: "I recently searched the international literature for empirical research into how residents learn. Remarkably little has been published". In the light of the evidence on the struggles junior doctors face, especially at the beginning of their clinical career (Barach & Philibert, 2011; Cameron, Millar, Szmidt, Hanlon, & Cleland, 2014; Young et al., 2011), this lack of research on junior doctors' learning in the workplace is surprising. Current research in this regard is most often concerned with residents' feeling of preparedness for practice (Brennan et al., 2010; Goldacre, Taylor, & Lambert, 2010; Ochsmann, Zier, Drexler, & Schmid, 2011; Prince, van de Wiel, van der Vleuten, Boshuizen, & Scherpbier, 2004), dealing with stress (Bullock et al., 2013; Henning et al., 2014; Paice, Rutter, Wetherell, Winder, & McManus, 2002; Reimann, 2013) or working hours (Fletcher et al., 2005; Lockley et al., 2004). Little is known about the process of learning in medical specialty training, although "[w]ork-based learning has now taken centre stage in the training and ongoing development of the medical workforce" (Swanwick, 2005, p. 859). This thesis addresses the identified lack of research on junior doctors' learning in the workplace by capturing the perspective of experienced physicians as well as junior doctors themselves on clinical learning and performance. The aim is to gain a better understanding of junior doctors' performance and especially the process of how they learn what they need to know for their clinical practice.

The domain of interest for the studies at hand is the specialty of internal medicine, which following Cranston et al. (2013) "remains the backbone of adult medical care". The domain of internal medicine puts junior doctors in a position of high responsibility within a system of complex processes and the need to work interdisciplinary with a holistic approach (Köbberling, 2009). Demanding tasks and processes on the ward are well described in the literature and allow a systematic approach to the domain. Additionally, the specialty of internal medicine is one of the largest medical specialties with 19.25% of all registered physicians in Germany holding a specialty degree working in internal medicine (own calculation; Bundesärztekammer, 2014a). All hospitals, irrespective of their level of care, include internal medicine as clinical specialty. Therefore the found results, even

though an explorative and qualitative research approach was chosen, should be relevant and applicable for a wide range of physicians and workplaces.

From a pedagogical point of view, with the studies in this thesis further information on informal and socially embedded workplace learning in a complex domain at an early career level should be gained. The conducted studies try to interlink and transfer established knowledge about factors affecting learning in the workplace such as social relations, structure of work, and personal characteristics (Eraut, 2007) in the medical domain and apply it to the context of junior doctors' professional learning. Furthermore, with the chosen social network approach a deeper understanding of socio-cultural influences on learning and performance in the medical domain might be achieved. Based on the results of the conducted studies as well as the reviewed literature, training hospitals should be provided with information about factors related to junior doctors' clinical learning and performance in order to enable these hospitals and the responsible educators to offer junior doctors supportive learning and performance conditions. The results also might help to inform junior doctors about the factors that influence their learning and clinical performance and show them how they themselves might be able to influence their professional development. Additionally, the findings might be of value for medical schools by giving hints on learning objectives which can be integrated into undergraduate medical education in order to better prepare junior doctors for the challenges of clinical practice.

1.2   Aim of the Thesis

From a socio-cultural perspective on learning and professional development, this thesis aims to contribute to a better understanding of junior doctors' clinical performance and the factors affecting their learning in clinical practice.

In order to understand junior doctors' learning and performance in clinical practice, we first need to conceptualize the terms *clinical practice*, *learning*, and *performance in clinical practice*. Junior doctors' performance is tied to clinical practice and clinical practice is tied to learning, because practice and learning are inseparable (Billett, 2004). Hence, we try to accomplish the conceptualization of junior doctors' learning and performance in clinical practice by relying on theories of organizational socialisation, workplace learning, and current research results on the transition from student to junior doctor. Having conceptualised junior doc-

tors' learning and performance in clinical practice from a theoretical perspective, the found concepts are put on the stand by relating them to the practical perspective of experienced physicians working in the field of internal medicine. The insights of experienced physicians on how junior doctors learn in clinical practice and subsequently change their clinical practice gives information on formal and informal educational processes within the workplace which contribute to junior doctors' clinical performance. Taking the perspective of experienced physicians into account also ensures the applicability of the described theories to the domain of internal medicine as well as the defined setting of early career learning. Factors crucial to junior doctors' professional development as perceived by experienced physicians are identified and used as a foundation for the subsequent study conducted with junior doctors.

The previously identified factors affecting junior doctors' clinical learning and subsequently their clinical performance get addressed by studying those who are affected, i.e. physicians at the beginning of their clinical career. The circumstances of junior doctors' clinical performance are investigated based on current research results regarding their feeling of preparedness for clinical practice, models for early career learning, and models for residents' learning in the workplace. The study is guided by the question: *"How do personal knowledge, social interaction, and perceived working conditions relate to junior doctors' clinical learning and performance?"*. To gather information on junior doctors' clinical performance their knowledge of established work practices and strategies of using clinical resources in solving clinical tasks is assessed. Junior doctors' social relations, personal knowledge, and perceived working conditions are taken into consideration and relations between those factors and junior doctors' clinical performance are highlighted.

1.3   Outline of the Thesis

The thesis is divided in two parts. In the first part, the relevant theoretical constructs considering junior doctors' clinical practice, performance, and learning in practice are elaborated, laying the foundation for the conducted empirical studies. In the second part, the empirical studies are described in detail, beginning with an overview of the research aims and ending with a discussion of both studies' findings as well as further implications of the results.

Part I: Theoretical framework and state of research

The chapters in the theoretical framework shape the theoretical foundation for the conducted studies and reflect the current state of research in the field of junior doctors' social learning in the workplace. In Chapter 2 the formal structure of medical education in Germany is described in order to provide an overview of the content and formal requirements in the process of becoming a medical specialist. The chapter concludes with the characterisation of the transition from student to junior doctor as a critically intensive learning period. Based on the presented background information on undergraduate and postgraduate medical education, junior doctors' clinical practice is explored in more detail in Chapter 3. Some key concepts in this thesis, like *clinical practice* and *efficient clinical performance,* are defined and put into context. This chapter also elaborates which tasks in the clinical environment are especially demanding for junior doctors. Referring to research on newcomer socialization as well as on junior doctors' feeling of preparedness for clinical practice, organizational knowledge, task mastery, and role clarity get identified as critical components in clinical learning and performance. Chapter 4 is concerned with junior doctors' learning in clinical practice. In order to specify factors affecting junior doctors' learning in clinical practice, formal and informal learning processes in the workplace are described and theoretical models for learning at an early career level in general and for junior doctors in particular are established. Taking the described models of learning in the workplace as a starting point, the identified factors affecting learning in the social context of work are elaborated in more detail and embedded in the context of learning in the medical domain.

Part II: Empirical studies

Derived from the findings of the theoretical framework, in Chapter 5 the aims and corresponding research questions of the thesis at hand are presented and an overview of the conducted empirical studies is given. The first study, an interview study exploring experienced physicians' perspective on junior doctors' learning in the workplace, is described in Chapter 6. It focuses on the factors the experienced physicians perceived as having affected their learning at the beginning of their own clinical career as well as the factors the experienced physicians perceive as affecting junior doctors' learning to show efficient clinical performance nowadays. Chapter 7 is concerned with the development of the research instrument used in the second study to assess junior doctors' clinical performance. First of all, the concept, validity, and appropriateness of clinical vignettes in researching clinical performance are elaborated, followed by a detailed description of the four-step development process of the clinical vignettes. In the second study, which is described in Chapter 8, the perspective of the junior doctors themselves is in the spotlight. Information on junior doctors' personal characteristics, their egocentric networks, their perceived working conditions, and their clinical performance was collected and analysed in order to gain a better understanding of the interrelatedness of the mentioned factors. With the second study, the research questions related to Aim 3 *(Exploring the factors affecting junior doctors' learning in the workplace.)* and Aim 4 *(Understanding junior doctors' clinical performance considering their social relations, personal knowledge factors, and perceived working conditions.)* were addressed. In Chapter 9 the results of both studies are summarized and discussed, highlighting key themes in relation to the overall aim of this study: to broaden the understanding of junior doctors' clinical learning and performance. In the final chapter, the theoretical and practical implications of the found results are discussed and suggestions for further research are given.

Part I

Theoretical Framework and State of Research

2   Junior Doctors' Medical Education

When talking about medical education or medical training the terminology as well as the content of training is often ambiguous. Different countries have established different systems in educating their physicians. Even within the same country, differences in the medical education system can be observed. In general there is a distinction between undergraduate and postgraduate medical education. Additionally, continuing professional education is a big issue in the medical domain as the half-life of knowledge is rather short (Bennett et al., 2000; Davis, Davis, & Bloch, 2008). Some efforts have been made, for example by the World Federation for Medical Education, to define comparable standards for basic and postgraduate medical education (World Federation for Medical Education, 2003, 2012) to help build an accreditation system for medical schools and facilitate the comparability of medical degrees in Europe. The standards are meant to be used in the development of educational programmes as well as in self- and external evaluations of those programmes. The defined standards for undergraduate medical education include 100 basic standards (all medical schools have to meet them) and 91 quality development standards (all medical schools should strive to meet them) within nine areas relating to the structure, process, and outcome of medical education, for example educational programme, academic staff/faculty or programme evaluation (World Federation for Medical Education, 2012). In a similar manner, basic standards and quality development standards are described for postgraduate medical education (World Federation for Medical Education, 2003).

Establishing a common ground for medical education seems critical as the international mobility of medical education graduates is rather high. According to the German Medical Association (Bundesärztekammer, 2014a), the number of physicians in German hospitals who have completed their basic medical education in a foreign country is increasing. In 2014 the German Medical Association counted 39,661 physicians from foreign countries working in Germany, which is about 11% of all working physicians in Germany. Naturally, physicians who have completed their basic medical training in Germany also seek work in other countries (2,361 left in 2014) (Bundesärztekammer, 2014a). However, despite the international and especially Europe-wide exchange of physicians and the described efforts to define common grounds in medical education, currently comparability across different countries and therefore different educational systems remains challenging. Wijnen-Meijer, Burdick, Alofs, Burgers, & Cate (2013) present a comprehensive overview of similarities and differences in the structure and

terminology in medical education. They propose a general model of six routes in medical education, considering whether certain educational steps (i.e. secondary school, college, medical school, internship, mandatory services, and residency) are to be completed in specific countries or not. According to their overview, the German medical education system is represented in Route I, beginning with secondary school followed by medical school (undergraduate training) and residency (postgraduate training) (Wijnen-Meijer et al., 2013). In order to become a physician in Germany, the achievement of extremely high marks in the final exams in secondary school (Abitur) is a crucial prerequisite. The highly requested university places are mainly allotted by the final grades. In winter terms approximately five students apply for one of about 9,000 places available at the 36 public medical schools in Germany. In spring terms approximately eleven students apply for one of about 1,700 offered places (Hochschulstart.de, 2014). In order to provide basic insight in the domain of research, in Chapter 2.1. and 2.2. the two remaining elements described by Wijnen-Meijer et al. (2013) in Route I (medical school and residency) are elaborated in more detail for the German system.

To avoid terminological confusion, in the following the term *junior doctor* is used for physicians at the beginning of their clinical career, which we define as the first 36 months on the job after completing medical school. *Experienced physicians* are physicians with more than 36 months of clinical experience irrespective of their formal qualification, i.e. specialty degree. *Senior physicians* are physicians with a specialty degree and are in a leading position with responsibility for junior doctors.

2.1   Undergraduate Medical Education in Germany

The following characterisation of undergraduate medical education in Germany provides the necessary distinction between formal legal regulations fixed by the government for the process of medical education and the actual content and educational procedure which is mostly in the hands of each single educating university.

Formal and legal structure of undergraduate medical education

The aims and basic principles of undergraduate medical education in Germany are defined in the Licensing Regulations for Physicians "Ärztliche Approbationsordnung" (ÄApprO) (Bundesministerium für Gesundheit, 2002). The Licensing Regulations for Physicians tend to focus more on the structural properties of medical education than on the content and the form of content presentation. It specifies which specialties need to be taught, but neither does it define in which form nor does it point out how much time has to be spent on every specialty. It is specified how many hours of bedside teaching are required and how many students are allowed to be at the bedside at the same time, but not how the actual teaching should be performed. Moreover, after having gained governmental agreement, medical schools can chose to implement model or reform curricula, which for example integrate the preclinical and clinical phases over the whole course of the medical education. Students following a regular undergraduate medical curriculum are trained in basic medical science for four terms (preclinical phase), followed by a basic medical clinical training at a university clinic for six terms (clinical phase) and end their training with one year of practical placement.

Following the Licensing Regulations for Physicians, in the preclinical phase students learn about physics, biology and chemistry as well as anatomy, physiology, bio-chemistry, medical psychology, and medical sociology. Additionally, students have to complete a first aid course and a three month nursing experience before they are allowed to finish the preclinical phase of their studies. Clinically integrated seminars in cooperation with a university hospital provide the students with a first glimpse into the clinical workplace. At the end of the preclinical phase students have to finish the first stage of a three-stage medical examination called "Physikum", which consists of a written and an oral examination. Having successfully completed the preclinical phase, the students proceed to the clinical phase of their studies.

In the first term of the clinical phase, students usually attend clinical-theoretical subjects like microbiology and pathology. Later on, they get involved in clinical specialties like internal medicine, surgery, anaesthesiology, ophthalmology, paediatrics, and psychiatry as well as cross-sectional specialties like radiology or ethics. The required disciplines in the clinical phase are defined in the Licensing Regulations for Physicians. During their clinical phase, students have to take a total of four months of clinical electives outside the teaching periods. These electives aim to get the students acquainted with inpatient as well as ambulatory care settings. The clinical phase ends with the second stage of the three-stage medical examination. If the students pass this written exam they are allowed to begin their year of practical placement.

After ten terms of theoretical and partly practical training, every student is obliged to do three 16-week long work placements which sums up to 48 weeks of practical training, the so-called "practical year" (Bundesministerium für Gesundheit, 2002). Surgery and internal medicine are mandatory placements. The third placement can be completed either in general practice or in any other clinical/practical specialty, except surgery or internal medicine. While completing their practical year, students are not allowed to perform any clinical tasks unsupervised. University hospitals and authorised teaching hospitals offer practical placements. Students may choose their preferred location for each third of the practical year and many students use the opportunity to complete parts of their practical year in foreign countries. The aim of the practical year is to allow students to get to know the working processes in hospitals so they can get some routine in basic medical skills, for example history taking and clinical examinations. In order to ensure the exposure to learning relevant tasks and provide structural guidance, in 2013 a mandatory journal for the practical year was introduced for every specialty. The universities had to define learning objectives for the practical year in every specialty and lay them down in the respective journals. After the practical year, the students complete the third and last stage of the medical examination, which consists of a two-day practical exam. After passing the last exam, the medical students can request their approbation, which allows them to practice medicine in a hospital setting.

Content and educational formats in undergraduate medical education

Whereas the legal regulations for the formal structure of medical education are the same across all German universities, how the relevant subjects are organized and taught within the medical curriculum is at the discretion of each university. In consequence, dealing with the lack of established catalogues stating detailed learning objectives for medical education, some universities came forward in developing their own catalogues of learning objectives (Medizinische Fakultät der Universität Hamburg, 2006; Universität Göttingen, 2008), especially for the clinical phase of the basic medical education. Recently, in a joint effort the German Medical Faculty Association (Medizinischer Fakultätentag, MFT) and the Society for Medical Education (Gesellschaft für Medizinische Ausbildung, GMA) developed and released the *National Competency-Based Learning Objectives for Undergraduate Medical Education* (Nationaler Kompetenzbasierter Lernzielkatalog Medizin - NKLM), which is meant to provide a framework for curriculum organization for all medical faculties in Germany (Medizinischer Fakultätentag der Bundesrepublik Deutschland e.V. & GMA Gesellschaft für Medizinische Ausbildung e.V., 2015). The medical societies as well as the medical faculties were asked to contribute to the development process of the NKLM in order to achieve consent on the relevant learning objectives and harmonize the content of the medical curricula. How faculties, curriculum planners, and clinical teachers as well as students may use the NKLM is currently discussed vigorously within the medical faculties and the Society for Medical Education. Whether the effort put into a joint catalogue of learning objectives for German medical education will be fruitful and help to set nationwide common standards remains to be seen, but the experiences with similar frameworks in other countries are promising (Parent, Jouquan, & Ketele, 2012).

Considering the learning formats in undergraduate medical education, quite some diversity can be observed. Theoretical knowledge is mostly presented in lectures, through e-learning opportunities, in seminars, or students are referred to text books. The distinctive feature of teaching theoretical knowledge in medical education, especially in the clinical phase, is the involvement of patients in teaching situations. As the clinical phase of medical education in Germany is provided by university hospitals, in many lectures patients who volunteered to support the students' education are present and students have the opportunity to get information about their disease and the treatment directly from the patients. Next to well-known formats like lectures, the concept of problem-based learning has found

quite some resonance in medical curricula (Barrows, 1996; Norman & Schmidt, 1992). Problem-based learning formats in medical education are supposed to build a bridge between theoretical knowledge and action strategies. In problem-based learning scenarios students are confronted with a medical problem, mostly on paper, and have to solve the problem at hand in a small group setting. The educator is merely present as a moderator within the group of students. In solving the medical problem, the students have to use and generate theoretical knowledge as well as think about strategies of how to deal with the specific problem presented in the medical case. The effects of problem-based learning formats are still discussed controversially within the medical education community, as the performed meta-studies and reviews are not conclusive and to some extent even contradictory (Colliver, 2000; Koh, Khoo, Wong, & Koh, 2008; Norman & Schmidt, 2000). Besides theoretical knowledge and action strategies, medical students need to learn necessary medical skills like taking blood, performing a clinical examination, or an anamnesis. In most of the universities skills labs for the teaching of medical skills and procedures have been established. These skills labs allow students to learn and train their skills in a simulation-based environment without harming patients (Barry Issenberg, McGaghie, Petrusa, Lee Gordon, & Scalese, 2005; Schnabel et al., 2011; Ziv, Ben-David, & Ziv, 2005). Actors playing the role of patients are commonly used to train communicational skills (Cleland, Abe, & Rethans, 2009) and patient simulators are applied for the training of emergency situations (Eyck, Tews, & Ballester, 2009; Fritz, Gray, & Flanagan, 2008; McLaughlin et al., 2013). Some universities have built special patient rooms or even training wards equipped with video surveillance to allow students to train their ward round and bedside skills in a simulated setting with video feedback (Lottspeich et al., 2011; Nikendei et al., 2007; Nikendei, Kraus, Schrauth, Briem, & Jünger, 2008). Additionally, students are taught practical skills and procedures in their practical placements and mandatory bedside teaching courses.

With the ongoing discussion about how to best prepare medical students for their future responsibilities, the functions and abilities of clinical teachers in this process have gained more and more attention (Harden & Crosby, 2000; Ramani & Leinster, 2008). Most medical faculties have established mandatory teacher training for their staff in order to ensure the quality of undergraduate medical education. However, it should also be mentioned that the staff teaching in undergraduate medical education at university hospitals has to find a balance between

patient care, research, and educating students. How this balance is achieved depends not only on the clinical teachers' individual motivation for educating students but also on hospital policies, the responsible head of department, and ultimately on the significance allotted to teaching students at the particular university hospital (Dybowski & Harendza, 2014).

Nevertheless, one core issue remains to be answered: Why do junior doctors put it upon themselves to pursue a medical specialty degree and therefore stay in the "student" role for additional five to eight years after having studied for six years? Firstly, without a specialist diploma physicians are not licensed to open up their own medical practice (Kirschner, Rottkemper, & Binsch, 2014). Career and therefore financial perspectives are rather limited even for physicians who want to work in a hospital setting without a specialist diploma (Gehle, Benemann, & Renzewitz, 2014; Kugelstadt, 2014). Also, being promoted to the position of a senior physician is almost impossible without a specialist diploma (Kugelstadt, 2014). Furthermore, the working conditions for non-specialists are often less pleasant than those of medical specialists (Bauer & Groneberg, 2014). Hence, most graduates start specialty training after having completed their basic medical education (Gehle et al., 2014).

2.2   Postgraduate Medical Education in Germany

In contrast to undergraduate medical education, postgraduate medical education in Germany is not regulated by federal law but within the administration of physicians' self-government. Consequently, residency training in Germany is regulated by the State Chambers of Physicians of each federal state (Gehle et al., 2014; Kirschner et al., 2014). The German Medical Association has published exemplary *Guideline Regulations on Specialty Training* for each specialty which serve as a framework for the regulations administered by the respective State Chambers of Physicians (Bundesärztekammer, 2015). Depending on the specialty, training usually takes between five to six years. A basic prerequisite for every specialty training is the achievement of the licence to practice medicine (Menelaou, 2012).

Three professional designations can be distinguished: medical specialist (Facharzt), medical specialist with subspecialty degree (Facharzt mit Schwerpunktbezeichnung) and specialist with additional qualifications (Facharzt mit

Zusatzweiterbildung) (Gehle et al., 2014). In the specialty of internal medicine a physician may achieve a specialty degree in internal medicine and the subspecialty of gastroenterology, which indicates the distinct focus and additional competencies in the domain of gastroenterology within the field of internal medicine. An additional qualification implies further education and taking the respective assessment in a specific medical field like emergency medicine or palliative care, after having accomplished a specialty degree (Kirschner et al., 2014). The State Chambers of Physicians describe and assess the mandatory requirements for specialty training including subspecialties and additional qualifications. The respective State Chambers of Physicians also decide which institutions are licensed to educate residents, thereby considering the patient-mix as well as medical and staff resources at site (Kirschner et al., 2014). Experienced physicians with a specialty degree in the respective discipline, who are authorised for this educational task by the State Chambers of Physicians, provide the residents' training at site. The approval is granted after the assessment of the professional as well as personal qualification of the applying physician and can be revoked with the physician changing the hospital or if doubts in the professional or personal qualification become apparent (Bundesärztekammer, 2015). An approved physician has to develop and hand out the formal curriculum for the specialty training, has to provide feedback on the residents' progress in annual reviews, and has to keep records of the progress in a mandatory journal (Bundesärztekammer, 2015). Although junior doctors are recognized as learners, they work as regular physicians in hospitals during their residency training and get paid accordingly (Bundesärztekammer, 2015). After having completed the mandatory time of specialty training as well as the mandatory amount of procedures and skills, the residents may apply to be assessed at the respective State Chamber of Physicians. The assessment takes place as an oral examination which the residents need to pass before being awarded with a specialist diploma.

Specialty training in internal medicine, which is the domain of interest in this thesis, takes at least five years. There are several ways in which the specialty training may be completed, depending on whether the aim is to gather a specialty degree in internal medicine (with or without a subspecialisation) or to become a general practitioner (Figure 1). For the studies presented in the following chapters we focused on residents in the first 36 months of their specialty training, as this time span can be assumed as mandatory basic training irrespective of the cho-

sen subspecialty within the field of internal medicine as well as the progression to become a general practitioner.
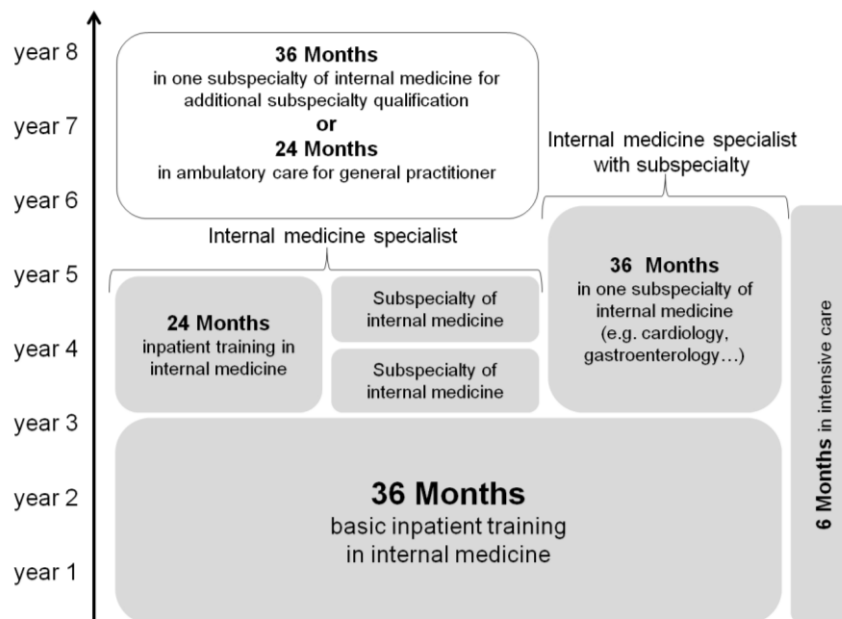
Figure 1   Overview of Internal Medicine Specialty Training in Germany
(adapted from Berufsverband Deutscher Internisten e.V.)

The *Guideline Regulations on Specialty Training* provide a legal framework for postgraduate medical education. However, similar to undergraduate medical education, these regulations give only limited information on the content and process of education. An evaluation of postgraduate training programmes launched by the German Medical Association in 2009 and 2011 (Bundesärzte-kammer, 2011) revealed an average overall satisfaction of residents in all specialties with their training. In the study of 2011, 20,518 residents (38.6% of all residents in Germany registered with the German Medical Association) answered the survey. Alongside a global rating, the main themes of the survey were teaching of professional competence, learning culture, management culture, management of critical incidents, decision-making processes, corporate culture, and evidenced based medicine (Kirschner et al., 2014). Concerning the transparency of the training programme at site, the results showed that only one third of the respondents received the curriculum for their training in a written form and 42% received none at all. More than a third of the participants rated the learning culture at their hospital as satisfying to deficient and the training in evidence-based medicine was evaluated as only satisfactory or below by 69%. Although there is a

slight improvement in the overall ratings between the studies from 2009 to 2011, there still seems to be a need for improvement in postgraduate training programmes. To address this need, a "vigorous discussion on the future of postgraduate medical training in Germany" (Berberat et al., 2013, p. 2) is ongoing. An orientation on competencies or entrustable professional activities in postgraduate medical education (Berberat et al., 2013; Cate, 2005; David et al., 2013; Hauer et al., 2013) is widely recognized as an opportunity to enhance medical education (Hodges, 2010). This competency-based concept of residency training focuses on trainees' actual clinical performance and not on temporal regulations for the accomplishment of a formal training programme. However, just defining and teaching entrustable professional activities does not solve the problems of assessing residents' performance or the associated necessity of a clinical teacher training. Therefore, the German Medical Association is working on the advancement of the current postgraduate training regulations in consideration of the newly developed NKLM (Nationaler Kompetenzbasierter Lernzielkatalog Medizin - National Competency-Based Learning Objectives for Undergraduate Medical Education), to form a coherent system of learning objectives for becoming a medical specialist (Bundesärztekammer, 2014b). In the revision of the *Guideline Regulations on Specialty Training* a focus is put on competencies and different levels of competence to be achieved for certain procedures and not so much on the time the residents are obliged to spend on mandatory tasks (Gehle et al., 2014). This process of finding a realizable consensus for the new regulations on specialty training is still ongoing and the question "*how do residents actually learn in practice?*" remains rather unsettled. A first step in answering this question, at least from a theoretical perspective, might be to describe the transition from student to doctor as a phase of intensive learning within a specific cultural setting.

2.3   The Transition from Student to Doctor

From the described contents, processes, and legal regulations for undergraduate and postgraduate medical education, fundamental differences between those two phases of medical education become apparent. The well-described gap between theory and practice, as defined for many other disciplines, is also observable for the medical domain (Cave, Woolf, Jones, & Dacre, 2009; Goldacre et al., 2010; Ochsmann et al., 2011). Within the rather school-like undergraduate medical education system it is not possible to prepare medical students for all the chal-

lenges of clinical practice. Although the introduction of clinical clerkships, simulation-based education, and a high amount of patient contact hours allow students to learn about the structural working patterns in hospitals, tacit knowledge is necessary to fully comprehend the site-specific working patterns. This tacit knowledge is bound to every individual hospital site and can only be experience in everyday clinical practice. Thus, newly qualified physicians struggle in the transition and even if they were provided with all the necessary medical knowledge for clinical practice, they are still not prepared for the site-specific organizational practices, cultures, and activities. Kilminster, Zukas, Quinton, & Roberts (2011, p. 1014) argue that "practice, performance and learning are so interlinked that they are inseparable and dependent on the specific setting. Consequently, doctors cannot be fully prepared for a transition". Relying on Kilminster et al. (2011) the factors representing this specific setting and affecting junior doctors' performance during transition are organizational, individual, and task related (Figure 2).
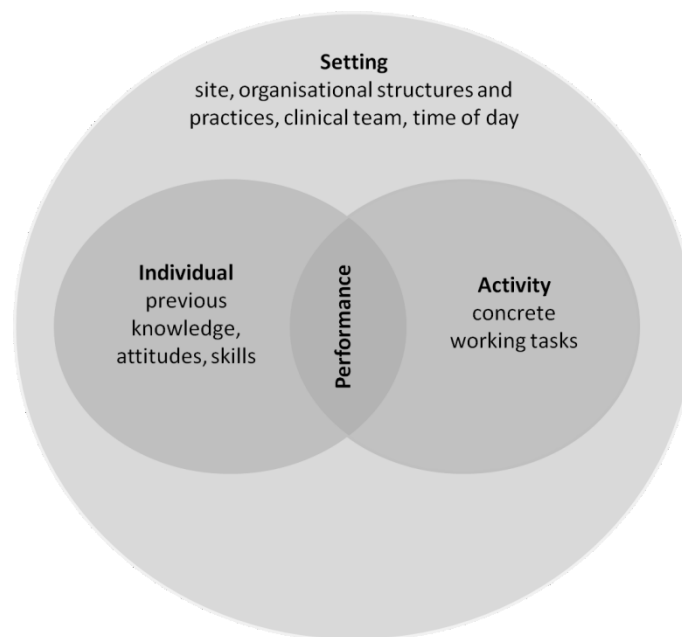
Figure 2   Factors Affecting Performance of Junior Doctors during Transition
(adapted from Kilminster et al., 2011, p. 1013)

Studying transitions in the career of physicians, especially the transition from medical student to junior physician, Kilminster et al. (2011) came to conclude that instead of focussing on preparedness for practice, a better understanding of junior doctors' performance might be gained by recognizing the transition phase as a "Critically Intensive Learning Period" (CLIP). In this period, "the doctor engages

with the particularities of the setting and establishes working relationships with other doctors and other professionals." (Kilminster et al., 2011, p. 1014). The word "critically" refers to a "limited time in which some event can occur, usually resulting in some kind of transformation" (Zukas & Kilminster, 2012, p. 204). The word "intensive" addresses the immediacy of the learning process which is a result of the time-critical elements of patient care that are an integral part of everyday social practice in the workplace (Zukas & Kilminster, 2012). Defining the transition from medical student to junior doctor as a CLIP has considerable consequences on organizational, task and individual level and puts a strong focus on junior doctors' learning in their clinical practice. A socio-cultural perspective on junior doctors' clinical practice and performance becomes necessary, as junior doctors' learning in the clinical workplace takes place in social interaction with patients, nurses, peers, colleagues, and superiors.

3 Junior Doctors' Clinical Practice and Performance

As explained in the previous chapter, practice, performance, and learning are context-dependent and inseparable (Kilminster et al., 2011). In order to develop an understanding of learning and performance in the clinical setting, the construct of clinical practice needs to be elaborated and factors relevant in dealing with the challenges of clinical practice ought to be described.

3.1 Defining Clinical Practice and Clinical Performance

A definition of physicians' clinical practice and clinical practice in internal medicine can be achieved from multiple perspectives. Cranston et al. (2013) conducted a survey on clinical practice of internists in Europe which covered organisational processes, performed procedures, medical problems encountered, and medical diagnose managed by European internists. The results of their study inform about common medical problems encountered within the field of internal medicine, like abdominal pain, chest pain, or fever as well as commonly performed procedures, like drawing arterial blood or ECG recording and interpretation. While this kind of knowledge is very helpful in the discussion on the training content in postgraduate medical education, the complexity of clinical practice and the challenges in the everyday work of physicians can only in a limited way be explained by solely focusing on medical conditions and procedures.

Taking a broader perspective on clinical practice, particularly clinical practice of junior doctors, Kugelstadt (2014) defined six forces building the area of conflict, which resemble the complexity junior doctors face at the beginning of their career (Figure 3). The described areas of conflict include predominantly the social side of physicians' every day work, the patients, the nursing staff, the chief and senior physicians, and also the employer (Kugelstadt, 2014).
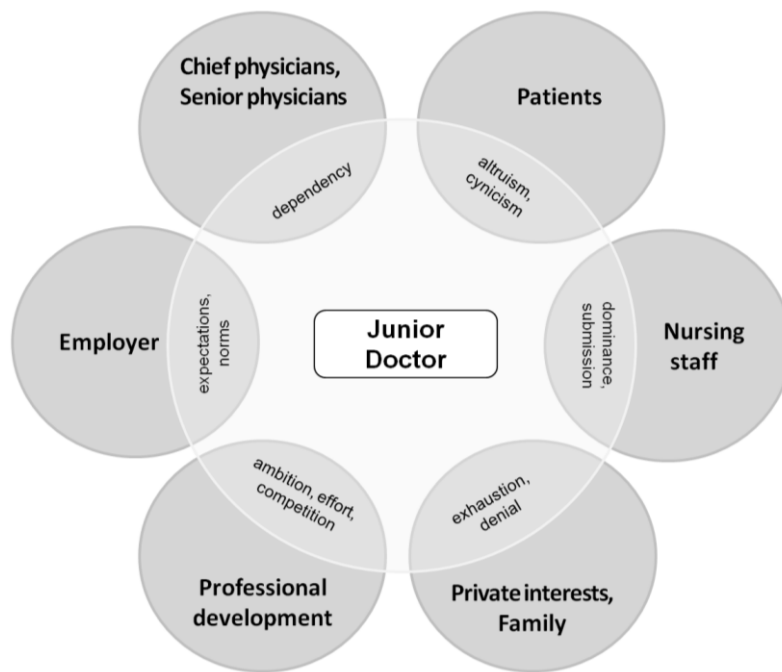
Figure 3   Six Factors Influencing Junior Doctors' Clinical Practice at the Very Beginning of their Career (adapted from Kugelstadt, 2014, p. 101)

All mentioned relationships include different hierarchical structures, different expectations to be met on both ends as well as interdependencies to be dealt with. Especially at the beginning of their career, physicians have to work out their position in this web of social interactions in the clinical workplace (Füllekrug, 2008). Next to the social contacts in the workplace, junior doctors' clinical practice is also influenced by their personal situation, their family situation, their interests and their previous education (Kugelstadt, 2014). Although the described area of conflict between different social groups as well as different expectations, different needs and communicational challenges present themselves not just to junior doctors but in similar form to all working physicians, these factors are especially challenging to the former, because all factors are new and need to be dealt with at the same time.

Hoff, Pohl, & Bartfield (2004) also present a framework for junior doctors' practice, conceptualizing clinical practice as a learning environment. They describe a residency culture which is situated in the work context and which includes factors such as trust, empathy, support, respect, examination of failures, and sharing of information. These elements of residency culture are related to junior doctors' opportunities to gain competence, whilst residency culture is simul-

taneously influenced by factors related to the working context such as time pressure, workload, physician-nurse collaboration, availability and support of supervisors as well as the work-life balance. By describing the learning environment of residents from a cultural perspective which is influenced by factors related to clinical practice, Hoff et al. (2004) present a similar area of conflict as explained by Kugelstadt (2014), only from a slightly different point of view. So far, clinical practice was described from a medical knowledge perspective and based on factors contributing to the area of conflict that clinical practice represents for junior doctors. In the following, the constructs *professional practice* and *clinical performance* are further elaborated considering a theoretical perspective affiliated with learning in the workplace.

Eraut (2010, p. 43) describes professional practice as comprising four distinct but interacting elements: (1) assessing clients, workers and situations, (2) deciding what, if any action to take, (3) pursuing an agreed course of action, (4) metacognitive monitoring. Following Eraut (2010, p.44) these "element[s] can take many different forms according to the context, the time available and the types of technical and personal experience being deployed." This description of professional practice seems appropriate for clinical practice as well. In clinical practice a physicians has to (1) assess the client's, i.e. the patient's complaints, then has to (2) decide which examination or treatment is appropriate, and then (3) needs to proceed with the decision made while (4) constantly monitoring the ongoing progress and eventually revise or adjust the decision made. Also, all the aforementioned elements strongly depend on time and the personal knowledge the physician brings to the situation. All of this has to be done in an organizational context and in interaction with other health professions, the patients, and their relatives, which adds further complexity to clinical practice.

In the clinical context the term *performance* is rarely explicitly defined but it is "generally implicitly understood as practice or action" (Kilminster, Zukas, Quinton, & Roberts, 2010, p. 557). Clinical performance and clinical practice are inseparable, as clinical performance depends on the affordances and constraints of clinical practice (Kilminster et al., 2011). Therefore establishing a list of competencies to describe clinical performance seems an approach too static and narrow to enhance our understanding of what a doctor actually does. Performance in a broad sense "includes those thoughts and actions, which take place within a chosen performance period, or which focus primarily upon preparing for, or reflection on, that period" (Eraut, 2007, p. 406). Taubman (1991, p. 314) defines efficiency in

clinical performance via "the amount of resources such as time, effort and money, that must be invested in achieving a desired effect". Szymczak & Bosk (2012, p. 350) take a more pragmatic perspective towards efficiency in clinical performance and state—as a working definition—that efficiency contains the "ability to prioritize, to anticipate problems, and to take action in order to accomplish tasks". Accordingly efficient clinical performance contains the context-appropriate ability to apply knowledge of established work practices as well as the ability to apply appropriate strategies of using clinical resources to solve the task at hand. This implies setting the medically induced priorities, working in a timely manner, being responsible in the application of clinical resources, finding ways to deal with organizational constraints and having the patients' safety in mind while doing so.

Junior doctors in German hospitals are forced to deal with this complexity right from the beginning. This means taking responsibility, for example for patients, ward rounds, prescriptions, ordering laboratory and radiology tests as well as doing all the necessary paperwork. Current research from the UK and the US indicates that junior doctors seriously struggle in handling the tasks mentioned before (Young et al., 2011). Recent studies from the UK and US about the well-being of patients who come to the hospital the day when newly graduates start their clinical work even indicate higher death rates for these patients (Barach & Philibert, 2011; Cohen et al., 2013; Young et al., 2011). Most of the newly graduates recognize their lack of medical knowledge, but also a dangerous lack of organizational knowledge and strategies to deal with the necessary routines of clinical practice. As a multitude of aspects contribute to the challenges faced in clinical practice, in the following we will focus on the knowledge elements and skills, which cannot or only in a limited way be taught in medical school because they are determined by the specific context at site. Drawing on the literature on newcomer socialization (Morrison, 2002), the challenges and related learning needs faced by junior doctors correspond to three broad categories of necessary contents for newcomer socialization (Figure 4): organizational knowledge (Chapter 3.2), task mastery (Chapter 3.3), and role clarity (Chapter 3.4). Naturally, the boundaries of these categories are floating and the related factors interact.
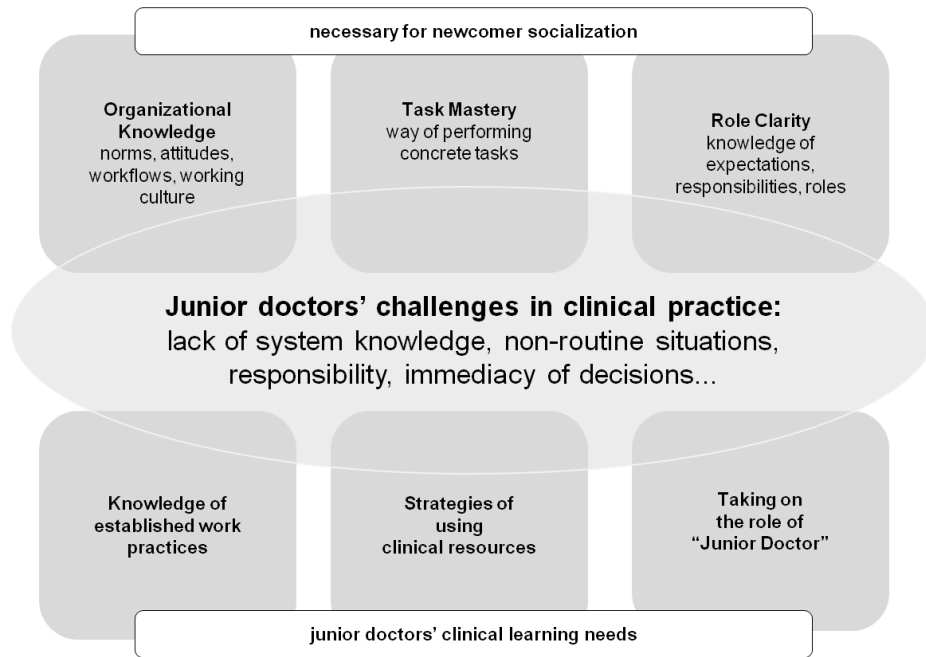
Figure 4   Junior Doctors' Challenges and Learning Needs in Clinical
                 Practice

Admittedly, the information about what is challenging for a junior doctor in clinical practice is mostly derived from self-reports, addressing the feeling of *preparedness for practice* (Illing et al., 2013; Prince et al., 2004; Sheehan, Wilkinson, & Bowie, 2012). Although the feeling of preparedness for practice does not necessarily reflect the actual performance (Kilminster et al., 2010), the insights derived from these kind of self-reports seem valuable in order to get a better understanding of the obstacles junior doctors face at the beginning of their career as well as their corresponding learning needs.

3.2   Organizational Knowledge in Clinical Practice and Performance

The term *organizational knowledge* refers to the knowledge of organizational and team norms, attitudes, and workflows (Morrison, 2002). It concerns the overall cultural knowledge embedded in an organization, such as a hospital, on the macro level of the whole organization as well as on the micro levels, like specialties, institutes, wards, and working teams (Hodkinson, Biesta, & James, 2007; Zukas & Kilminster, 2012). This knowledge of established work practices, i.e.

system knowledge, seems necessary for junior physicians in order to provide efficient clinical care (Young et al., 2011). However, the relevant knowledge is often not explicitly stated and "novices may need to engage with and learn from those who can offer the requisite insights, procedures and dispositions" (Billett & Choy, 2013, p. 265).

Sheehan et al. (2012, p. 941) found that junior doctors tend to struggle with everyday *project management tasks*, impeding their attempts to keep "things running smoothly", due to a lack of knowledge about how things are done at the specific site (i.e. organizational knowledge). Guidelines and especially evidence-based guidelines, which have a long tradition in medicine, might help closing the organizational knowledge gap, at least to some degree. These guidelines, developed by professional medical societies or hospital staff, aim to set a standard as well as to support decision making, reduce risks, allow treatment according to state of the art research, and thus raise the quality of care, while trying to reduce unnecessary costs. Physicians are obliged to know these guidelines and decide whether they are applicable for the individual patient at hand (Mercuri et al., 2015). Besides these official guidelines, every hospital has a working culture of its own. Sheehan et al.'s (2012) qualitative study reports that during their first year of practice junior doctors learn a lot about these site specific organizational processes and structures (e.g. "finding out where resources can be located", p. 940). The knowledge of these more tacit guidelines and structures about how things are done at the specific hospital, specialty, and ward, seems equally necessary for junior doctors to show efficient clinical performance. Since the organizations' structures are site, workplace, and specialty specific, medical schools can prepare their students only in a limited way in this regard (Illing et al., 2013).

However, in non-routine or unclear clinical situations even the knowledge of guidelines is only partially useful (Illing et al., 2013). A junior doctor who is on a ward for pulmonary diseases, for example, is most likely to be familiar with the common pulmonary diseases after a few months. When this junior doctor finds himself in a situation where his patient with a pulmonary disease suddenly develops an additional symptom, such as abdominal pain, the situation becomes non-routine for him and determining what to do next in order to help the patient may be very difficult for him. The same applies for highly complex clinical situations where a lot of different factors need to be considered in treating a patient (Prince et al., 2004). For example, when uncertainties appear about the origin of the symptoms or legal issues are involved (e.g. a patient who is declared legally in-

capable). Also an acutely sick patient requiring immediate decision and action from the junior doctor can be considered as a non-routine and therefore demanding clinical task (Illing et al., 2013). Medical schools try to prepare their students for non-routine and unclear clinical encounters by teaching emergency skills and confronting them with the inherent uncertainty of a lot of medical situations, but these attempts still seem insufficient (Illing et al., 2013; Laven, Keefe, Duggan, & Tonkin, 2014). Although junior doctors are generally not expected to come up with the perfect medical solution—because after all they are still in their specialty training and not considered medical experts—when encountering a non-routine or unclear clinical situation, junior doctors are expected to have strategies to deal with these kinds of situations (Brydges & Butler, 2012). These strategies might include asking the nursing staff or a peer for help as well as calling a specialist or the senior physician for advice. Nonetheless, current research indicates that junior doctors tend to struggle in these non-routine and unclear clinical situations (Brennan et al., 2010; Sheehan et al., 2012) and are "often uncertain what to do themselves and when to call their superior" (Prince et al., 2004, p. 326). Junior doctors sometimes appear unaware "when to seek help and what help to seek" (Brennan et al., 2010, p. 456). Hence, organizational knowledge about workflows and especially about *who knows what at work* seems necessary for junior doctors to be able to show efficient clinical performance.

3.3   Task Mastery in Clinical Practice and Performance

The term *task mastery* refers to knowledge about how specific tasks are carried out at a specific site (Morrison, 2002). In the following, task mastery in clinical practice is seen as a twofold concept including medical knowledge and skills as well as meta-strategies facilitating the efficient use of the medical competencies.

Considering the medical components of task mastery, they relate to the fundamental duty every junior doctor faces in clinical practice: patient care. Basic skills in patient care are taking the patient's history and performing a targeted clinical examination. For both tasks junior doctors report to feel rather well-prepared for by their medical schools (Illing et al., 2013; Prince et al., 2004). Junior doctors' feeling of preparedness regarding their communicational skills, for example in history taking, might be explained by the emphasis put on the physician's role as a communicator in the last decade (Bundesministerium für Gesundheit, 2002; Frank, 2005; Medizinischer Fakultätentag der Bundesrepublik

Deutschland e.V. & GMA Gesellschaft für Medizinische Ausbildung e.V., 2015). Accordingly, lots of medical schools work with simulated patients to educate their students in history taking and delivery of bad news (Jünger & Köllner, 2003). The training of communicational skills was even included in the current *German Licensing Regulations for Physicians* (Bundesministerium für Gesundheit, 2002). Getting to the right conclusion and formulating a first working hypothesis after the anamnesis and the clinical examination seems to be a bigger challenge for the junior physicians (Brennan et al., 2010; Prince et al., 2004). Depending on their working hypothesis, they start ordering diagnostic measures to gather further information supporting or falsifying their hypothesis. Research shows that the overuse of medical tests is a common problem amongst physicians (Winkens & Dinant, 2002). Wanting to get a thorough picture of a patient's condition and avoid missing something important by ordering a diversity of medical tests is a very understandable behaviour. Nevertheless, some medical tests come with (high) risks for the patient and the decision to take that risk needs to be made carefully and in consideration of the informational value the respective results might provide. Especially junior doctors tend to order medical tests which are of no or only little use to further inform the diagnostic process or the treatment of a patient (Miyakis, Karamanof, Liontos, & Mountokalakis, 2006). On the one hand, this behaviour might be caused by their lack of medical knowledge, but on the other hand it might be attributed to their unawareness of the costs (for the patient and the clinic) accompanying extensive ordering of medical tests (Miyakis et al., 2006). Similar to the uncertainties when confronted with ordering diagnostic measures, junior doctors also report doubts about their capabilities considering the treatment of a patient due to their lack of experience in this regard (Prince et al., 2004). Medical knowledge and skills are crucial components of task mastery and therefore crucial elements in junior doctors' abilities to show efficient clinical performance. However, even though the medical components of task mastery are most salient challenges for junior doctors, in their role as juniors in medical practice they are commonly not expected to be able to solve all challenges on their own. Nevertheless, in order to show efficient clinical performance junior doctors are expected to apply organizational knowledge and meta-strategies in task mastery.

The major problem in clinical practice is lack of time (Keller, Bamberg, Kersten, & Nienhaus, 2013). The inability to keep the clinical daily routine in track, as described in Chapter 3.2, to some extent explains the prevalence of junior doc-

tors' perceived lack of time. Illing et al. (2013) identified prioritising of patients and time management as key learning needs for junior doctors. To be able to prioritise tasks and manage one's own time efficiently is generally assumed as an important skill in the workplace. Claessens, van Eerde, & Rutte (2007, p. 262) define time management as "behaviours that aim at achieving an effective use of time while performing certain goal-directed activities". In the context of junior doctors' clinical performance the goal-directed activity might be the treatment of a patient, writing a prescription, or writing a discharge letter. To show efficient time management, junior doctors need to be capable of monitoring their own use of time and need to be able to engage in planning activities like prioritising tasks, setting goals, or making a to-do list (Claessens et al., 2007). Research indicates that with more clinical experience doctors get better in managing their time and especially increase their ability to allocate time to the tasks that matter (Szymczak & Bosk, 2012). Junior doctors seem to learn to distinguish between urgent and time critical tasks and those with no need of their immediate attention by gaining the ability to anticipate problems (Szymczak & Bosk, 2012).

Additionally and related to the theme time management, junior doctors on the ward are not just responsible for the patients and their well-being, but are also supposed to be ward team leaders and decide on the allocation of staff. The skills necessary to be the leader of a ward team are rarely an explicit part of medical curricula, although they are described in various physicians' competency frameworks as vital elements of a physician's set of competences (Frank, 2005; Medizinischer Fakultätentag der Bundesrepublik Deutschland e.V. & GMA Gesellschaft für Medizinische Ausbildung e.V., 2015). Brennan et al. (2010) point out that communicating and working in a multiprofessional team as well as being responsible and having to show leadership qualities are major challenges and learning objectives for junior doctors. Junior doctors need to find a balance between delegating tasks and doing them on their own, which is especially troubling for them as they often have to rely on the nursing staff to help them come around. Nevertheless they are regarded as the team leader and the final responsibility for patient-relevant decisions is on them.

3.4   Role Clarity in Clinical Practice and Performance

The term *role clarity* refers to the knowledge of the responsibilities and constraints associated with one's position (Morrison, 2002). In order to establish a clear role definition for themselves, junior doctors need to bring together the expectation set in them, their own expectations on the job and themselves as well as the responsibility of the job. Research indicates that this process of role formation starts very early in physicians' professional development, beginning with undergraduate medical education (Cox, Irby, Stern, & Papadakis, 2006; Gordon, 2003; Hafferty & Franks, 1994; Pitkala & Mantyranta, 2003) and readjustments are made throughout the whole professional life (Hafferty & Castellani, 2010; Hilton & Slotnick, 2005). Several transition phases in the life of physicians demand that they readjust their role (Kilminster et al., 2010; Lockyer, Wycliffe-Jones, Raman, Sandhu, & Fidler, 2011; Zukas & Kilminster, 2012).

A glimpse at the multitude of expectations junior doctors face at the beginning of their career was already given in Chapter 3.1, with the presented area of conflicts constituting clinical practice. Well described conflicts of expectations and duties can be found for teaching and university hospitals where doctors are supposed to carry out high quality patient care, to do research and also to teach students (Dybowski & Harendza, 2014; Hakimi, Geisbüsch, Kotelis, & Böckler, 2010; Hoffman & Donaldson, 2004). To cope with the whole of these demands is very challenging, especially when new on the job and on top of that when prepared by medical school mainly in the field of medical knowledge and skills but often less so in research and teaching skills. Conflicts occurring between these duties are almost inevitable (Putz, 2010). Junior doctors need to take care of patients while their superiors demand from them to attend scientific journal clubs and to be an active member of a specialty research group. Junior doctors who try to resolve conflicting duties by disobeying the wishes of their superiors might face career-breaking consequences (Nickel, Füllekrug, & Trojan, 2008).

Within their struggle to meet the set expectations, junior doctors also have to deal with the ever increasing amount of responsibility they find themselves confronted with in their daily clinical practice. Finding a way to deal with their new role and the associated responsibilities is a very demanding task for junior doctors. The undergraduate medical curricula can barely help to prepare junior doctors for the task mentioned before. The responsibilities of being a doctor on the ward with all the accompanying consequences for decisions made seem hard to teach in a formal setting or in a simulation (Illing et al., 2013). The few promising

exceptions aside where junior doctors are slowly guided to fulfil their new role by an experienced physician, most junior doctors need to take on the responsibility for patients from the very beginning (Brennan et al., 2010; Paice, Rutter et al., 2002). The transition from student to practitioner therefore is often rather a hard change of roles than a smooth process (Jarvis-Selinger, Pratt, & Regehr, 2012). However, even if there are educational programmes to ease the transition, junior doctors still claim not to get enough exposure to the tacit knowledge located in the workplace (Bullock et al., 2013). Gathering information from an experienced ward team might be valuable for junior doctors in coping with their new responsibilities. Nevertheless, junior doctors often show deficient communicational strategies hindering the flow of information in the ward team (Brennan et al., 2010).

In summary and to address the first aim of this thesis (Aim 1: *Describing junior doctors' clinical practice and perceived learning needs in order to show efficient clinical performance.*), junior doctors' clinical practice can be described as an area of conflict. In order to be able to perform within this area of conflict, junior doctors need organizational knowledge, task mastery, and role clarity. Organizational knowledge, task mastery, and role clarity are bound to junior doctors' specific working context and hence can only be achieved if junior doctors actively engage in clinical activities within their working context. Consequently, Chapter 4 is concerned with theoretical conceptions and current research results on how this active engagement in clinical activities relates to junior doctors' learning in clinical practice.

4   Junior Doctors' Learning in Clinical Practice

The concept of learning in the context of work, especially in the medical domain, "is as old as medicine itself" (Dornan, 2012, p. 15). To be able to handle the changing work requirements, learning in the workplace seems inevitable. As mentioned above, it is necessary to understand the changing requirements of work in order to determine the "goals for workplace learning efforts" (Billett & Choy, 2013, p. 266). According to Billett & Choy (2013, p. 273) "learning in the workplace is multimodal and complex, considering the socio-cultural boundaries that influence learning in multiple ways". The question remains which forms of learning in the workplace are adequate to meet the challenges posed by new requirements of the workplace and especially the fact that workers like physicians are "to make informed judgments at work" (Billett & Choy, 2013, p. 267). Swanwick (2005) claims that while the definition of learning objectives is useful in formal educational settings, socio-cultural theories fit better to the informal workplace learning conditions of postgraduate education. Hence, in the following a focus is put on informal learning in a socio-cultural context.

The "socio-cultural literature presents a view which accentuates the social and cultural genesis and appropriation of knowledge" (Billett, 1996, p. 264). From a socio-cultural perspective learning and gaining competence are bound to social practice, to a specific context or domain, which makes this perspective on learning especially relevant for the workplace context. Engaging in meaningful interaction with others, thus becoming part of a community of practice, facilitates the professional development of the individual (Lave & Wenger, 1991; Wenger, 2000; Wenger, 2009). Novices take part in meaningful practice as peripheral actors in social communities and slowly integrate as full members into this community of practice. Thereby they generate the necessary knowledge in the discourse with others through negotiation of meaning. Discussions are ongoing about the deterministic character of the social context and the dichotomy between a socio-cultural perspective on learning and a rather congnitivist perspective on learning (Billett, 1996, 2008; Gruber, Palonen, Rehrl, & Lehtinen, 2007; Hodkinson et al., 2007). However, in this thesis the interrelatedness of the social context and individual agency is emphasized and following Billett (2006, p. 65), we "propose a more socially inclusive, engaged, and sympathetic view of the individual". The individual is recognized as an active actor within the learning process, with previous experiences, knowledge, and personal characteristics, which influence the learning resources sought out as well as the social contacts formed. Taking the

socio-cultural stand on learning with an active learner in mind also relates to the understanding of the social network perspective on learning, which is followed in this thesis. Considering the importance of social interaction and the social context of work in learning, a theoretical and empirical conceptualization following social network constructs seems appropriate. How the social network may contribute to a better understanding of junior doctors' learning and clinical performance is presented in more detail in Chapter 4.4.

4.1 Formal and Informal Learning in Clinical Practice

Generally one can distinguish between formal learning and informal learning at work. Following Eraut (2004), this dichotomy should not be seen as absolute, but informal learning is rather defined "as learning that comes closer to the informal end than the formal end of a continuum".

Formal learning in the workplace

According to Eraut (2000) formal learning occurs in situations where one of the following criterions is met:

- a prescribed learning framework,

- an organised learning event or package,

- the presence of a designated teacher or trainer,

- the award of a qualification or credit,

- the external specification of outcomes.

This form of workplace learning has by now become very common and is a big part of the mandatory continuing medical education (CME) of physicians. German physicians have to engage in learning activities as regulated in the *Recommendations on Continuing Medical Education of the German Medical Association* (German Medical Association, 2007). The *Continuing Medical Education Regulations* of every German federal state specify the amount of credits needed in a given time. In Bavaria, for example, every physician has to achieve 250 credits within five years, with 45 minutes of study constituting one credit (Bayerische Landesärztekammer, 2013). Some of this formal learning is integrated in physicians' everyday clinical practice through scientific journal clubs and in-house

trainings on various topics, from new treatment options to emergency simulations. A further opportunity for formal learning is presented in morning reports, lunch seminars or radiological conferences, all of which take place on a daily basis. Junior doctors in their specialty training are involved in these obligatory formal learning situations. Most hospitals with residency training programmes have additional formal teachings for their trainees carried out by more experienced physicians. Also, courses on the used patient-administration software as well as the handling of special radiology software are very common. Sometimes formal training courses for junior doctors are represented within the mandatory residency curriculum. Although these courses are without a doubt necessary for the physicians to keep up to date and be able to perform efficiently, the knowledge gained is mostly factual and therefore cannot sufficiently address the implicit structures and work practices also essential in everyday work.

Informal learning in the workplace

As "doctors spend more time in practice than in formal educational settings" (Burford et al., 2013, p. 394), a big part of what is learned in postgraduate medical education is learned informally in the workplace (Swanwick, 2005). Eraut (2004) distinguishes between three levels of intention within informal learning. These levels are:

- *implicit learning:* the learner is not consciously trying to learn and unaware of the learned content;

- *reactive learning:* the learner is aware of learning, but the level of intention varies, since this kind of learning often occurs unplanned and the learner might not always be able to articulate explicitly what was learned without setting time aside for reflection;

- *deliberative learning:* the learner engages proactively in learning activity at the workplace and consciously takes time to do so.

The described types of learning can be further defined by related activities at work. Eraut (2007) categorized activities at work which might lead to learning according to whether the focus is more explicitly on working or learning. Learning in the workplace may often be an unconscious by-product of work when junior doctors work alongside experienced co-workers. When getting information or asking actively for advice in the workplace, the learning process is located within

the work. There are also learning processes which occur at or near the work-place, such as being supervised or coached as well as attending conferences or visiting other hospitals for educational purposes (Eraut, 2007). In Chapter 3 we explained that junior doctors learning needs include "tacit knowledge" of estab-lished work practices and strategies in using clinical resources. Hence, the focus in this thesis is on those learning processes which are a by-product of work or are located within the work. As most of those learning processes are connected to the learners' interaction with others in the workplace, a socio-cultural perspective on learning in the workplace is used.

4.2   Models for Learning in Clinical Practice

Looking at the descriptions of different forms of learning in the workplace, it be-comes apparent that one has to consider several factors which influence learning in the workplace. Over the years, researchers tried to define factors enhancing and hindering learning in the workplace as well as describing how learning in the workplace takes place. In the following, two frameworks for learning in the work-place with specific relevance for junior doctors' learning are examined in more detail. At first, Eraut's (2004) *two triangle model* for learning in the workplace is elaborated, as it focuses on factors affecting learning in the workplace especially at an early career level. Secondly, the framework of Teunissen, Scheele et al. (2007) for residents learning in the clinical workplace will be looked at, because this framework incorporates hospitals as a work environment with the specific tasks encountered there and tries to describe the "how" of residents learning. Both presented models fit with the conception of the transition phase from medi-cal student to junior doctor as a critically intensive learning period (Kilminster et al., 2011) and the socio-cultural perspective on learning in the workplace, which is also the perspective adopted in this thesis.

Learning at an early career level
Having conducted extensive research on workplace learning of newcomers, Eraut (2007, p. 418) presents a *two triangle model* of factors affecting learning at work at an early career level that gives useful orientation in conceptualizing the clinical workplace as a learning environment for junior doctors.
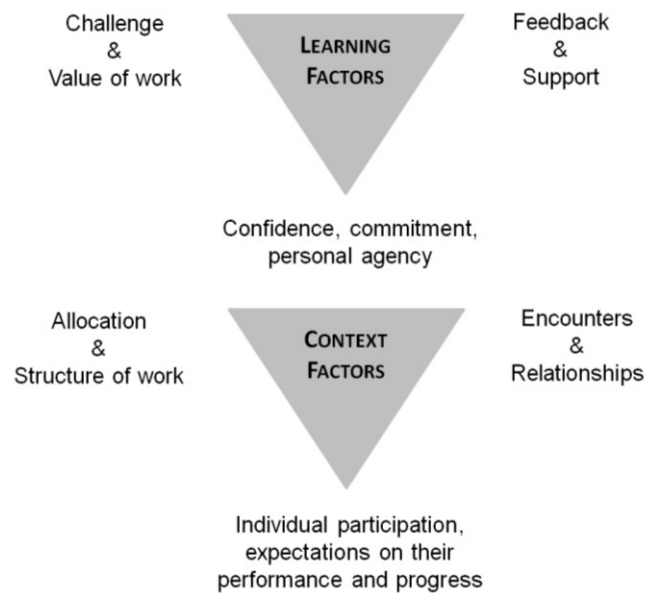
Figure 5   Factors Affecting Learning at Work According to Eraut's Two Triangle
Model (2007, p. 418)

Both triangles (learning factors and context factors) are surrounded by elements
that are to some extent interrelated, but can be broadly summarized into three
categories: social relations on the right-hand corners of the triangles, individual
factors at the bottom and perceived working conditions on the left-hand corners
of the triangles. Considering the learning factors, individual confidence seems
critically important for successful workplace learning. For Eraut (2012, p. 26)
learners do not just need confidence in their own abilities, e.g. clinical skills to
manage the challenges of work, but they also need "confidence in their col-
leagues support" and feedback. Looking at the context factors, the "allocation
and structuring of work" seems to be the central factor because it determines the
learning opportunities at site (Eraut, 2012). Imagining the busy clinical practice on
a ward, time pressure and the sheer amount of work can be overwhelming for
junior doctors. This busy working environment further implies that co-workers
might also have a lot to do and no time to give feedback and support to junior
doctors. Having an explicit schedule and structure of work (in terms of how and
what work needs to be done at the ward) reduces the uncertainties for junior doc-
tors and the whole ward team and might enable junior doctors to receive feed-
back on challenging tasks.

Residents' workplace learning

Taking the clinical task as a starting point, Teunissen, Scheele et al. (2007) tried to specify the factors contributing to workplace learning especially in the medical domain and proposed a framework of residents' learning in the clinical workplace. The basic assumption of the framework is that clinical tasks contain medical information as well as socio-cultural information and in dealing with these tasks, the residents incorporate this new information into their personal knowledge via interpretation and construction of meaning. This model relates well to the previously described interrelatedness of learning, practice, and performance in junior doctors' clinical environment. The term *personal knowledge* in Teunissen, Scheele et al.'s (2007) framework refers to knowledge as defined by Eraut (2007, p. 406) as "what individual persons bring to situations that enables them to think, interact and perform". Highly important in the process of interpretation and construction of meaning are the social relations and social interactions of residents which facilitate the learning process. In Teunissen, Scheele et al.'s (2007) model the inseparability of learning, practice, and performance becomes more salient, as learning as a whole is bound to the performance of concrete tasks and the knowledge generated in doing so.

Both models consider the interconnection of learning and the situation in which learning takes place, with the medicine-specific framework of Teunissen, Scheele et al. (2007) using Eraut's (2004) model as reference. Learning is recognized as an active process demanding commitment and engagement from the learner as well as from potential teachers. Social interaction is a major part of clinical practice and therefore the learning situation is tightly knit to the learning process itself. The gaining of knowledge and skills is not viewed as a process of transfer from teacher to learner but as socially constructed and situated within the specific workplace. Taking the socio-cultural perspective on learning and having Eraut's (2007) model as well as Teunissen, Scheele et al.'s (2007) framework in mind, we can summarize three factors affecting junior doctors' learning in the workplace:

- their personal knowledge,

- their social relations in the workplace,

- their perceived working conditions.

4.3   Personal Knowledge in Learning through Clinical Practice

The term *personal knowledge* refers to all the traits "individual persons bring to the situations that enable them to think, interact and perform" (Eraut, 2007, p. 406). As there is always interdependence between the personal and the social (Billett, 2006), elements that an individual brings to the situation become relevant, for example personal characteristics, previous experiences in form of codified and cultural knowledge as well as individual agency. As we take a social network perspective in the empirical part of this thesis, junior doctors' personal characteristics in learning through clinical practice are taken into consideration from this analytical point of view. The elements of personal characteristics described in the following paragraphs serve as antecedents for junior doctors' social networks, which in turn might provide them with the social contacts in the workplace necessary for their professional development. Personal knowledge might also be relevant in enabling junior doctors to efficiently use the resources of the social network as well as the workplace in a fruitful way.

Personal characteristics

Personal characteristics, such as gender, age, race, cultural background, and profession, influence the way you interpret the world as well as the opportunities, resources, and contacts you may have at your disposal. In social network research, the influence of personal characteristics, gender, age, race, educational or cultural background on the development of social relations has been well documented (Ajrouch, Blandon, & Antonucci, 2005; Ibarra, Kilduff, & Tsai, 2005; Mehra, Kilduff, & Brass, 2001). This becomes crucial in the context of a socio-cultural perspective on learning, as social relations are recognized as resources which may facilitate or restrain learning opportunities, support professional performance, and open up new career-advancing contacts and chances. The phenomenon "that a contact between similar people occurs at a higher rate than among dissimilar people" (McPherson, Smith-Lovin, & Cook, 2001, p. 416) is called the *principle of homophile* and prompts, for example, different networks for men and women (Ajrouch et al., 2005). These gender-specific differences might result in different learning opportunities and support mechanisms social networks can provide. In general, the development of social networks follows the *Matthew principle* (Merton, 1968; Perc, 2014), meaning that if you are a highly educated

male with a prestigious job, it is very likely that your social network contains a lot of men with similar personal characteristics and therefore enables you to gain even more influence and prestige via your network.

For junior doctors' learning in clinical practice gender-specific differences might be a crucial factor, as the number of female students and consequently residents is increasing (Statistisches Bundesamt, 2015a) while the prestigious positions of senior physicians and especially chief physicians in many medical specialties are still mainly in the hands of men (Statistisches Bundesamt, 2015b). Female junior physicians might have difficulties in finding adequate role models to learn from (Alers, van Leerdam, Dielissen, & Lagro-Janssen, 2014). Female junior doctors might tend to build up gender homophile social networks, causing them to miss valuable learning resources experienced chief and senior physicians may provide. Homophile considering the profession or professional status might also restrict the learning opportunities for junior doctors. Interprofessional care and interprofessional learning is vigorously discussed in the literature (Kenaszchuk, MacMillan, van Soeren, & Reeves, 2011; Thistlethwaite, 2012, 2013; Wagter, van de Bunt, Honing, Eckenhausen, & Scherpbier, 2012), however, following the principle of homophile, physicians' main interaction partners would be physicians. This focus on intraprofessional contacts might restrain the learning opportunities for junior physicians and therefore have serious impact on the quality of patient care they are able to provide (a more detailed overview on the theme of junior doctors' interprofessional learning is presented in Chapter 4.4). Furthermore, the familial and cultural background of medical students and especially junior physicians is changing (Bundesärztekammer, 2014a). As mentioned in Chapter 2, more and more physicians who completed their studies in a foreign country start their residency training in Germany. Considering that the formation of physicians' professional identity begins already during undergraduate education (Hafler et al., 2011; Haidet & Stein, 2006; Jarvis-Selinger et al., 2012), junior doctors from foreign countries might be used to different working cultures as well as different cultures in regard of social contact formation. The cultural background of junior physicians as well as the understanding for cooperative and interdisciplinary care might influence their advice-seeking and feedback-seeking behaviour.

Although personal traits influence social networks, junior doctors are not helplessly exposed to the forces of their personal characteristics and social network ties. In this thesis learners are defined as active and self-determined agents

within the learning process. Accordingly, junior doctors might change the educational potential of their social network by purposefully engaging in beneficial social contacts. Nevertheless, the ability to actively contribute to one's own network development might depend on individual agency as well as the given structure of work at site.

Codified and cultural knowledge

The term *codified knowledge* refers to knowledge that is explicit and "(1) subject to quality control by editors, peer review and debate and (2) given status by incorporation into educational programmes, examinations and courses" (Eraut, 2000, p. 114). The term *cultural knowledge* refers to knowledge that is mostly acquired informally through participating in the work process and contains information about the cultural work practices as well as the belief-systems and behavioural patterns of co-workers (Eraut, 2007). Both types of knowledge have to be considered in the context of junior doctors' learning in clinical practice, as previous learning experiences in medical school, during practical placements as well as their final practical year might have an impact on the social relations junior doctors can develop in the workplace and therefore the learning opportunities on site.

Codified knowledge in the medical domain is learned and taught in medical school through lectures, seminars, practical courses as well as practical placements (a detailed description of the medical education system in Germany is presented in Chapter 2). "In the course of their medical training, students acquire rich, elaborate *causal networks* explaining the causes and consequences of disease in terms of general underlying biological or pathophysiological processes" (Schmidt & Boshuizen, 1993, p. 208). After the standardized final medical examination all junior doctors who completed their studies in Germany are supposed to show a basic and comparable level of medical knowledge and skills. However, seeing that other countries have different medical education systems with different methods in testing their students, differences in the basic medical knowledge of junior physicians in clinical practice might be present. Nevertheless, the basis for junior doctors' clinical performance is the acquired knowledge about diseases and their underlying reasons. This fundament of medical knowledge is also the basis for their further professional learning and enables them to incorporate new

knowledge, to encapsulate knowledge, and to form illness scripts (Schmidt & Boshuizen, 1993; Schmidt & Rikers, 2007).

Cultural knowledge is mostly acquired informally through participating in the work process (Eraut, 2007). Students in German medical schools might gather cultural knowledge during their medical education within practical placements as well as their final practical year. Practical placements, maybe even at the very hospital they later on choose as workplace, might give them an understanding of "how things are done" at site and also enforce their understanding of clinical work processes (Chapter 3.2). Hence, when junior doctors start working at a ward, they might not be so "junior" after all, because of the previous experiences they gained while completing parts of the practical year or a practical placement at the exact same ward. They might already have some knowledge about structural working patterns and relevant interaction partners. Similarly, the number of completed clinical rotations might influence junior doctors' cultural knowledge. Every rotation comes with new experiences which might broaden junior doctors' insights regarding clinical and structural knowledge as well as the acquaintance of new interaction partners who might provide useful information about different task-related questions.

Individual proactive behaviour

In this thesis we conceptualized learning as an active socially embedded constructive process which is bound to the cultural context of an actively involved learner. Hence, within the construct of personal knowledge, personal traits such as junior doctors' individual proactive behaviour are crucial elements of their learning in clinical practice. Individual activity at the workplace influences the learning opportunities as well as the social contacts formed (Billett, 2004, 2008). To what extent an individual actively engages with the challenges of the workplace is influenced by previous experience. Additionally, how individuals engage in learning through work activities may be related to their own expectations, their perceived confidence and commitment to the norms and cultural practices at site (Billett, 2004). A study conducted by Sterkenburg, Barach, Kalkman, Gielen, & Cate (2010) at the University Medical Centre of Utrecht assessed factors that influence experienced anaesthesiologists' decisions to trust residents who were in different stages of their specialty training with clinical tasks. They identified structural workplace conditions, task complexity, and personal characteristics of

the residents as well as the experienced anaesthesiologists as crucial factors influencing the anaesthesiologists' decision to trust their residents with unsupervised tasks. Their results indicate that if junior doctors show confidence in their daily clinical work, their superior tend to give them new responsibilities and thereby stimulate their learning (Sterkenburg et al., 2010).

4.4   Social Relations in Learning through Clinical Practice

In this thesis a socio-cultural perspective on learning is taken, putting social relations in the workplace in focus when describing learning in practice. Bearing the situated learning theory of Lave & Wenger (1991) in mind, it seems important to assess the social community the novice junior doctor is slowly integrating through everyday clinical practice. When considering learning through social relations, a lot of factors have to be taken into account. First of all one has to think about persons from whom the junior doctors might learn with all their characteristics, such as profession, hierarchical status, and experience. The context of everyday clinical practice offers different social encounters for the junior doctor, which includes different social learning opportunities. So far, medical education literature has tackled the subject of "learning from others at work" mainly from three different perspectives: learning from role models, learning from peers, and interprofessional learning (e.g. learning from the nursing staff).

Learning from role models

Especially in the medical domain, in which traditionally a lot of teaching is done by demonstrating skills and procedures before letting students do them, observational learning from role models is of high relevance (Kenny, Mann, & MacLeod, 2003). Bandura (1971) described general preconditions for efficient observational learning which are still reviewed and discussed in learning from role models in the medical domain. Right from the beginning of their undergraduate medical education medical students are confronted with a wide range of potential role models in their theoretical education as well as their practical placements. Potential role models during medical education may be their teachers but might as well be every other working physician they encounter during practical placements. Those role models consciously or unconsciously influence the students' perspective on the work and attitudes of their future profession (Cruess, Cruess, & Stein-

ert, 2008) and thereby contribute substantially to the formation of their professional identity (Haidet & Stein, 2006; Hilton & Slotnick, 2005; Kenny et al., 2003; West & Shanafelt, 2007). However, role models are not just relevant for junior doctors gaining clarity about their own role but they are also significant for acquiring organizational knowledge and strategies to handle clinical tasks. A recent literature review which contrasts characteristics of positive and negative role models of interns and residents reveals that excellent clinical performance, patience, and explicit teaching as well as integrity and an investment in doctor-patient relationships are necessary prerequisites to be recognized as a positive role model (Jochemsen-van der Leeuw, van Dijk, van Etten-Jamaludin, & Wieringa-de Waard, 2013). It also seems important that interns can work up a trustful and fear-free interaction with their superiors (who also represent role models) to take more learning input out of their interactions and the superiors' feedback and accordingly change their practice (Teunissen et al., 2009). Similar findings are reported by Sheehan, Wilkinson, & Billett (2005), who in their qualitative study with interns and clinical educators asked about factors that encourage or hinder participation of interns in workplace learning. They identified the relationship with the supervisor and the opportunity to interact with more experienced staff as critical components for the engagement of junior doctors in learning activities (Sheehan et al., 2005).

Learning from peers

In the context of learning through social relations in clinical practice, learning from and in social interaction with peers comes to mind. Peers are in the same situation as oneself, they know the challenges encountered in everyday clinical practice first-hand. They work within the same structural and organizational constraints and affordances and therefore are valuable interaction partners. Peers not only might have useful advice or even give a helping hand at times, but they also can be a resource of emotional support because they can personally relate to the emotional conflicts and problems. However, the literature on peer learning among junior doctors is less extensive than on role modelling. The usage of the term "peer" is often ambiguous, sometimes referring to colleagues with the same level of experience and sometimes used to address slightly more experienced colleagues (Eisen, Sukhani, Brightwell, Stoneham, & Long, 2014). The focal point of learning from peers is that it might be easier for junior doctors to ask peers for advice or support than to ask the chief physician. Furthermore, the peers might

be on the same or a nearby ward and therefore easier to reach. However, peers seem a valuable source of information for junior doctors in their everyday clinical practice (Hardyman, Bullock, Brown, Carter-Ingram, & Stacey, 2013). The interaction with peers is also useful in gaining information on organizational shortcuts in order to overcome perceived organizational constraints (Szymczak & Bosk, 2012). Structured programmes for peer learning, for example mentoring-programmes (Eisen et al., 2014), reveal positive learning outcomes for mentors as well as mentees. Junior doctors perceived the mentoring relationship as highly useful in the acquisition of new skills and they further appreciated the mentors' advice concerning possible career options (Eisen et al., 2014). Szymczak & Bosk (2012) reported that peers seem especially important for emotional support and discussing critical experiences in the workplace.

Interprofessional learning

To take care for a patient involves a lot of different professional groups, the minimum unit being a physician and a nurse. Interprofessional learning, which occurs in the interaction of two or more members of different professions (Thistlethwaite, 2012), has widely been recognized as an important aspect in regard of the outcomes of clinical care. Successful collaboration between physicians and nurses have been linked to positive outcomes for the patient as well as higher job satisfaction for both professional groups (Zwarenstein & Bryant, 2000). Nevertheless, the collaboration between nurses and physicians is not always as smooth as it could or should be. Conflicts arise due to misconceptions about each other's responsibilities and professional roles as well as communication deficits (Carpenter, 1995; Tasselli, 2015). Educational settings promoting interprofessional learning have been integrated in undergraduate medical curricula, aiming to reduce prejudices on both sides and enhancing positive attitudes toward the other profession as well as laying the grounds for an appreciative working climate (Carpenter, 1995; Parsell, Spalding, & Bligh, 1998). Studies on formal (simulation-) trainings for ward teams describe the effects on team-communication, attitudes, and performance of interprofessional learning in the workplace (Kenaszchuk et al., 2011; Reeves, Della Freeth, McCrorie, & Perry, 2002). Learning from and with each other in an interprofessional team seems especially important for junior doctors who are still trying to figure out their role in the whole clinical system and also how to deal with the threats posed by the clinical environment. Research indicates that although learning from nursing staff can be extremely helpful for

junior doctors, they struggle with the fact that they often have less knowledge about certain aspects of daily clinical practice than the nursing staff but at the same time have to be the formal leader of the ward team (Prince et al., 2004).

A social network approach to junior doctors' learning through clinical practice

Looking carefully at the current research on junior doctors' learning form others at work, it becomes apparent that there is hardly any information on the broader social context of these learning experiences. The social embeddedness of all the single social contacts junior doctors deliberately or unconsciously use as learning resources in the workplace is rarely addressed. However, gaining an understanding of the social surroundings of dyadic relationships is essential in understanding these dyads, for example the contact between junior doctors and their superiors (Diaz-Bone, 1997). According to the social network research theorem, the actors' social context in which they are embedded explains individual agency and agency in return provokes changes in the social context (Gruber & Rehrl, 2007). A deeper insight into the social relations of junior doctors can therefore be gained by a social network approach. "A social network consists of a finite set or sets of actors and the relation or relations defined on them" (Wasserman & Faust, 2007, p. 20). The definition of a network is purposefully neutral, since all structural properties as well as negative and positive elements of social networks are subject of empirical research questions (Gruber & Rehrl, 2007). The actors, also called knots, in a social network can be institutions, working groups (e.g. ward teams), or individuals. The content between the actors defines the purpose of the network, such as advice, supervision, friendship, information, or trade of goods. Every network is relation-specific, but it is possible that actors share multiple relations (Jansen, 2006). A junior doctor, for example, might ask colleagues for advice in the workplace and also share free time with them as friends. Social networks can be described in regard of their antecedent, their structural and relational properties as well as their consequences. In the exploration of current research on social networks we focus on results related to learning and performance in the health sector and especially of physicians at the beginning of their career, but we also refer to research in other complex domains which presents findings on general principles, properties, antecedents and consequences of social networks. For the health care sector Tasselli (2014) provides a comprehensive review on current research in social networks, focusing especially on inter-

personal networks of medical professionals in organizations. Cunningham et al. (2012) also reviewed social network studies in health care, focussing rather on the outcomes of networks in terms of effectiveness, sustainability, quality of care, and patient safety. Both reviews provide useful orientation in considering physicians' social networks and even give some hints on junior doctors' roles within these networks.

Research on social networks in health care and other complex work environments revealed findings about structural properties such as network range, network density, and network centrality, which might be helpful to achieve a better understanding of the relations between social contacts and clinical performance of junior doctors. Considering the most basic measure of social networks, i.e. network range, research indicates that having a lot of social relations opens access to more information, learning resources, and potential cooperation partners (Brass, Galaskiewicz, Greve, & Tsai, 2004). At the same time though, results on network range indicate that maintaining a lot of social relations can be very time-consuming and hence the effects of a high number of social contacts are quite ambiguous. There also is a strong relationship between network range and network density, with lager networks mostly being associated with lower density, because the more contacts are present in one network, the less likely it becomes that all actors know each other. Network density is defined as the amount of established connections between the actors in relation to all possible connections between the actors (Jansen, 2006). Having a dense network of social relations has proven to be beneficial when tacit knowledge needs to be exchanged (Lehtinen, Hakkarainen, & Palonen, 2004) or emotional support is required. Acquiring the tacit knowledge hidden in the social structures of the workplace is of critical importance for newcomers in enabling them to show efficient performance (Morrison, 2002).

Nevertheless, very dense social networks have also been associated with internal closure, which might hinder innovative behaviour and enhance group thinking (Borgatti & Foster, 2003), the latter being crucial within clinical practice, as efficient patient care demands interprofessional and boundary-crossing cooperation (Zwarenstein & Reeves, 2006). Research also shows that actors in social networks who are able to bridge those boundaries between different closely-knit social groups can gain considerable advantages from this position (Burt, Kilduff, & Tasselli, 2013). These actors show high values for *betweenness centrality,* which indicates to what extent their position in the network is on the shortest path

between two other actors within the network. The focus is on the structural dependency of the ego's neighbours from the ego (Mutschke, 2010). Being in this brokerage position is associated with the possibility to access non-redundant information from diverse sources (Cross & Cummings, 2004). Current research from Tasselli (2015) indicates that junior doctors are likely to act as broker in clinical practice networks and mediate the communication between nurses and physicians. In his study Tasselli (2015) assessed the social network and knowledge exchange between 118 medical professionals (53 doctors and 65 nurses) working at a hospital department in Italy. He found that "junior doctors are more willing and able to act as inter-professional brokers by borrowing social capital from their senior peers" (Tasselli, 2015, p. 862). This brokerage position allows them to gain valuable knowledge through social contacts with a wide range of interaction partners. In their role as "learners" junior doctors are accepted as go-betweeners and in some respect outside the boundaries of the distinct occupations. In this role they are supposed to search and access to the knowledge necessary to show efficient clinical performance.

In their reviews of social networks in the health sector, Cunningham et al. (2012) as well as Tasselli (2014) came to the conclusion that physicians in general tend to turn to their own profession for advice and knowledge exchange. However, it stands to reason that junior doctors in their role as learners show slightly different network patterns as they need to acquire all the knowledge they can get irrespective of the professional boundaries. The positive effects associated with well-established and good-functioning interprofessional social contacts in clinical practice on individual satisfaction and health outcomes for the patient are well described (Cunningham et al., 2012; Tasselli, 2014; Zwarenstein & Bryant, 2000). These found associations open up the discussion on effects of network diversity in junior doctors' learning and clinical performance. Diverse networks that include contacts not only from different professions but also from different specialties (e.g. internal medicine, surgery, and anaesthesiology) and of different hierarchical status allow boundary-crossing exchange of information and resources. Using the resources provided by a diverse social network, junior doctors might easily and in a timely manner access the advice of a colleague form another department. Research on expert performance has emphasized the importance of hierarchically diverse and wide-spreading social relations for one's professional development (Gruber, Lehtinen, Palonen, & Degner, 2008). Superiors or "mentors" with wide-spreading social networks have the opportunity to fa-

cilitate further contacts for their trainees, which might provide access to new learning resources. It might be very beneficial for junior doctors to have an experienced chief physician as an actor in their social network because this chief physician may, for example, facilitate further contacts for junior doctors, which might allow them broader access to additional learning opportunities.

Research also indicates that social network patterns form along the line of working structures because predefined working patterns facilitate the contact between certain individuals (e.g. on the same ward or in the same department) (Borgatti & Cross, 2003; Brass et al., 2004). "To the extent that formal structures situate actors in physical and temporal space, they exert an additional influence on network building" (Brass et al., 2004, p. 797), which makes the consideration of work organization and workflow also relevant for network formation and in consequence for learning through social interaction. As junior doctors are dependent on the advice of their supervisors and in a lot of clinical situations have to contact colleagues from different specialties to ensure the best treatment for the patient, it stands to reason that they might form hierarchically and specialty-diverse social networks. As already mentioned in Chapter 4.3, diversity in personal characteristics might also influence the learning opportunities junior physicians may have. Given that the majority of senior physicians are male, female junior doctors might have difficulties receiving the necessary information if they form rather homophile social networks.

With all the positive associations considering learning form others at work, we should also take a look at some rather difficult aspects in this regard. Firstly, junior doctors face the challenge to tell the "good" from the "bad" role model. If they are not able to distinguish between those two, they are in serious danger to learn insufficient patient management strategies or long overcome working traditions, which might negatively affect the working climate and not help but even harm the patient (Kenny et al., 2003). To overcome those difficulties junior doctors need to find out who they can trust in asking for advice and who has the necessary clinical experience to be of help. Secondly, we have already described the principle of homophile in social network formation (McPherson et al., 2001). This means similar persons tend to find themselves in one network or form subgroups within networks, which applies for personal characteristics as well as specialty boundaries or hierarchical status. As this might have adverse consequences in terms of opportunities for learning and support in performance, junior doctors' social networks need to be analysed in this regard. Similarly, junior doc-

tors in internal medicine are integrated in their specialty network with specific group rules and norms (Hewett, Watson, Gallois, Ward, & Leggett, 2009), which might even include a hidden disregard for other specialties. This strong inner group thinking might have adverse consequences not only for junior doctors' learning but also for the patients if collaborative patient care gets impeded. Whether junior doctors are able to overcome their specialty boundaries or deem specialty-crossing social contacts necessary for their professional development has not been addressed in research so far. Thirdly, "everyone knows that networks do not act—people act" (Burt et al., 2013, p. 536), which emphasises personal agency and puts the allegedly deterministic character of social networks into perspective.

Social networks are a dynamic concept, they change over time. Junior physicians get to know new colleagues, and hence their social network and available resources change. Depending on the researchers' preferred perspective, individual agency gets more or less attention in social network research. In this thesis social networks are analysed in regard of egos' personal characteristics, which might have influenced the network formation, as well as in regard of their associations to junior doctors' learning in practice.

Considering the current research on social networks in the health professions, it stands to reason that junior doctors' social networks are associated with their learning and clinical performance, but it also becomes apparent that we can only rely on very few empirical insights considering social networks in junior doctors' learning through clinical practice. It seems worthwhile to take a closer look at the social relations of junior doctors beyond the sole investigation of role models and peer-support in order to get a picture of the whole network of social relations which provide learning opportunities. Furthermore it seems necessary to evaluate the connection between junior doctors' social networks as learning environments and their clinical performance. However, as described in Chapter 4.3, the formation of social networks and learning is strongly linked to individual characteristics, but also the perceived working conditions at site have to be considered in early career learning (Eraut, 2004). Hence, in the following sections junior doctors' working conditions in learning through clinical practice will be further elaborated.

4.5 Working Conditions in Learning through Clinical Practice

In Chapter 3 we elaborated the features of clinical practice and clinical perform-ance. However, it needs to be further discussed how generic components of clinical practice manifest themselves in concrete working conditions which in turn influence the learning opportunities at site for junior physicians. In Chapter 4.2 we identified the challenge and value of work, the allocation and structure of work, and the working climate as crucial factors in junior doctors' working conditions. Within these factors several interrelated themes are addressed.

Challenge and value of work

Eraut (2007) identified the challenge and value of work as a crucial factor for learning in the workplace at an early career level. A certain amount of challenge is necessary for a working task to be of interest and facilitate learning at the workplace. Having to perform solely routine and non-challenging tasks can be tiring and can also lower motivation and performance (Kendall, Hesketh, & Macpherson, 2005). Nevertheless, if the task is too challenging, junior doctors might get overwhelmed and the cognitive load gets too high, thus hindering their learning. However, the challenge of work does not only depend on the complexity of the tasks itself, but also on the temporal constraints faced while trying to com-plete a task (Eraut, 2010) as well as on social stressors faced in clinical practice. Even the easiest of tasks gets challenging when adding enough time pressure and having no routines to rely on to complete the task (Kendall et al., 2005). Support from social contacts might help to reduce the cognitive load for junior doctors in these situations and enable them to handle the situation, but given the conditions of a clinical workplace, the time pressure might also concern the co-workers, thereby reducing the possibility of their help (Eraut, 2007). Excessive demands from patients and their relatives might also add to the challenge of a clinical task (e.g. patients who have googled all their symptoms in advance and thereafter disagree with the suggested diagnoses and therapy options, or rela-tives who articulate unrealizable and unaccomplishable demands). These *social stressors* might influence junior doctors' clinical performance and learning, espe-cially if they are unable to receive support from their social networks. Another element to consider when talking about the clinical workplace as a learning envi-ronment is the location of the hospital. The hospitals' patient mix and clinical pic-

tures to encounter influence the challenge junior doctors have to faced in daily clinical practice as well as the learning opportunities available to them (Hoffman & Donaldson, 2004). The clinical learning environment might differ between small rural and big university hospitals because the kinds of patients differ and also the responsibilities of junior doctors are different (Kendall et al., 2005). In a rural hospital junior doctors might be the only physicians available at a time, whereas this is fairly unlikely in a big university hospital. Smaller hospitals might have more interest in preparing their junior doctors fast and efficiently to handle things on their own, as they need them as fully accountable staff to be able to provide the necessary care. Hence, in smaller hospitals the challenge might be to take on a rather high amount of responsibility very quickly, while at a university hospital the challenge lies more in dealing with complexity, severity, or rareness of the patients' conditions. Equally important seems the value of work. There are two inter-related perspectives on the value of work: on the one hand the value of the work depends on the recognition of this work by others and on the other hand it depends on the value the individual allots to the work (Billett, 2006). The interdependency is due to the fact that receiving positive feedback and praise for one's work may increase the perceived value of this specific task. Therefore the motivation to further engage in these kinds of activities may also increase. In a study with nurses at the beginning of their career, the perceived value of work also helped them to overcome difficult and emotionally disturbing situations in clinical practice (Eraut, 2007). Junior doctors also describe feeling valued within the health care team as enhancing their learning in the clinical workplace (Kendall et al., 2005).

Allocation and structure of work

Allocation and structure of work represents the basic daily framework for junior doctors' clinical learning environment. The study of Kendall et al. (2005) on junior doctors' learning in clinical practice indicates on the factor of *allocation and structure of work* that organizational aspects like time pressure and economical pressure may limit the learning opportunities. However, organizational patterns differ widely between hospitals, as every hospital has its own style of working, organizational policies, implicit routines, workflows, values, and norms. According to Brass et al. (2004), social connections tend to develop along the given communication and working patterns at the workplace. The organizational structures of a specific hospital may therefore determine whether the social connections formed

are specialty-specific or more general, hierarchically diverse or solely among peers. The everyday clinical work therefore influences who junior doctors are in contact with and who they consequently might consult for advice and support. Predefined organizational structures are also relevant in reducing uncertainty about everyday working patterns and workflows, which might in turn help to reduce the complexity of the tasks encountered (Stok-Koch, Bolhuis, & Koopmans, 2007). As described in the previous paragraph, task complexity also influences learning and performance. When talking about the allocation and structure of work it also seems important to consider junior doctors' workload and distribution of work at the respective clinic or department.

The formal allocation of work often puts a lot of tasks in the hands of junior doctors. Especially at the beginning of their career, when they are yet to learn how to organize themselves, this high workload causes them severe stress. Stok-Koch et al. (2007) found that high workload and unstable organizational patterns impede learning in postgraduate medical education. When suffering from too much workload, it also becomes difficult for junior doctors to establish meaningful social relations with co-workers and superiors, simply due to the lack of time for social interactions. In his study, Eraut (2007) showed that learning of novice hospital nurses suffers when they get overwhelmed by the workload of clinical practice. Additionally, the high quantity and urgency of work showed negative consequences regarding the time for feedback and the social support accessible for the novice nurses (Eraut, 2007). Hoffman & Donaldson (2004) report similar results for junior doctors concerning the crucial relationship between the amount of workload and the time for feedback and learning. Hence, in addition to the complexity of everyday clinical demands, the formal structure and allocation of work can be regarded as a crucial element of junior doctors working conditions influencing their learning in clinical practice. As explained in Chapter 2.2, junior doctors' residency training in Germany should follow a predefined curriculum, organized by the employing hospital and responsible residency trainer. While accomplishing their residency training, junior doctors rotate through several subspecialty departments in order to learn all the mandatory procedures and skills. The defined duration of each clinical rotation junior doctors complete during their specialty training may also have an impact on the learning opportunities they encounter. To develop trustful relationships and to get to know the structures and hidden channels of information-flow takes some time. If the duration of rotations is too short, junior doctors might not be able to sufficiently engage with others and

hence might not have the opportunity to learn. Another factor considering the allocation of work as well as the formal structure of residency training is whether the junior physicians are accepted as learners in their department and whether their professional development is facilitated accordingly (Kilminster et al., 2011), for example by giving them the opportunity to attend formal trainings or seminars and respecting their level of competence in task division.

Working climate

It is not only formal working patterns that are important in the context of learning in the workplace, but also more implicit factors like working climate (Brass et al., 2004). An overall positive working climate between nurses and physicians "in the resident's work setting enhances the chances that the resident can engage in practices like inquiry, feedback, forgiveness of one's self, empathy, and consensus building" (Hoff et al., 2004, p. 538). Studying the distress and work satisfaction of German hospital physicians working in internal medicine, Bauer & Groneberg (2014) showed that overall the physicians rated their working climate rather positive. Nevertheless, the results of the study also showed significant differences in perceived working conditions, with junior physicians being rather unsatisfied (Bauer & Groneberg, 2014). A fundamental issue for junior doctors' learning and clinical performance in this context is whether they feel save to ask for help (Kennedy, Regehr, Baker, & Lingard, 2009). In their study on trainees' advice seeking behaviour Kennedy et al. (2009) identified three factors influencing junior doctors' decision to ask for advice: (1) the clinical question itself (complexity, importance), (2) supervisor factors (availability and approachability), and (3) trainee factors (appropriate self-assessment, desire for independence, and desire to get evaluated or educated). In their study, they also found that junior doctors fear a loss of professional credibility when they ask for their supervisors support (Kennedy et al., 2009). When the costs of asking for advice are too high, for example in terms of status loss or adverse consequences (Cross, Borgatti, & Parker, 2001), junior doctors might find it difficult to build up trustful relationships and seek for advice and feedback to improve their practice and to ensure patient safety. Teunissen et al. (2009) studied feedback seeking behaviour of Dutch residents during nightshifts and found that residents feedback seeking behaviour also depends on their superiors: a supportive supervisory style encourages residents to ask for help because they perceive more feedback benefits and fewer feedback costs.

In summary, some information ascendants of junior doctors' learning in clinical practice could be found. Relying on Eraut's (2007) model of workplace learning at an early career level and Teunissen, Scheele et al.'s (2007) framework of residents' workplace learning, we identified personal knowledge, social interactions, and working conditions as crucial components in junior doctors' learning in clinical practice. However, only few research results could be found about the interplay of the described factors and the influence of junior doctors' social embeddedness (i.e. social networks) on their learning in clinical practice. The studies described in the empirical part of this thesis address these research needs.

Part II

Empirical Studies

5   Research Questions and Overview of the Empirical Studies

5.1   Aims and Research Questions

The aim of this thesis is to gain a better understanding of junior doctors' learning and clinical performance. Therefore special attention is paid to junior doctors' social relations, their knowledge of established work practices, and their strategies of using clinical resources in solving clinical tasks. Junior doctors' personal knowledge and perceived working conditions are also taken into consideration in order to widen the insight and to highlight relations between the factors affecting junior doctors' workplace learning and their clinical performance.

Junior doctors' clinical performance is tied to clinical practice and clinical practice is tied to junior doctors' learning, assuming that practice and learning are inseparable (Billett, 2004). Accordingly, in order to gain a better understanding of junior doctors' learning and clinical performance at first we need a conceptual definition of clinical practice, learning, and performance in clinical practice. Hence, in the theoretical part we addressed the first aim of this thesis and described junior doctors' clinical practice, clinical performance, and the current state of research on factors that influence the accomplishment of clinical performance. Based on current research results we elaborated which clinical tasks are demanding for junior doctors and which knowledge and strategies they need to acquire, in order to be able to show efficient clinical performance. In the following, the first aim with the related research questions is presented:

Aim 1: Describing junior doctors' clinical practice and perceived learning needs in order to show efficient clinical performance.

Research question (RQ) 1.1: According to current research, how can junior doctors' clinical practice and performance be described?

RQ 1.2: According to current research, how is organizational knowledge related to junior doctors' clinical practice and performance?

RQ 1.3: According to current research, how is task mastery related to junior doctors' clinical practice and performance?

RQ 1.4: According to current research, how is role clarity related to junior doctors' clinical practice and performance?

The second aim of the thesis is concerned with experienced physicians' perspective on junior doctors' learning in the workplace and the evaluation of the authenticity of the developed research instrument for junior doctors' clinical performance. Experienced physicians' insights on how junior doctors actually learn and perform in practice are related to models on early career learning and residency learning. Additionally, the experienced physicians evaluate our developed research instrument for measuring junior doctors' performance, which is applied in the second study relating to the third and fourth aim of this thesis. In the following, the second aim with the related research questions is presented:

Aim 2: Gaining insight in experienced physicians' perspective on junior doctors' learning in clinical practice and evaluating the authenticity of the constructed clinical vignettes.

RQ 2.1: Which factors influence junior doctors' clinical performance and how do they achieve efficient clinical performance?

RQ 2.2: Is a junior doctor likely to encounter a case as described in the clinical vignette?

RQ 2.3: Do the cases and additional materials presented within the clinical vignettes resemble clinical reality?

As we want to gain a better understanding of junior doctors' professional development and consequently their clinical performance, with our third and fourth aim we address the named target group directly. After having discussed theoretical frameworks for junior doctors' learning in practice in Chapter 4, with the third aim the factors identified to influence junior doctors' learning through clinical practice are empirically elaborated. Thus, the focus lies on junior doctors' personal characteristics, their social interactions in the workplace, and their perceived working conditions.

Aim 3: Exploring the factors affecting junior doctors' learning in clinical practice.

RQ 3.1: How can junior doctors' egocentric networks be described in regard of their structural and relational properties?

RQ 3.2: How do junior doctors' egocentric networks differ in regard of the junior doctors' personal characteristics (gender, family background, location of study, clinical experience, and the workplace's level of care)?

RQ 3.3: How do junior doctors perceive their working conditions regarding allocation and structure of work, time pressure, uncertainty of work contents, social stressors, conditions for professional development, participation, and equity?

RQ 3.4: How does junior doctors' perception of their working conditions differ in regard of the junior doctors' personal characteristics (gender, family background, location of study, clinical experience, and the workplace's level of care)?

RQ 3.5: How are the structural and relational characteristics of junior doctors' egocentric networks related to the factors of their perceived working conditions?

Aim 4 is concerned with junior doctors' clinical performance in consideration of the results received regarding factors affecting junior doctors' learning in clinical practice.

Aim 4: Understanding junior doctors' clinical performance considering their social relations, personal knowledge factors, and perceived working conditions.

RQ 4.1: How can junior doctors' clinical performance be described in regard of organizational knowledge, task mastery, and role clarity?

RQ 4.2: How does junior doctors' clinical performance differ in regard of the junior doctors' personal characteristics (gender, family background, location of study, clinical experience, and the workplace's level of care)?

RQ 4.3: How can the relationship between junior doctors' social networks, personal knowledge factors, perceived working conditions, and clinical performance be described?

5.2   Overview of the Empirical Studies

Studying experienced physicians' perspective on junior doctors' learning

The aim of the first study is to gain insight in experienced physicians' perspective on junior doctors' learning in the workplace in the domain of internal medicine (Chapter 6) and to evaluate the authenticity of the constructed clinical vignettes. A detailed description of the evaluation of the clinical vignettes is presented in Chapter 7. The guiding research questions in the first study were:

- Which factors did the experienced physicians perceive as having affected their learning at the beginning of their own clinical career?

- Which factors did the experienced physicians perceive as affecting junior doctors' learning in order to show efficient clinical performance?

For the first study in 2014, interviews with N = 12 internal medicine specialists (8 to 35 years of clinical experience) in rural and university hospitals in Southern Germany were conducted to assess the specialists' perspective on junior doctors' learning at the workplace. Eraut's (2004) model of early career learning and Teunissen, Scheele et al.'s (2007) framework of residents learning in the workplace informed the development of the interview guide. A literature-based coding-scheme was used in an inductive-deductive approach to analyse the data. Social relations in the workplace, personal knowledge, and the structure of work were identified as factors related to junior doctors' learning in the workplace. The respondents also mentioned the availability of contact persons, a supporting and fear-free working climate as well as the provision of a save learning environment. The results suggest that different contacts relate to different learning needs and fulfil different functions, with superiors being mainly responsible for teaching of medical facts and giving legal reassurance, nurses giving advice and teaching practical skills, and peers also giving advice and providing emotional support. Furthermore, the respondents put emphasis on the critical balance between giving enough responsibility to the junior doctors to allow meaningful experience, while at the same time not overwhelming them. Consequently, the experienced physicians viewed the internal medicine specialty training as a highly individualized process which depends on the junior doctors' personal commitment as well as their ability to rightfully estimate their own competences. The results of the first study reinforce the interrelatedness of social interaction, personal knowledge, perceived working conditions, and clinical performance.

Developing clinical vignettes to study junior doctors' clinical performance

In order to research junior doctors' clinical performance, two clinical vignettes were developed (Chapter 7). The development process followed four steps: In the first step an experienced internal medicine specialist and the author developed two clinical vignettes based on the described elements contributing to junior doctors' clinical practice and in regard of current research on conceptualizing clinical vignettes. Both vignettes concern common clinical encounters with high relevance in junior physicians' clinical practice and are constructed to address the elements of clinical performance defined in Chapter 3: organizational knowledge, task mastery, and role clarity. Following this initial development of both clinical vignettes, in a second step we discussed the vignettes with two experienced physicians from internal medicine and surgery to ensure the authenticity of the case description and identify potential improvements. Within this discussion, a preliminary coding scheme for the clinical vignettes was also developed. In the third step, following the expert discussion, the revised clinical vignettes were presented to 12 experienced internal medicine specialists to further evaluate the authenticity of the vignettes and to elaborate factors such as adequacy on target group, comprehensibility of language, and appropriateness of additional materials. In the last step, a pre-test of the once more revised clinical vignettes was conducted with a junior doctor in his first year of clinical practice, leaving us with the final versions of the clinical vignettes which were applied in the second study of this thesis.

Studying junior doctors' learning and clinical performance

The aim of the second study is to gain information on how junior doctors themselves perceive their learning and how they handle demanding clinical tasks (Chapter 8). Thus, based on the results of the first study, junior doctors were asked about their social relations in the workplace and their working conditions. Furthermore, they were asked to solve the developed clinical vignettes. With the second study, the research questions related to Aim 3 *(Exploring the factors affecting junior doctors' learning in clinical practice.)* and Aim *4 (Understanding junior doctors' clinical performance considering their social relations, personal knowledge factors, and perceived working conditions.)* should be answered. Interviews were conducted with 23 junior doctors (9 male and 14 female) at the beginning of their internal medicine specialty training in Southern German hospi-

tals. Junior doctors' egocentric networks were used to assess the contribution of social relations to junior doctors' clinical performance. To gather information on how junior doctors handle demanding clinical situations, the developed clinical vignettes were introduced and the perceived working conditions were assessed with a questionnaire. In order to analyse the received answers on social network contacts, perceived working conditions, and clinical performance in relation to the junior doctors' personal knowledge, several questions on the demographical and educational background of the respondents were asked. We found that in general notion, irrespective of the hospitals' level of care, all respondents reported similar egocentric network patterns. The junior doctors in our study showed rather dense and homophile networks concentrating on intraprofessional contacts for advice and learning. Additionally, the egocentric networks seemed to mirror the hospitals' working structures by focusing rather on the clinical function of the respective network contact than on personal characteristics. Overall the respondents seemed to be quite satisfied with their working conditions and tended to accept unpleasant working conditions as long as they felt they got some benefit out of it. Junior doctors were used to time pressure and dealing with uncertainties in their decisions. At hospitals with basic care level the respondents seemed to be more satisfied with the learning opportunities at site than at hospitals with medium care level. Considering the interrelatedness of junior doctors' social networks, their perceived working conditions, and their clinical performance, significant correlations were found giving further hints on the associations between relational network characteristics and performance.

6 Experienced Physicians' Perspective on Junior Doctors' Learning

The first study is concerned with experienced physicians' perspective on junior doctors' learning in the workplace in the domain of internal medicine. In order to understand the experienced physicians' frame of reference we also questioned them about the learning experiences at the beginning of their own career. Additionally, to enable us to relate the new-found information to previous studies and evaluate the scientific worth of the conducted research, the described state of the art in research on junior doctors' workplace learning (Chapter 4) was included in the development of the research instrument. The guiding questions in the presented study were:

- Which factors did the experienced physicians perceive as having affected their learning at the beginning of their own clinical career?

- Which factors did the experienced physicians perceive as affecting junior doctors' learning in order to show efficient clinical performance?

The interviewed experienced physicians also evaluated the authenticity of the constructed clinical vignettes. A detailed description of the evaluation of the clinical vignettes is presented in Chapter 7.

6.1 Method

To answer our research questions, 12 experienced physicians from German hospitals who are involved in residency training were interviewed in semi-structured interviews following a literature-based interview guide. Semi-structured interviews allow taking respondents' frame of reference into consideration in analysing the answers. A purposeful sampling approach was used because the "focus is on understanding and illuminating important cases rather than on generalizing from a sample to a population" (Patton, 1999, p. 1197). To fit the purpose of the study described above, we identified the following sampling criteria: (1) Participants must work at a hospital with an internal medicine specialty programme and be actively involved in postgraduate medical education. The active involvement in the practice of junior doctors' training was defined as prerequisite for the interview partners to be able to report their perception of junior doctors' learning and performance. (2) Participants must have an internal medicine specialty degree to

ensure that they have the necessary insight and experience in the medical domain of our interest. Any further formal medical qualifications in addition to the internal medicine specialty degree (e.g., gastroenterology, endocrinology) were not regarded necessary, as those qualifications are not mandatory to practice in the field of internal medicine. (3) The importance of hierarchical structures in the medical context (Haidet & Stein, 2006, p. 17) was considered by defining that all interview partners had at least to be a senior physician. Being a senior physician or chief physician puts the interview partners in a position of responsibility for junior doctors' learning as well as performance and therefore ensures their experience of meaningful interaction with junior doctors. (4) As working and learning cultures might differ between different hospital sites (Kendall et al., 2005) and "some variety in the sources of the data does facilitate and enhance the dialectic inherent in the search for depth of meaning" (Crouch & McKenzie, 2006, p. 494), we decided to interview experienced physicians from rural as well as university hospitals, thus detecting these potential differences and gaining stronger evidence for the patterns occurring in all the considered settings (Patton, 1990). After having defined these criteria, possible interview partners were searched via the homepage of the Bavarian State Chamber of Physicians as well as the homepages of hospitals in Southern Germany. The fitting of the found candidates with the criteria described above was discussed with two experienced physicians from internal medicine and surgery who are involved in postgraduate medical education at the University of Regensburg and had no further connection to the following interview process.

6.1.1 Sample

All 12 interview partners met the sampling criteria described above, held a medical specialty degree in internal medicine, were practicing medicine at a hospital with a residency training programme, and were involved in junior doctors' clinical training. The author contacted the chosen candidates via e-mail with a short description of the purpose and procedure of the interview, concluding with an invitation to take part in the study. Of 40 experienced physicians contacted, 12 agreed to take part in the study. An overview of the demographic information of the respondents is presented in Table 1.

The mean age of the interview partners was 47.5 years (SD = 8.12). All respondents had at least eight years of clinical experience (M = 20.25; SD = 8.87)

and also have been or still are intensively involved in the medical training of residents as direct supervisors, chief physicians, senior physicians, or experienced colleagues.

Table 1   Overview of Experienced Physicians' Demographical Information

Name	Gender	Age	Years of practice	Specialty
E1	m	40	14	Pneumology
E2	m	45	13	Haematology-oncology
E3	f	43	17	Endocrinology
E4	m	39	13	Oncology, endocrinology
E5	m	53	30	Pneumology
E6	m	61	33	Gastroenterology
E7	m	38	8	Emergency medicine
E8	m	43	15	Infectiology, rheumatology
E9	m	60	35	Cardiology
E10	m	53	23	Cardiology
E11	m	53	26	Emergency medicine, gastroenterology, intensive care
E12	f	42	16	Cardiology

All interview partners perceived the training of junior doctors as an integral part of their job description. Interview partner E7 explained: "The training of residents is a fundamental issue, as it always takes place; it's not just something you do on Mondays, but you do it all the time" (E7/21). Also the interview partners agreed that their involvement in junior doctors' training began shortly after they themselves had started as junior doctors. Four of the experienced physicians worked at a university hospital (E1, E2, E4, and E12), E3, E6, E8, E9, and E11 worked at a teaching hospital and trained students in the practical placement, E5, E7, and E10 worked at a hospital without any connection to undergraduate medical education. All but two of the interview partners (E4 and E12) had already changed their workplace at least once and all but three (E3, E9, E10) had international experiences.

6.1.2 Instrument

All interviews were conducted following a semi-structured interview guide, which is presented in Appendix 1. Central to the interviews was the experienced physi-

cians' perspective on factors affecting junior doctors' learning and clinical performance. The following paragraphs describe the main themes (background information, factors affecting junior doctors' learning and clinical performance, evaluation of the clinical vignettes) of the literature-based interview guide.

Background data

Besides the gathering of common demographical information like age and gender, questions on the participants' previous work experiences were included in the interview guide to gain insight in the extent as well as the diversity of their working experience. Having worked at a lot of different workplaces or even in a foreign country might have an influence on the experienced physicians' perspective on workplace learning, as with every change of site they themselves most likely had to actively take part in learning at the workplace (Lockyer et al., 2011). Also, the knowledge of different kinds of working and organizational patterns might influence their answers. As an introduction to the main theme of the interview, the participants were asked to think about their own experiences at the beginning of their clinical career. They were invited to talk about how they had dealt with demanding clinical tasks and what had facilitated or hindered their clinical learning and performance. With the information about their own experiences as junior doctors, a frame of reference for their perspective on junior doctors' learning nowadays could be set up.

Factors affecting junior doctors' learning and clinical performance

Based on the learning experiences at the beginning of their own clinical career, the participants were asked to describe the factors affecting clinical learning and performance of junior doctors nowadays. In concordance with the theoretical conception of junior doctors' learning in the workplace described in Chapter 4, detailed questions were asked about junior doctors' social contacts, their personal knowledge, and the structure of clinical work. To further stimulate the conversation about junior doctors' learning, the experienced physicians were asked what they would classify as demanding clinical tasks and how the junior doctors should attempt to handle these kinds of tasks.

Evaluation of the two clinical vignettes

The last stage in the interview included the evaluation of the authenticity of the constructed clinical vignettes. The clinical vignettes were presented to the interview partners on paper or, in case of a telephone-interview, sent to them in a digital format via e-mail. The respondents were asked if they perceived the described situations as authentic and common clinical encounters. They were invited to give suggestions for improvements concerning the authenticity and the content of the cases described in the clinical vignettes. A detailed description of this part of the interview with the corresponding analysis is presented in Chapter 7.2.3.

6.1.3 Procedure

Interviews were conducted in 2014 at Southern German hospitals with a residency training programme for internal medicine. The interviews took between eight and 42 minutes (M = 24.75 min; SD = 10.36). After having gained informed consent, each interview was tape-recorded. All interviews were conducted by the author. The interviews took place either at the respondents' workplace, their home, or at the author's workplace. Two of the interviews (E5 and E10) were conducted via telephone (Holt, 2010), because this setting was easier to arrange for the interview partners. The interviewer tried to ensure a calm and relaxing environment for the interviews in order to achieve an authentic and every-day communication situation which allowed participants to feel save answering the interview-questions honestly and throughout (Lamnek, 2010). Despite all best efforts, some interviews, especially those at the busy clinical workplace of the participants, suffered from disruptions by nursing staff, colleagues, or urgent calls. In these cases the interview and the tape recording was paused and resumed after the disturbance was cleared. All interviews were conducted in a moderately neutral interview style (Atteslander, 2008).

6.1.4 Analysis

We transcribed the interviews verbatim in order to prepare them for further analysis. The received background information on each interview partner was transcribed into a spreadsheet and measures of demographical data were calculated.

An inductive-deductive procedure was applied to analyse the interview data. Accordingly, participants' statements were categorized following a literature-based preliminary coding scheme and new codes were generated from the data if necessary (Bortz & Döring, 2006; Mayring, 2010). The preliminary coding scheme was derived from the results of the reviewed literature on junior doctors' learning in the workplace, which is elaborated in Chapter 4. In regard of the previous literature review and the developed research questions, the following three main themes were covered in the coding scheme:

- personal knowledge related to learning in the workplace (previous knowledge, personal traits, proactive behaviour);

- social interaction related to learning in the workplace (preconditions for interaction, content of interaction, hierarchical status of interaction partner);

- structure of work related to learning in the workplace (formal training structure, work organization).

Every code was explained in a description and further clarified with an anchor-example to ensure the objectivity of the coding process (Bortz & Döring, 2006). The author reviewed and critically discussed the categories with colleagues from the medical as well as educational domain. The entire coding scheme is presented in Appendix 2.

To ensure the reliability of the constructed coding scheme, one interview was randomly chosen and completely coded by a second coder, the first coder being the author. The second coder was an experienced physician (16 years of clinical experience) with a specialty degree in internal medicine. For the inter-rater agreement Cohen's Kappa (κ) was calculated, with κ-values from .60 to .75 resembling good concordance (Wirtz & Caspar, 2002). The received Cohen's Kappa value (κ = .69) is well within the range of good inter-rater agreement. Given the exploratory character of the study at hand and the relatively low sample size, no inferential statistical analyses were performed.

6.2 Results

The results of the first study are presented to answer the research questions relating to Aim 2 (*Gaining insight in experienced physicians' perspective on junior doctors' learning in clinical practice and evaluating the authenticity of the con-*

structed clinical vignettes.), starting with factors related to the learning experiences of the participants at the beginning of their own clinical career. In the following paragraph, the factors affecting junior doctors' clinical learning as expressed by the experienced physicians are displayed. The examples from the interviews are cited with the code for the interview partner (e.g. for interview partner seven the code is E7) and with a reference to the exact paragraph in the transcript. As all interviews were conducted in German, the author translated the interview sections cited into English for clarification purposes.

6.2.1 Own learning experiences

As an introductory question, the experienced physicians were asked about how they got to learn the knowledge and skills necessary to perform efficiently in the clinical workplace at the beginning of their own clinical career. The results are organized following the described factors affecting learning in the clinical workplace with (1) personal knowledge, (2) social interactions, and (3) structure of work.

(1) Personal knowledge related to learning at the beginning of one's own career

The respondents mentioned only a few aspects concerning the personal knowledge related to their learning at the beginning of their own clinical career. Noted as being helpful was having knowledge of the working processes in a clinical environment and especially at the hospital one starts working. E12 put a strong focus on knowing how to work on one's own and having learned to be self-dependent. Furthermore, the ability to reflect on what is expected from oneself as well as the ability to reflect on one's own mistakes and change practice accordingly was brought up.

> "Right at the beginning it's always difficult to realize what you're allowed to or can do on your own and what you're not allowed or can't do on your own. And you know they expect you to do a lot of things and you're in a grey area." (E4/23)

(2) Social interactions related to learning at the beginning of one's own career

When asked about the factors facilitating their learning at the beginning of their own career, all interview partners referred to social interactions with experienced colleagues and superiors. All interview partners emphasised the importance of having an experienced colleague to show them how things are done at site and to explain basic procedures. Attention was brought to learning by observing or working alongside experienced colleagues and superiors. Interactions with superiors, such as asking questions or discussing diagnostic results, were less frequently put on record. The availability of interaction partners as well as the general working climate at site were mentioned as necessary preconditions for interaction. The interview partners had experienced a fear-free and good working climate as very helpful in their personal development, but also described some bad experiences in this context. Interview partner E11 was very explicit in describing some bad experiences concerning the working climate at his first workplace:

> "You always knew exactly, in case of doubt, if something happened it would be your fault and nobody would support you. Quite on the contrary, they'd be coming down on you more than ever." (E11/25)

The experienced physicians named different interaction partners as relevant for their own learning. While experienced colleagues and superiors were the ones most frequently mentioned, the interaction with other health professions, especially the nursing staff, also seemed important. Peers with the same level of experience as well as family and friends were less often named by the experienced physicians. Experienced colleagues and superiors were mainly brought up in the context of working alongside each other and learning through observation. E4 explained: "Well, naturally, in the first phase one learned through observing more mature physicians" (E4/21). E8 particularly valued that his superior expected him to take on responsibility and challenged his skills, while simultaneously providing a safe learning environment and ensuring patient safety.

> "[...] the crucial element was that there was somebody who said: 'Just try it. I'm watching you and will monitor it. Don't be afraid. If you make a wrong decision, then this won't affect the patient.'" (E8/18)

The nursing staff was valued for teaching basic medical skills (e.g. how to take blood) and procedures as well as giving informal advice on how things are done at site.

> "In the surgical department I was on my own a lot. During the ward rounds I didn't know a thing. Hence, I just asked the senior nurses […]: 'How would the senior physician or the chief physician do it?' And then they told me: 'Like that.' And then I said: 'Well, then let's do it like that now.'" (E10/25)

(3) Structure of work related to learning at the beginning of one's own career

Concerning the structure of work, none of the interview partners reported any structured training programme. They agreed that they had to take on responsibility right from the beginning and complained that they had no initial training or time for orientation.

The interview partners remarked that the heavy workload they had to cope with at the beginning of their career and the high responsibility right from the start were sometimes a threat to their professional development. E1 summed up this crucial balance between responsibility and learning in saying:

> "[...] but when you instantly have to take on a lot of responsibility, then, most of all, that's not nice. On the other hand, that's why the learning curve is fairly steep. However, that's rather not how it should be." (E1/22)

The abilities of the clinical teachers were regarded as very important in the organization of clinical training. The clinical teacher should give enough room for development while simultaneously ensuring that the junior doctor does not feel overwhelmed.

6.2.2 Perspective on junior doctors' clinical learning

The results for the experienced physicians' perspective on junior doctors' learning in the workplace are organized following the same three themes as the description of the results considering their own learning:

(1) personal knowledge related to junior doctors' clinical learning and performance,

(2) social interaction related to junior doctors' clinical learning and performance,

(3) structure of work related to junior doctors' clinical learning and performance.

Every theme is introduced with an overview of the emerged categories and key components as well as the number of interview partners who mentioned a certain key component (*n*) and the frequency of statements for each key component (*f*). As the interviews were conducted in an open semi-structured style, the interview partners occasionally talked about certain themes, categories, or key components several times in the course of the interview. Therefore, the frequency might sometimes be higher than the actual number of interview partners (*N*).

(1) Personal knowledge related to junior doctors' clinical learning and performance

Table 2   Results for Personal Knowledge in Junior Doctors' Clinical Learning

Category	Key components	*n*	*f*
Previous knowledge and skills	Theoretical and practical knowledge acquired in medical school	6	6
	Theoretical and practical knowledge required while working in a clinical setting (e.g. practical placement)	1	1
Personal traits	Dedication; compassion for patients; empathy	6	7
	Passion for the job; awareness of responsibility	4	6
	Self assessment; learning from mistakes	10	19
	Respect for all professions in the health sector	4	6
Individual proactive behaviour	Showing interest and actively asking questions	3	3
	Actively engaging in clinical activities and wanting to do things on one's own	7	15
	Doing the necessary self-study	2	2

Not all the interview partners commented on the role of *previous knowledge and skills* in junior doctors' professional development (Table 2). The ones who did stated that having a basis of medical knowledge and skills is important, but the notion that medical schools can educate future physicians only in a limited way was clearly recognized by the interview partners. More emphasis was put on *personal traits* affecting junior doctors' learning. The concept of "being a doctor" and what elements contribute to "being a good doctor" in a junior doctor were recurrent themes in the interviews. The experienced physicians explained that for them being a good doctor is more than just a "nine-to-five job", but instead it is a "calling". In their view, the junior doctors need to take on responsibility and deal with the faith their patients put in them.

> "I think there's no need to work as insanely as 30 years ago in the university hospitals because this is also not beneficial for patient-safety. On the other hand, there are sick patients who put their trust in you and if you just drop your pen at five o'clock because your duty time's over, you're just not doing justice to the calling of being a doctor." (E8/39)

The experienced physicians perceived a genuine interest in patients and the display of an appropriate amount of kindness towards patients as a necessary trait in junior doctors in order to learn how to show efficient clinical performance. However, in the respondents' opinion, junior doctors do not only need to be able to show appropriate behaviour and attitudes concerning patients but also towards the whole health team. Given the emphasis that the experienced physicians put on the notion of learning through interaction, they perceived it as fundamental for junior doctors to show appreciation for the health team and try to contribute to a climate of mutual support and trust.

> "It's important to show respect for all the other co-workers [...]. Given the mutual respect, learning from each other happens automatically." (E12/29)

The interviewed physicians further agreed that the ability to reflect is crucial for junior doctors' learning in the workplace. The results indicate two dimensions regarding junior doctors' ability to reflect. Firstly, junior doctors need to be able to assess their level of knowledge and skills correctly in order to recognize their own shortcomings and to know what they can or cannot do in the clinical workplace without threatening patient safety. Secondly, reflection on the work done and re-

sults achieved seems necessary to detect made mistakes and take a better approach next time a similar situation occurs.

> "An important aspect is the ability to reflect, which some people have and others don't and which leads to problems both ways. People overestimate themselves and people underestimate themselves." (E4/51)

Showing *proactive behaviour* through actively engaging in clinical tasks and especially through wanting to perform clinical tasks on one's own was also mentioned by the experienced physicians as an important aspect for junior doctors' learning in the workplace. In the respondents' opinion junior doctors need to show interest and try to get actively involved in clinical activities in order to learn the skills and procedures to perform efficiently in clinical practice.

> "It's important; if you're doing everything self-dependently from the very beginning, you'll get more encouragement." (E12/39)

The respondents put on record that junior doctors not only should observe clinical procedures being performed by more experienced colleagues but should strive to perform these procedures on their own in supervised settings. Through this active involvement in clinical tasks junior doctors have the opportunity to receive feedback on their performance and learn from mistakes.

Besides junior doctors' active involvement in clinical tasks, the experienced physicians perceived it as a matter of course that junior doctors do the necessary reading up to close their knowledge gaps.

(2) Social interaction related to junior doctors' clinical learning and performance

Table 3   Results for Social Interactions in Junior Doctors' Clinical Learning

Category	Key components	*n*	*f*
Preconditions for interaction	Availability of interaction partners	4	9
	Welcoming and cooperative working climate	6	10
Content of interaction	Training of medical skills, procedures, thinking, knowledge (one-on-one teaching, observing, working alongside each other)	11	27
	Controlling and feedbacking junior doctors' work and giving feedback on progress and performance	6	11
	Advice (medical as well as personal, e.g. career planning)	7	8
	(Legal) Reassurance	5	9
	Support concerning emotional well-being	2	3
Interaction partners	Interaction with superiors	11	29
	Interaction with colleagues	11	25
	Interaction with nurses and other health professions	10	16
	Interaction with peers	4	5
	Interaction with family and friends	1	1

The experienced physicians perceived social relations as crucial in junior doctors' learning to show efficient clinical performance (Table 3). The interview partners agreed that as a *precondition for meaningful interaction in the workplace* experienced colleagues as well as superiors need to be available to junior doctors sufficiently and in a timely manner. They also perceived a "good" working climate as a crucial factor in the formation of social relations in the workplace. The "good" working climate was specified through social interaction partners who are welcoming and friendly to newcomers, thereby ensuring a fear-free work environment that encourages junior doctors to actively ask questions and seek support. E11 summed it up:

"[…] only when you give them [the junior doctors] the feeling that they're safe and have nothing to fear, are you able to provide them with a good training." (E11/49)

Getting more into detail about what junior doctors actually learn from their social interactions in the workplace, the main *contents of interaction* mentioned by ex-

perienced physicians were the training of medical skills, medical procedures, and medical thinking. The term "training" takes on a wide definition in this context without directionality of efforts. It incorporates formal one-on-one teaching as well as working alongside each other or observing experienced co-workers. The respondents agreed that junior doctors need to get enough feedback on their performance to keep them updated on their own progress and give direction to their further learning efforts.

> "But it's about learning and about recognizing where I am right now and where I need to go. How am I doing in comparison to my peers concerning my competencies and how can I further improve specific competencies? Certainly, some form of feedback would be necessary for that." (E4/53)

Encouraging junior doctors to take on responsibility and try to solve problems on their own while giving them the necessary reassurance was believed to be an important content of social interaction in the workplace. It also became apparent that the different contents of interaction mentioned by the interview partners seem to relate do different interaction partners. Table 4 presents an overview of the relationship between content of interaction and the related interaction partners as described by the respondents.

Table 4   Content of Interaction in Relation to Interaction Partner

Interaction partner	Content of interaction f				
	Training	Controlling/ Feedback	Advice	Reassurance	Emotional support
Superiors	11	4	1	7	1
Experienced colleagues	10	2	1	3	1
Peers	3	0	1	0	1
Nursing staff	3	3	5	0	0
Family and friends	0	0	0	0	1

Experienced colleagues and superiors are mainly mentioned as role models, trainers, and to provide legal reassurance. Nursing staff and other health professions are valued for their practical knowledge and therefore their informal advice and feedback. The interview partners agreed that getting advice from the nursing staff might be very helpful at the beginning of one's career, but some of the inter-

view partners put constrictions on the value of the nursing staff's advice. Those respondents explained that junior doctors need to know which nurses are experienced enough and therefore trustworthy. Furthermore, advice given by nurses is nothing the junior doctors can rely on, because to be legally valid decisions concerning patients' medical care have to be made by a doctor and not a nurse.

> "Yes, sure, it's also important to have an experienced nurse who has already seen a lot of medical conditions or can estimate how the patient's doing. Does one have to call somebody or is it enough to wait till the afternoon when the superior's expected to come by anyway? They [the nursing staff] can balance out some uncertainties, I think, and give some advice. […] But ultimately, they can't really replace medical supervision or a colleague." (E1/26)

Only one respondent named family members and friends as valuable interaction partners for junior doctors. In this case, family and friends were regarded as a source for emotional support. In general the experienced physicians scarcely talked about emotional support as a content of social interaction in the workplace.

(3) Structure of work related to junior doctors' clinical learning and performance

Table 5   Results for Structure of Work in Junior Doctors' Clinical Learning

Category	Key components	n	f
"Formal" training structure	Structure of the junior doctors' training (rotations, formal courses)	9	16
	Time to adjust to new environment; introductory programme	7	10
	Time allocated to formal training or studying	5	6
	Qualities of clinical teachers (abilities necessary to facilitate junior doctors' learning, guidance, knowledge of teaching methods)	10	13
Work organisation	Workload (amount, difficulty of work)	6	7
	Working hours	5	6
	Guidelines (site-specific organisational and specialty-specific medical guidelines)	12	26
	Responsibility put on junior doctors	4	9
	Transparent clinical organisational structure (who to call, when to call, who is in charge of what)	3	3

The interviewed physicians' perspective on *structured training programmes* for junior doctors was ambivalent. On the one hand, they perceived it as valuable when time was allocated for initial orientation, for example to get to know the hospital structure or the digital patient management system at site, as long as this initial orientation phase is granted during the very first days of junior doctors' clinical practice. On the other hand, a strict formal regulation of junior doctors' training in regard of the timing of rotations and the content of training was seen more sceptical. Due to experiences with quality-management and formalization of organizational processes, some of the interview partners expressed resentments to putting the whole training of junior doctors into a formalized structure. They criticized that a formalized structure might not be adjusted to junior doctors' levels of competence and warned about constructing a "one-fits-all approach" to junior doctors' education. They voted for a flexible organizational structure of rotations and allocation of tasks in concordance with the individual learning pace, interest, and abilities of each junior doctor. Especially the respondents working in smaller hospitals with fewer junior doctors valued flexible training systems, but also acknowledged that flexibility in training structure might not be appropriate if there were a lot of junior doctors to train at the same time, as it is often the case at university hospitals.

As mentioned before, social interaction was considered an important factor in junior doctors' learning in the workplace. Therefore, the experienced physicians emphasized the importance of clinical teachers' abilities to support junior doctors' development, for example by giving appropriate feedback on their clinical performance. Furthermore, the respondents claimed that clinical teachers need to be able to bring demands and responsibilities they confront junior doctors with in accordance with their competency level. Clinical teachers should challenge junior doctors to handle clinical situations on their own, while providing a safety backup if tasks get too overwhelming for junior doctors and making sure that patient safety is granted. However, mandatory educational or feedback training for clinical teachers was not reported and in most cases also not deemed necessary by the respondents.

The issue of responsibility seems to relate to the theme *work organization*. The interview partners agreed that giving responsibility to junior doctors is an important aspect of their learning in the workplace, but they also warned that to facilitate learning the level of responsibility has to be appropriate to the junior doctors' abilities. When the level of responsibility and the level of competence

were incongruent, the experienced physicians perceived it as hindering junior doctors' development. In the opinion of the respondents a similar balance needs to be found for workload and working hours. A certain level of workload is necessary for junior doctors in order to actively engage and being challenged, but if this level is exceeded, the high workload might overwhelm them and in consequence hinder their learning. To ensure enough free time for junior doctors, working hours regulations were accepted as necessary, but at the same time seen as a threat to a thorough education. Having to leave the hospital and the patient for legal reasons (i.e. working hours regulations), in spite of medical procedure in progress, was perceived as withholding learning experiences from junior doctors.

> "The working hours per day have been significantly limited, therefore some educational possibilities, which one was able use according to one's own initiative in the past, today are at least constricted. I'm not saying that it's not possible anymore, but it isn't as easy as it used to be. This especially concerns the surgical disciplines, but of course also internal medicine specialty training." (E9/22)

Similar to the perception of formalized training programmes, the experienced physicians remained ambivalent considering the role of guidelines in junior doctors' clinical learning. Medical guidelines and standard operating procedures (SOPs) were regarded as helpful for junior doctors in giving them orientation and basic information on how to handle certain situations, especially when no direct interaction partner is immediately available. However, guidelines were criticised for being static and only in a limited way able to represent the complexity of clinical daily routine.

> "Well, it's not only the SOPs or guidelines that should direct medical actions, but there are a lot of other factors that have to be taken into account, too: the structure of the patient as well as the structure of the clinic. One can also vary those SOPs accordingly. It's not carved in stone, but an important aspect especially for newcomers so they get to know certain procedures after all." (E5/35)

Some of the interview partners also mentioned that in the busy clinical environment the usefulness of guidelines might be further limited due to the fact that junior doctors do not have the time to read them all. Guidelines trying to make work-processes more transparent, such as whom to call when or contact information

for important interaction partners, were perceived as helpful for junior doctors at the very beginning, although they would soon become redundant due to face-to-face interaction in the workplace.

6.3   Discussion

The results are discussed beginning with the elaboration of the interview partners' perceived changes in junior doctors' education over time and site-specific differences related to junior doctors' medical training. The changes over time and site-specific differences allow us to gain a frame of reference for the results on junior doctors' clinical learning we received from the respondents. Having set the scene, the found factors relating to junior doctors' clinical learning and their interplay are discussed and connected to current research and theories. The discussion ends with the elaboration of the limitations of the conducted study.

Changes over time and site-specific differences in junior doctors' learning and performance in the clinical workplace

We found that the experiences the interviewed physicians made at the beginning of their clinical career reflected on their current perception of junior doctors' learning. Whereas the overall factors affecting junior doctors' clinical learning seem to have rarely changed over time, the emphasis put on certain factors seems to have altered. A main theme in this context is the social status of junior doctors as well as the conception of medical training and clinical working. It seems as if the experienced physicians perceived the hierarchies at the beginning of their career as steeper than they are today. This finding, concerning the changing hierarchies in hospitals, is in concordance with the ongoing discussion about the *Generation Y* (Schmidt et al., 2011). Due to better career opportunities as well as a changing understanding of leadership and power, junior physicians might have different demands on their training and work, which in turn might force hospitals to adapt their structures. Although the experienced physicians agreed that establishing reasonable hierarchical structures and ensuring a workload that enables an adequate work-live balance for junior doctors are improvements, in comparison to the situation at the beginning of their own career, they showed concern about the development of the medical profession form a "calling" to a "job".

Furthermore, we found that there seem to be differences in junior doctors' learning in the workplace in relation to the hospital size and status. Especially in rural and smaller hospitals the interviewed physicians valued the possibility of intensive interaction with the junior doctors and demanded a more individualistic approach to junior doctors' learning in the workplace. These findings are in concordance with the findings of Kendall et al. (2005, p. 620), who state that smaller peripheral hospitals "are better organized, give junior doctors more time, and more individual contact with their seniors, provide more detailed feedback and follow-through of patients, and give exposure to a broader range of conditions and situations". Furthermore, the interview partners noticed differences in the independence and autonomy of junior doctors in relation to hospital size, which was also found in a study on doctor-doctor consultations by Pimmer, Pachler, & Genewein (2013), who reported that in smaller hospitals doctors tend to treat patients more independently and have more autonomy in decision making and problem solving. Pimmer et al. (2013, p. 468) further described that in larger hospitals doctors tend to have more time in the student role and benefit from "specialised knowledge of a large number of experts in different specialties". The highly specialized knowledge junior doctors access in larger hospitals or university hospitals was also recognized by the interviewed physicians, but at the same time concerns about the broadness of junior doctors' clinical education were raised. The respondents' comments indicate that in their opinion, specific hospital settings provide specific educational environments which correspond to specific career options and pathways for junior doctors.

Factors related to junior doctors' learning and clinical performance

We found that experienced physicians perceive personal knowledge, social relations, and structure of work as factors affecting junior doctors' learning in the clinical workplace. In the general notion our findings are in concordance with the models for learning in the workplace by Eraut (2004) and residents' learning by Teunissen, Scheele et al. (2007). However, we found that the interviewed physicians put a slightly different emphasis on the single factors then proposed by Teunissen, Scheele et al. (2007) and they allowed us a new insight in the interplay of the mentioned factors especially in the context of German internal medicine specialty training.

Personal knowledge

The results suggest that in terms of personal knowledge the professional self-concept, the ability to reflect, and showing proactive behaviour while trying to engage in clinical activities seem necessary traits for junior doctors in their clinical learning.

The results indicate that junior doctors need to understand the difference between "*doing* the work of a physician" and "*being* a physician" as described by Jarvis-Selinger et al. (2012, p. 1185). They are expected to take on the responsibility of the job and form a professional self-concept incorporating passion for the job and compassion for patients. The formation of junior doctors' professional self-concept relates to their interaction with clinical role models, who often unconsciously allow them insight into their professional self-concept (Kenny et al., 2003; Paice, Heard, & Moss, 2002) and thereby facilitate junior doctors' integration in the professional community of practice (Lave & Wenger, 1991).

The results further suggest that the ability to reflect is a very important factor in junior doctors' clinical learning. Junior doctors are expected to continuously assess their abilities, compare them with peers, and reflect on their mistakes to enhance their performance. This finding is in line with the results found by Teunissen, Scheele et al. (2007, p. 767), who showed that residents perceived reflecting on their personal knowledge as a "vital part of their learning process". To facilitate the process of junior doctors' reflection, the experienced physicians emphasized the role of supervisors or experienced co-workers giving guidance, which Mann, Gordon, & MacLeod (2009) in their literature review also identified as a key component of reflective practice in the health professions education.

The respondents expect junior doctors to show proactive behaviour and engage actively in clinical tasks. As the regulations for junior doctors' training are rather broad, they are expected to take on responsibility for their own learning and to actively ask for advice as well as demand to be allowed to practice skills and procedures. Engaging in clinical tasks was found by Teunissen, Scheele et al. (2007) as a starting point for junior doctors' clinical learning. However, the opportunities to actively engage in work activities might not always be equally distributed among the junior doctors due to factors like race, gender, age, and personal sympathy (Billett, 2001). Especially in the clinical workplace with often highly hierarchical structures the majority of learning opportunities might be given to those who are *not talking back* and subordinate themselves according to the

wishes of their superiors (Füllekrug, 2008). Hence, the working climate as well as the working structure at site have to be considered in the context of junior doctors' taking responsibility for their own learning through proactively engaging in clinical tasks.

Social interaction

Acknowledging the importance of social interaction in junior doctors' clinical learning, current models (Teunissen, Boor et al., 2007; Teunissen, Scheele et al., 2007) propose a pivotal role of clinical activities for junior doctors' learning in the clinical workplace. Relying on our results, we suggest to extend this view and propose a pivotal role of social interaction in junior doctors' clinical learning. Sure enough, to engage in clinical activities is vital for learning in the workplace, but our results suggest that the social interactions in the workplace decide whether this activity or situation facilitates learning or not. Through social interactions junior doctors are able to encode the medical and cultural knowledge embedded in clinical activities (Teunissen, Scheele et al., 2007). Therefore, as mentioned in the interviews, the availability of interaction partners as well as a benevolent working climate seem to be essential preconditions for junior doctors' clinical learning. The necessity of a fear-free environment to facilitate advice-seeking and feedback-seeking behaviour has been established for the medical domain (Bok et al., 2013; Teunissen et al., 2009), but also for other domains (Borgatti & Cross, 2003; Rijt, 2013).

Our results further suggest that different qualities of interaction facilitate different learning processes and that the intensity of guidance is reduced with junior doctors' increase in clinical competence, as it can be found in an apprenticeship approach and for the clinical context in the notion of progressive independence (Kennedy, Regehr, Baker, & Lingard, 2005). In terms of frequency and intensity, different qualities of interaction are related to different contents of interaction and different interaction partners fulfil different needs in junior doctors' clinical learning. It seems helpful if junior doctors are able to build a wide and boundary-crossing social network with people working in different hierarchical as well as specialty domains. Teunissen, Scheele et al. (2007, p. 769) come to a similar conclusion: "Whereas faculty tend to focus on the medical aspects of a resident's performance, nurses, for instance, can provide feedback on the social skills of residents and how these are perceived by patients". Consultations with special-

ists can help to widen junior doctors' knowledge of the working culture at site (Pimmer et al., 2013) and informal lunch meetings might be a "main source of their knowledge about how to care for patients" (Parboosingh, 2002, p. 231). The contact with superiors and mentors can be highly relevant for their future career perspectives (Gruber et al., 2008). The understanding of tacit knowledge about work practices requires close interaction (Billett, 2004; Lehtinen et al., 2004), in our study mostly with experienced colleagues or nurses, whereas information on how to perform an uncommon procedure or knowledge on certain diseases might come from a more distanced or informal contact (Hansen, 1999; Jippes et al., 2010). Looking in more detail at what is learned from whom in the workplace, some related problems become apparent. The danger of unconsciously learning behaviours and attitudes handed down over generations—although they are not appropriate (any more)—is inherent to the social learning process as well as the possibility that the interaction partner does not have the required expertise and therefore wrong knowledge is generated (Kenny et al., 2003; Szymczak & Bosk, 2012).

Structure of work

The results show that the experienced physicians remain ambivalent considering the amount of regulation necessary concerning the work and training structure of junior doctors. They acknowledged the positive aspects of having restricted working hours for junior doctors' health as well as the necessity of a phase for initial orientation, but fear the loss of learning opportunities due the lower amount of time available for contact with patients. After the changes in working hours regulations in 1994 (Bundesministerium der Justiz und für Verbraucherschutz, 1994) a lot of researchers have tackled this topic and the related consequences for physicians' clinical performance and involvement in lethal mistakes (Helmig, Hinz, Michalski, & Trotha, 2010; Landrigan et al., 2004; Lockley et al., 2004), mental and bodily health (Fletcher et al., 2005) as well as work-satisfaction (Helmig et al., 2010). Despite the positive effects found supporting a certain restriction of working hours, those regulations still suffer from an acceptance problem throughout the medical profession. Füllekrug (2008) suggests, as an explanation of physicians' negative attitude towards the legal regulations of working hours and training programmes, that they might perceive those regulations as a threat to their well-established working processes and their professional self-conception as a very autonomous profession. This whole discussion about work-

ing hours and educational standards seems to be a "work-in-progress", accelerated by the upcoming *Generation Y* (Schmidt et al., 2011) as well as increasing numbers of female medical students and subsequently female physicians (Statistisches Bundesamt, 2015a).

The results also suggest that superiors need to facilitate the critical balance between the responsibility put on junior doctors and their level of expertise. The clinical teachers need to have the ability to give junior doctors enough room for own decisions while simultaneously preventing harm from patients and thereby creating a safe learning environment for junior doctors. In their study with experienced physicians Teunissen, Boor et al. (2007) found a similar pattern. Experienced physicians purposefully put residents in highly challenging situations, while accepting to slightly overwhelm the residents to stimulate their learning. The ability of clinical teachers to rightfully estimate the competence of junior doctors and give them the adequate amount of autonomy to make independent decisions was not just claimed in our interviews, but is a frequently mentioned trait of positive role models and teachers in the clinical context (Jochemsen-van der Leeuw et al., 2013). Nevertheless, the results of the interviews reveal an ambiguous perspective on the teaching skills of clinical supervisors and the need of clinical teacher training. The experienced physicians remained rather sceptical in regard of mandatory teacher trainings, which might once more reflect the physicians' self-concept containing defensiveness considering their professional autonomy (Füllekrug, 2008). Additionally, some of the interview partners explained that medical expertise qualifies physicians for their teaching duties, which refers to competency frameworks for medical education that include the *Teacher* as one of the many roles of a physician (Frank, 2005; Medizinischer Fakultätentag der Bundesrepublik Deutschland e.V. & GMA Gesellschaft für Medizinische Ausbildung e.V., 2015).

In conclusion, the results on the structure of work suggest a highly individualized approach to junior doctors' clinical learning, which is well in line with the ongoing discussions concerning undergraduate medical education (Hodges, 2010) as well as postgraduate training (Sterkenburg et al., 2010) and put high expectation on clinical teachers, as they have the responsibility to facilitate such an individualized learning environment.

Interplay of factors related to junior doctors' clinical learning and performance

The results suggest that no single factor but rather the complex interplay between the factors affecting junior doctors' clinical learning needs to be considered to understand how junior doctors achieve efficient clinical performance. Major themes in the complex interplay seem to be the availability of interaction partners as well as a working climate of mutual support and trust to facilitate learning through interaction. Concerning the individual factors affecting junior doctors' learning, the ability to reflect on one's own actions seems very crucial to enhance performance. Junior doctors also need to realize that "*being* a physician" (Jarvis-Selinger et al., 2012, p. 1185) includes more than just gaining competences and "playing" certain professional roles but it also requires passion and dedication. The controversy surrounding the amount of working hours necessary to train junior doctors sufficiently, while not endangering their performance because of fatigue and overwork, could not be brought to conclusion. However, the structure of work needs to ensure that junior doctors are able to perform in a safe learning environment at the beginning of their clinical practice. Therefore, the amount of responsibility put on their shoulders and whether this is in line with their capabilities seem crucial. Too much or too early responsibility might be overwhelming for them and hamstring any action or learning, while too little responsibility might withhold important learning opportunities from them. A careful balance has to be found between too much and too little responsibility.

Limitations

As mentioned before, since some of the interviews were taken at the workplace of the interview partners interruptions of the interviews were inevitable. Most interruptions were short phone calls, pager messages, or residents and nursing staff asking questions. These interruptions sometimes caused the interview partners to lose track of what they were saying and it occasionally took them some time to find back into the interview situation. Although the interviewer tried to steer the conversation back to the themes that had been discussed before the interruptions, it is possible that some valuable information might have been lost due to the interruptions.

Another limitation of this study may be considered the low number of female experienced physicians who took part in the interview. While searching for poten-

tial interview partners, it became apparent that there a fewer female than male physicians in chief physician and senior physician positions. This observation is not surprising considering the data from the report of the Statistisches Bundesamt (2015b) covering basic information on German hospitals, which shows that female physicians in leading positions in German hospitals in the specialty of internal medicine count just for about 20% of all the physicians in leading positions. Although more and more women begin to study medicine (Statistisches Bundesamt, 2015a), the leading positions are still primarily occupied by men (Statistisches Bundesamt, 2015b). The number of women interviewed in study one can thus be considered appropriate, since it resembles the numbers found in the whole population.

A common concern, especially when conducting interviews with experts, is sample size and saturation. Naturally, the sample size in interview studies is constrained by economical and logistical reasons. This is also true for the study at hand. The sample consisted of experienced physicians in Bavarian hospitals. One can argue that experienced physicians in other parts of Germany might respond differently to the proposed questions. The sample size still is quite small and therefore the generalizability of the results is limited. Further studies, especially quantitative studies, are needed to deepen the insights gained in the study at hand.

7   Development of the Clinical Vignettes

The following paragraphs are concerned with the development of the clinical vignettes used to research junior doctors' clinical performance in the second study of this thesis. Based on a discussion of the concept, validity, and appropriateness of clinical vignettes in researching clinical performance, the development process of the clinical vignettes is described. The development process follows four steps from the literature-based first draft of the vignettes via expert discussion and evaluation of the vignettes to a pre-test with a junior doctor.

7.1   The Concept and Validity of Vignettes in Clinical Performance Research

Using clinical vignettes to assess physicians' clinical performance has become very popular over the last decades (Veloski, 2005). Clinical vignettes are used to asses if physicians know and follow the official guidelines in treating patients, to compare professional practice in a standardized manner, and also for teaching and assessment purposes in medical education (Dresselhaus, Peabody, Luck, & Bertenthal, 2004; Peabody, 2004; Peabody, Tozija, Muñoz, Nordyke, & Luck, 2004). Carefully constructed clinical vignettes are a time-efficient and valid way of assessing the quality of physicians' performance (Peabody, 2004). Research comparing clinical vignettes with real patient and standardized patient encounters proved that clinical vignettes are suitable to assess clinical performance and are, due to the possibility of standardization, even preferable to real patient encounters or records (Peabody, 2004). Although physicians might tend to give the ideal answer to the problems posed in clinical vignettes—which might not necessarily resemble their day-to-day clinical practice—clinical vignettes are useful in identifying physicians with insufficient knowledge regarding the ideal approach to the case (Norcini, 2004). Peabody (2004) also suggests that clinical vignettes are appropriate to measure the efficiency of clinical care because in his study it was possible to accurately identify unnecessary elements of care provided by the physicians.

Hence, the clinical vignettes developed in this thesis are not designed as a test of knowledge, but rather as a tool to gain insight in the work practices of junior doctors (Veloski, 2005). The clinical vignettes are applied to detect what junior doctors would do when confronted with a real patient similar to the one presented

in the clinical vignette. Since we defined efficient performance as the context-appropriate ability to apply knowledge of established work practices as well as the ability to apply appropriate strategies of using clinical resources to solve the task at hand (Chapter 3.1), the focus of the clinical vignettes is not mainly on the medical challenge but on the necessary knowledge of established work practices and the strategies of using clinical resources in handling the case presented in the clinical vignette. To overcome the well-described shortcomings of clinical vignettes (Hughes, 2002), a four-step approach was taken in developing and reviewing the clinical vignettes.

7.2   A Four-Step Approach in Developing and Reviewing Clinical Vignettes

To measure the junior doctors' clinical performance, an experienced specialist in internal medicine (16 years of clinical experience) and the author of this thesis designed two clinical vignettes following a four-step approach (Figure 6).

Step 1

Initial development

- Literature review
- Definition of the variables
- First draft of two clinical vignettes and coding scheme

Step 2

Expert discussion

- Identification of weaknesses in the case description and addition materials
- Refinement of coding scheme

Step 3

Evaluation

- Check of content, authenticity, comprehensibility, appropriateness, length
- Editing of the two clinical vignettes

Step 4

Pre-test

- Check of comprehensibility, length, appropriateness
- Check of instruments for analysis

Figure 6   Overview of the Four-Step Approach in Developing the Clinical Vignettes

We had the "issues of trustworthiness" as described by Lincoln & Guba (1985) in mind while developing and reviewing the clinical vignettes to ensure their quality. In a first step, after having identified the variables, we developed a literature and experience-based first draft of the vignettes. In the second and third step we tried to ensure the validity of the clinical vignettes by discussing and evaluating them with experienced physicians. In the final step we conducted a pre-test to make sure the vignettes were adequate to the studied group. The following sections explain the four steps in more detail.

7.2.1 Step 1: Initial construction of the clinical vignettes and coding scheme

An experienced internal medicine specialist (16 years of clinical experience) and the author of this thesis developed the first draft of both clinical vignettes. At first, we identified the variables relevant for the clinical vignettes. In order to ensure the authenticity of the vignettes, we decided to incorporate the elements contributing to junior doctors' *area of conflict in clinical practice* identified in Chapter 3 into the vignettes' case descriptions. In the development of the clinical vignettes we followed the recommendations of Peabody (2004, p. 778) and included "realistic temporal constraints", provided "realtime response where necessary", and tried to "reflect clinical complexity" while keeping the questions to the task open-end. We derived the themes of the clinical vignettes from real-life encounters of the experienced physician to guarantee their authenticity (Spalding & Phillips, 2007). Special attention was paid to the length of the clinical vignettes because the vignettes should be as precise and brief as possible, while at the same time avoiding unnecessary information (Hughes, 2002). Considering the target group (i.e. doctors in their first three years of clinical practice) for the clinical vignettes, we decided to use the common medical terminology (Hughes, 1998).

The medical issues presented in the two clinical vignettes are common clinical encounters in the specialty of internal medicine, especially for junior doctors who often have to take care of the everyday ward-work. Within the described cases of the developed vignettes the medical problem is not immediately apparent but needs to be discovered by junior doctors. In both clinical vignettes junior doctors also face some kind of time pressure and need to take responsibility for the further treatment of the patient. Hence, junior doctors are confronted with a

non-routine situation where organizational knowledge and metastrategies in task mastery are necessary alongside medical task mastery.

Clinical vignette 1 ("Frau Kubilei klagt über Bauchschmerzen") is a clinical case about a 65-year-old woman. During ward rounds she suddenly complains about abdominal pain, which is not the primary cause for her stay in the hospital. Junior doctors have to react to this condition, although they are expected to teach students after finishing rounds.

Mrs Kubilei's abdominal pain is a symptom for an acute mesenteric ischemia. Junior doctors need to show efficient clinical performance in order to discover the danger Mrs Kubilei is in and to initiate the necessary treatment to avoid lethal consequences. Acute mesenteric ischemia is a highly relevant issue, as the mortality rate is at 50% to 70%, mostly because the correct diagnosis is found too late or not at all, while the used diagnostic measures are inappropriate and time-consuming (Klar et al., 2014).

Clinical vignette 2 ("Herr Schuster fällt aus dem Bett") is a clinical case about a 79-year-old man with pronounced senile dementia who has fallen out of his bed at the very end of a junior doctor's shift. Shortly after, the patient complains about chest pain and shortness of breath. Junior doctors have to react to this condition, although their shift is already at its end.

Mr Schuster's shortness of breath and chest pain are symptoms for a pulmonary embolism. Pulmonary embolism (PE) is "a major international health problem" (Task Force on Pulmonary Embolism, 2000, p. 1302) because diagnosing PE is often difficult, which puts patients after surgery, injury, and a variety of other medical conditions under serious risk.

Junior doctors need to demonstrate knowledge of established work practices as well as strategies in using clinical resources to solve the tasks at hand. We decided to ask the junior doctors to react to the cases from their point of view in order to gather information on how they would actually solve the problem rather than on how they think it should be done.

Parallel to the development of the clinical vignettes we developed a preliminary coding scheme for the evaluation of participants' performance in the clinical vignettes, thereby following the recommendations of Peabody (2004). The coding scheme themes are organized according to the key elements in clinical practice

identified in Chapter 3: organizational knowledge, task mastery, and role clarity. With this mainly dichotomous coding scheme, which is constructed as a checklist, we aim to assess whether or not the participants mentioned the literature-based predefined criterions of organizational knowledge, task mastery, and role clarity.

7.2.2 Step 2: Expert discussion

The first draft of the clinical vignettes was presented to an experienced specialist in internal medicine (age = 49, 21 years of clinical experience) as well as an experienced surgeon (age = 40, 13 years of clinical experience). The content and possible solutions junior doctors might come up with as well as what both experienced physicians would expect them to do were discussed in in-depth interviews. Each in-depth interview took about one hour and was tape-recorded after having gained informed consent. To ensure a disturbance-free environment, the interviews were conducted at the author's office and at the home of one of the interview partners. Some weaknesses in the case descriptions as well as the additional information (e.g. ECG and laboratory test results) were identified. The identified weaknesses of both cases were corrected and the layout and mode of presentation was finalised. Based on the in-depth discussion with the experienced specialists the preliminary checklist for the clinical vignettes was further refined in concordance with the theoretical conception of the factors contributing to junior doctors' clinical performance outlined in Chapter 3 and the clinical guidelines considering the underlying medical conditions presented in both clinical vignettes. The minimum requirements applicable considering the elements of medical task mastery were critically discussed and integrated in the refinement of the coding scheme. Finally, we decided to weigh the *medical* elements of task mastery double in calculating the task mastery and overall score, as the defined checklist items represent medical essentials every junior doctor ought to know to ensure patient safety.

7.2.3 Step 3: Evaluation of the authenticity of the clinical vignettes

To further elaborate the appropriateness of the developed clinical vignettes, the author asked the experienced physicians interviewed in the first study to evaluate both clinical vignettes. The sample consisted of twelve experienced physicians

(male = 10, female = 2) with a mean age of 47.5 (SD = 8.12). All interview part-
ners had at least eight years of clinical experience (M = 20.25, SD = 8.87). The
sample, method, and procedure of the first study is presented in detail in Chapter
6.

Within the interviews of the first study, the clinical vignettes were presented to
the experienced physicians. When the interview was conducted face-to-face, the
interviewer handed the clinical vignettes and additional information to the partici-
pants on paper, when conducted via telephone, the interview partners received
the information in digital form via E-Mail. The respondents were asked to rate the
authenticity and likelihood of the clinical vignettes and they were invited to give
suggestions for improvements concerning the authenticity, the wording, the addi-
tional materials, and the content of the cases described in the clinical vignettes.

The interviewees agreed that the situations described in the clinical vignettes
are likely scenarios of daily clinical practice. They described the developed situa-
tions in the clinical vignettes as realistic:

> "It's taken from real life. As I've told you already, there are patients whose
> knowledge of the German language is so bad they can't even really tell
> you what's wrong with them." (E7/81)

Although the interview partners were not expected to solve the cases presented,
some of them mentioned different ways of how junior doctors might react and
therefore proved that the vignettes allow different and unique responses.

Asked about possible improvements, interview partners E4 and E2 noticed
some minor spelling mistakes and E2 pointed out that the heading of the second
vignette indicating a shortness of breath was confusing because shortness of
breath was not part of the initial case description but an information junior doctors
would get in the second step of the case. Thereupon, the author corrected the
noticed spelling mistakes and the headline of the second clinical vignette.

E7 mentioned that there had to be some previous information on the patient
(e.g. laboratory results, medication, and general health status), since both pa-
tients were on stationary treatment. He perceived this lack of previous results on
the patients' condition to be a threat to the authenticity of the clinical vignettes.
His suggestion to give more information on previous test results and treatment
was discussed between the authors of the vignettes, and we decided to leave the
amount of information on previous patient data at the necessary minimum be-

cause additional information on previous results would not change the decisions necessary or the treatment indicated. Interview partners E7, E9, and E10 also pointed out that both clinical vignettes were put in the context of a university or teaching hospital by mentioning undergraduate students or students in their practical year. E7 explained that in his hospital no students in their practical year were trained and suggested to replace the inapt terms with *visiting student* or *student in his/her clinical elective*. This was carefully considered by the authors and in order to widen their applicability both vignettes were changed according to E7's suggestion.

7.2.4 Step 4: Pre-Test

In the last step of the development process, a junior doctor with six months of clinical experience was interviewed for the test of the research instruments. The conducted interview took about 60 minutes. In order to discover possible pitfalls in the developed research instruments, the interview was followed by a short discussion on the challenges the respondent faced while answering the questions. Although the conducted interview covered all research instruments used in the second study of this thesis, only the results concerning the clinical vignettes are described this paragraph. The author conducted the interview at her workplace to ensure a calm and disturbance-free environment. After having gained informed consent, the interview was tape-recorded and transcribed verbatim. The clinical vignettes as well as the additional materials were handed to the junior doctor on paper. The interviewee was asked to articulate his thoughts and strategies and the additional material was given to him as soon as he asked for it or reached a point where without additional information he could not progress further in the case. It took the junior doctor about 20 minutes to solve both clinical vignettes to his satisfaction.

The respondent perceived no difficulties in understanding the presented clinical vignettes. As he was invited to articulate his thoughts while trying to solve the problems posed in the clinical vignettes, it was possible to gain information on his knowledge of established work practices and strategies of using clinical resources. The additional materials presented seemed adequate and helpful to further develop an understanding of his actions. In the discussion of the clinical vignettes following the interview, the junior doctor confirmed that he had no diffi-

culties in understanding the vignettes and also implied that it might be interesting to make the vignettes a little bit more challenging.

The team which had developed the clinical vignettes discussed the suggestion to increase the difficulty of the vignettes but decided to keep the complexity of the clinical vignettes unchanged, as we wanted to avoid creating an exceptional case which is only rarely found in clinical daily routine and would hence reduce the authenticity of the vignettes. The final versions of the clinical vignettes together with the corresponding checklists are presented in Appendix 3. A detailed description of the application of the coding scheme and the calculation of the performance scores for both vignettes is presented in Chapter 8.1.4.

8   Junior Doctors' Learning and Clinical Performance

The aim of the second study was to gather information directly from the junior doctors about how they perceive their own learning environment and how they handle demanding clinical tasks. Based on the results of the first study, we asked junior doctors about their social relations in the workplace, their working conditions, and confronted them with two clinical vignettes to solve. Consequently, the second study addresses the research questions related to Aim 3 *(Exploring the factors affecting junior doctors' learning in clinical practice.)* and Aim 4 *(Understanding junior doctors' clinical performance considering their social relations, personal knowledge factors, and perceived working conditions.)*.

8.1   Method

In the second study we interviewed 23 junior doctors at the beginning of their clinical career in the specialty of internal medicine in different Southern German hospitals. The interviews took place between winter 2014 and summer 2015. The focus of the study was on junior doctors' social relations, their perceived working conditions, and their handling of demanding clinical situations. As the findings from the reviewed literature (Chapter 4.3) and the results from the first study (Chapter 6) indicate the importance of personal characteristics and structural patterns in junior doctors' learning and performance, we analysed differences in the received answers considering the respondents' gender, familial background, location of study, and completed clinical rotations as well as the level of care provided at their workplace. The statistical methods used for analysing the differences are described in detail in Chapter 8.1.1. In order to address the aims and research questions described in Chapter 5.1, the design of the second study was divided into three research steps with three different research methods.

(1) The social relations contributing to junior doctors achieving efficient clinical performance were measured using egocentric networks. By analysing the found egocentric networks, RQ 3.1 and RQ 3.2 are addressed.

(2) The perceived working conditions were assessed with a questionnaire. The results of the questionnaire are used to answer RQ 3.3 and RQ 3.4., whereas RQ 3.5 is addressed by combining the results from the egocentric networks and the questionnaire on perceived working conditions.

(3) In order to gather information on how junior doctors handle demanding clinical situations, we asked the respondents to solve two clinical vignettes. The results of the clinical vignettes are used to answer RQ 4.1 and RQ 4.2. The results of the egocentric networks, the questionnaire, and the clinical vignettes are combined to address RQ 4.3.

8.1.1 Sample

The sample consists of 23 junior doctors, nine male and 14 female, at the beginning of their internal medicine specialty training (average clinical experience = 16.22 months, SD = 9.95) and working in hospitals in Southern Germany. An overview of the participants' personal characteristics is presented in Table 6. All interview partners were assigned an ID with a number that indicates the order in which the interviews were conducted (e.g. JD4 was the fourth junior doctor (JD) interviewed). Searching for study participants, several search strategies were used. The experienced physicians interviewed in the first study were asked to support the second study and all of them agreed to facilitate the contact between the author and junior doctors working in their hospital. With the support of the experienced physicians JD1, JD2, JD3, and JD7 were recruited as interview partners for the second study. In a next step the author reached out to well-established experienced physicians in different hospitals across Germany and asked for their support in facilitating the contact to junior doctors at the beginning of their training. Furthermore, the homepages of German hospitals with internal medicine specialty training programmes were searched for contact information on the residents working there. As information about junior doctors' years of clinical experience is mostly unavailable from the hospitals' homepages, all found residents were contacted via email and invited to participate in the study. In the invitational email the study purpose was explained and the requirements for participation (maximum of two years of clinical practice) were stated. A reminder was sent out two weeks after the first study invitation. Due to the applied strategies in participant recruitment, no definite number of invites or final response rate can be given.

Table 6   Overview of Junior Doctors' Demographical Information

ID	Gender	Age	Location of study	Final grade	Experience in months	Level of care[a]
JD1[*]	f	28	Hungary	1	36	1
JD2[*]	m	31	Czech Republic	3	20	1
JD3	f	26	Germany	1	5	1
JD4	f	26	Austria	1	16	3
JD5[*]	m	29	Hungary/Germany	2	17	3
JD6	m	28	Italy	1	20	3
JD7[*]	f	37	Germany	2	18	2
JD8	m	26	Germany	2	2	3
JD9	f	26	Germany	1	10	3
JD10	f	31	Czech Republic	2	36	2
JD11	m	28	Egypt	2	22	1
JD12	m	27	Czech Republic	3	21	2
JD13	f	28	Czech Republic	1	21	2
JD14	m	29	Germany	2	25	3
JD15[*]	m	33	Germany	2	18	3
JD16[*]	f	27	Germany	1	6	2
JD17	m	28	Germany	1	11	3
JD18	f	27	Germany	2	3	3
JD19	f	26	Germany	1	5	3
JD20	f	27	Germany	2	13	3
JD21	f	26	Germany	2	2	3
JD22[*]	m	33	Germany	3	31	3
JD23	f	30	Germany	2	18	1
M		28.57		1.74	16.22	
SD		2.83		0.79	9.95	

Notes: [a]basic care = 1, medium care = 2, maximum care = 3. *participants mentioned previous studies or vocational training before starting their medical education.

Gender and family background

The distribution of male and female participants in the sample, with slightly more female respondents, is in concordance with the increasing number of female physicians (Statistisches Bundesamt, 2015a, 2015b). Concerning the family background, 13 respondents talked about close family members also working in the medical domain, for example as physicians, nurses, or pharmacists. As explained in Chapter 4.3, gender and familial background might influence the for-

mation of social networks as well as the perception of working conditions, therefore both factors were used to analyse differences in the found results.

Location of study and final grade

The countries in which the respondents undertook their studies varied: 65.2% had completed their studies in Germany, whereas seven respondents had finished their studies in other European countries, with the majority having studied in the Czech Republic (n = 4). JD11 had studied medicine in Egypt. JD 21 was the only respondent who had studied medicine in a model curriculum, all other respondents completed their medical education following a regular curriculum. As explained in Chapter 2, the systems of undergraduate medical education as well as the final exams differ from country to country. In Germany the results of the state exam are combined to one final grade, whereas in the Czech Republic the students receive single final grades in different specialties. In order to allow a comparison of the achieved results at the end of the studies, the respondents who had not taken their final exams in Germany were asked to sum up their single final results and state a mean value, representing their final grade. The results on location of study and received final grade are also presented in Table 6. As explained in Chapter 4.3, the cultural background might influence the formation of social networks as well the perception of working conditions, considering that respective attitudes, norms, and behaviour patterns are already internalized in undergraduate medical education (Jarvis-Selinger et al., 2012). Therefore, to check for possible cultural differences the found results were analysed in regard of the respondents' location of study.

Age, clinical experience, and completed rotations

The mean age of the respondents was 28.57 years (SD = 2.83). Some of the older participants reported previous studies or vocational training before the beginning of their medical education. Older respondents also showed significantly more clinical experience than their younger colleagues (r = .503, p = .014). To complete their medical specialty training and accomplish all of the mandatory examinations and procedures specified in their journals, junior physicians rotate through several wards and departments. Different hospitals apply different rotational systems. In university hospitals, for example, rotations often are connected to the academic calendar and changes of rotations take place every change of

term. In the presented sample, $n = 6$ participants had not yet changed their ward, $n = 12$ respondents counted between one and three changes of work environment, and $n = 5$ junior doctors mentioned four or more changes. Some of the junior doctors who had changed their ward four or more times indicated that they constantly change wards. As explained in Chapter 4.3, the number of rotations might influence the formation of social networks as well as the perception of working conditions and the clinical performance. Therefore, the number of completed rotations was included in the analyses regarding differences in the found results.

Level of care

German hospitals can be categorized according to the level of care they provide to the society (Bayerisches Staatsministerium für Gesundheit und Pflege, 2015). Basic care level hospitals are rather small and provide primary health care. Medium care level hospitals fulfil the need of diagnostics and therapy above local level. Maximum care level hospitals, such as university hospitals, provide a differentiated medical service with corresponding medical and technical equipment. Junior doctors who work in a basic care hospital are less likely to encounter patients with highly complex and rare diseases than junior doctors who work at a medium or maximum care setting. In our sample, five respondents work in a hospital of basic care level, five in a hospital of medium care, and 13 in a hospital of maximum care. As our results of the first study (Chapter 6.3) indicated that the level of care might influence junior doctors' learning opportunities as well as the formation of social networks and the perception of working conditions, this factor was used to analyse differences in the found results.

8.1.2 Instruments

The whole interview followed a semi-structured interview guide. Within the interview three instruments were used: (1) an interview on demographic information and the social network connections, (2) a survey on perceived working conditions, and (3) two clinical vignettes to assess clinical performance.

(1) Interview on demographic information and social network connections

Prior to the questions on the participants' social network connections, some questions about demographics (age, family background, previous formal education) and previous studies (structure and duration of medical education, grade in final exam, location of medical education) were asked. Next, the concept and procedure of the social network assessment was explained and the following question was used as a name generator: *"With whom are you talking about work related subjects in your daily clinical practice?"*. The participants were asked to write down the names of relevant contacts (alters) as well as their contacts' profession, their amount of clinical experience, and their hierarchical status on small sheets of paper, one name with corresponding information per paper. As most of the interviews were undertaken via Skype or telephone, a PowerPoint presentation was prepared, allowing the participants to enter the same information in a digital form. In order to gain a thorough picture of their egocentric networks, the respondents were not restricted in the number of names they were allowed to mention. Additionally, using a *free choice* approach in gathering social network data and allowing respondents to name as many alters as they like has proven to be more reliable (Marsden, 1990; Wasserman & Faust, 2007). When the participants had not mentioned the nursing staff as alters, they were explicitly asked for their reasons, which often led them to add the nursing staff as contacts to their networks. In a next step, all mentioned social contacts and their connections to the junior doctor as well as to each other were visualized on paper (Hogan, Carrasco, & Wellman, 2007) or respectively in the PowerPoint presentation. Junior doctors were asked to indicate how intense the relationship presents itself by varying the thickness of the lines between the contacts. By using a visual aid in conducting the social networks, a reduction of the cognitive load for the participants is achieved. This allows to research egocentric networks with more than the commonly assessed five alters, without tiring the participants (Hogan et al., 2007). In addition, the visualization of the network enables the researcher and the interview partner to talk about the emerging network patterns and the respondents tend to give more information about the particulars of the alters as well as their relations (Hogan et al., 2007). To gain further insight in the interaction content between the junior doctors and their alters, the participants were asked to indicate their advisors, educators, and emotional supporters, allowing us to measure the strength and multiplicity of the relationships.

Nevertheless, the egocentric networks generated with the described method are an excerpt from reality as perceived by the interview partner. In very big egocentric networks with many alters, the process of gathering the network attributive and relational information is a very time-consuming process and the probability of missing information due to natural limits of participants' attention span has to be considered (Jansen, 2006). Additionally, the description of the alter-alter relationships is based on egos' estimation of these relationships and might be biased. However, research indicates that egos are rather good in estimating relationships between alters they themselves are very close to, whereas the information on relationships between alters more distant to egos tend to suffer from a stronger bias (Marsden, 1990). Furthermore, respondents' reports on observable attributes of their alters seem quite accurate, but information quality gets rather poor when alters' attitudes are researched (Marsden, 1990). In the study at hand only observable attributes of the alters were in the focus.

(2) Survey on perceived working conditions

To gather information on junior doctors' working conditions, four self-constructed questions on allocation and structure of work and six scales with 15 items from the short version of the *instrument for the stress-related job analysis for hospital physicians* (Keller et al., 2013) were used: time pressure (2 items), uncertainty on work contents (2 items), social stressors (2 items), conditions for on-the-job training (5 items), participation (2 items), and equity (2 items). The questionnaire was either handed to the participants on paper (in face-to-face situations) or sent to them in digital form (in case of a telephone or Skype interview). The chosen scales and corresponding items in the questionnaire relate to the patterns of working conditions which might influence junior doctors' clinical learning and performance described in the theoretical framework (Chapter 4.5).

Prior to the beginning of the second study, the instruments were tested by interviewing a junior doctor in his first year of medical training. In the discussion that followed the test interview the participant remarked no difficulties in understanding the instructions as well as questions in the survey and in the clinical vignettes.

 (3) Clinical vignettes

The two previously constructed clinical vignettes were used to gain information on junior doctors' ability to handle demanding clinical tasks, their organizational knowledge, their strategies in using clinical resources as well as established work practices and their role conception (a detailed description of the development of the vignettes is presented in Chapter 7).

> *Clinical vignette 1 ("Frau Kubilei klagt über Bauchschmerzen")* is a clinical case about a 65-year-old woman. During ward rounds she suddenly complains about abdominal pain which is not the primary cause for her stay in the hospital. Junior doctors have to react to this condition, although they are expected to teach students after finishing rounds.

> *Clinical vignette 2 ("Herr Schuster fällt aus dem Bett")* is a clinical case about a 79-year-old man with pronounced senile dementia who has fallen out of his bed at the very end of a junior doctor's shift. Shortly after, the patient complains about chest pain and shortness of breath. Junior doctors have to react to this condition, although their shift is already at its end.

The clinical vignettes and additional materials were presented to all participants in the same order. If the respondents did not mention the temporal constraints in the vignettes or the time of contact with their supervisors, the interviewer further questioned these topics. The interviewer also invited the respondents to share their current working hypothesis if they did not state their hypothesis on their own. The enquiries about temporal constraints, time of contacting a supervisor, and hypothesis were applied to encourage the thinking-out-loud process and avoid missing valuable information. In interviews which took place in person the clinical vignettes were presented on paper, in interviews via telephone or Skype the vignettes were presented in digital form.

The interview guide with the questions on the social network as well as the questionnaire on the perceived working conditions are presented in Appendix 4, the clinical vignettes are shown in Appendix 3.

8.1.3 Procedure

The second study was carried out in 2014 and 2015 in Southern German hospitals with internal medicine residency training programmes. Interviews took between 31 and 90 minutes (M = 51.65; SD = 15.71). At first, the 23 participants were asked about their demographic background and their social networks, then they worked with the clinical vignettes, and finally they completed the questionnaire on perceived working conditions. This order of data gathering instruments was used in consideration of the rather high level of concentration needed for the network visualisation. After having gained informed consent, each interview was tape-recorded. The interviews which took place in person (n = 5) were conducted either at the workplace of the junior doctor or the workplace of the author. The majority of the interviews (n = 18) were conducted via telephone or Skype. The interviewer tried to establish a trustful and disturbance-free environment. Despite all the best efforts, calls, nurses or colleagues demanding the attention of the interview partner interrupted some interviews, especially the ones taken at the workplace of the junior doctors. In those cases, the interview and recording were paused and continued after the interruption had been cleared.

8.1.4 Analysis

To prepare the received answers for the analysis, all interviews were transcribed verbatim. The data gathered in the questionnaire as well as the attributive information about the network contacts were transcribed in a spreadsheet. The gathered visual representations and additional information about junior doctors' social networks were transferred in matrices in preparation of the further analysis.

(1) Egocentric networks

Due to the used data gathering method we received weighted symmetric networks. The thickness of the lines between the actors in each network visualisation as well as the related comments during the interviews were used as an indicator for tie strength, with "4" representing very intense interaction and "1" representing rather sporadic interaction between the actors. The following paragraphs describe the structural and relational characteristics calculated for the found egocentric networks in relation to RQ 3.1 *(How can junior doctors' egocentric networks be described in regard of their structural and relational properties?).*

Structural characteristics

Network range, density, and centrality were calculated as basic structural charac-
teristics. The network range represents the number of mentioned alters. Higher
numbers of alters are commonly associated with more access to valuable infor-
mation and resources, but at the same time, depending on the intensity of the
relationship, it might be demanding to maintain this high number of contacts
(Jansen, 2006). Thus, information about solely the range of the network is insuffi-
cient to draw conclusions about the quality or the purpose of the relationships.

Network density is calculated by comparing the number of possible relation-
ships to the number of observed relationships (Wasserman & Faust, 2007). It
gives information about the overall connectedness of the actors in the network. In
calculating the network density, the ego-alter relationships were neglected as
these relationships evolve as an artefact of the measurement instrument (Jansen,
2006). Network density for dichotomised networks, which were used in the analy-
sis at hand, ranges between 0 and 1 with the latter representing a network in
which every possible link is realized. In general, big networks with many actors
tend to show lower density than smaller networks, because in smaller networks it
is just more likely that all mentioned contacts know each other. The bigger the
networks become, the more unlikely it is that all contacts share mutual relation-
ships. Research indicates that dense networks with strong ties are especially
useful in sharing tacit and complex information, but at the same time enhance
group thinking and might be hindering innovations (Hansen, 1999, 2002). Net-
works with low density and rather weak ties seem to have advantages if new in-
formation should be acquired or career opportunities are sought out (Brass et al.,
2004; Perry-Smith & Shalley, 2003).

Network centrality is concerned with the way resources (e.g. money, goods,
emotional support, or information) are distributed and controlled within social
networks (Borgatti, 2005). Freeman (1979) describes different measurements for
network centrality which are all based on the definition of a star-shaped network
graph as the most centralized form of a social network. In a star-shaped network
graph all network ties centre on one network actor. The commonly used *degree
centrality* is not applicable for the data at hand as it is calculated through the in-
coming and outgoing network ties of the actors, among which was not distin-
guished in our study. *Closeness centrality* also is an inappropriate measure for
the conducted egocentric networks, because within the applied method of data
gathering the distance from ego to all alters is predefined as an artefact caused

by the measuring instrument (Marsden, 2002). Hence, in the analyses of the received egocentric networks we decided to apply the concept of *betweenness centrality,* because for undirected egocentric networks, like the ones gathered in this study, *betweenness centrality* gives meaningful information about ego's position in the network (Everett & Borgatti, 2005). Betweenness centrality indicates to what extent ego's position in the network is on the shortest path between two other actors within the network, which leads the focus on the structural dependency of ego's neighbours from ego (Mutschke, 2010). The *normalized betweenness centrality* for every ego (C_{nB}) as well as every network was calculated. The calculation of the *normalized* betweenness measure considers the range of ego's network and compares the actual betweenness of ego to the *maximum possible betweenness* in ego's network (Jansen, 2006). Both values range from 0 to 1, with 0 indicating that there is no single central person in the network and 1 representing a star-shaped network visualization. Having a high betweenness centrality is associated with distinct control over the flow of information within the network (Freeman, 1979). Taking this central person out of a network may lead to severe communicational difficulties. Some parts of the network might lose contact to others completely because the central person was the only one linking those network parts. Current research on interprofessional interaction of nurses and physicians reveals that junior doctors might hold a broker position in the web of social relations in hospital settings and hence link otherwise unconnected professional groups (Tasselli, 2015).

To further describe the egocentric networks, the amount of cliques within each network was calculated. Cliques describe subgroups in social networks consisting of a minimum of three interconnected actors (Wasserman & Faust, 2007). In social networks cliques commonly form around personal characteristics like age, gender, religion, or level of education. In the egocentric networks of the respondents we expect cliques to represent, for example, professional groups, specialties, ward teams, and hierarchical structures. However, there are different definitions for and possibilities of calculating cliques in social networks (Täube, 2010). Cliques in social networks represent areas of high local density, as they originate from the maximum number of actors who have realized all possible (direct or indirect) ties between each other. Although there are strategies in analysing cliques that put less emphasis on direct contact between all the clique members, for the study at hand the narrow definition of a maximal complete sub-graph is applied. Using this definition implies that in the calculation of the cliques all

actors have to be directly connected to be counted as members of the same clique (Täube, 2010). This strategy in analysing cliques corresponds best with the focus of the study, which is on understanding the closely-knit social contacts junior physicians are integrated in within the workplace. For the interpretation of the found cliques we referred to the conducted attributional information about the junior doctors' contacts.

Relational characteristics

The results of the first study indicated that the content of the relationship between junior doctors and their contacts might relate to the contacts' clinical function and profession. Hence, in the second study, the relational characteristics of the respondents' egocentric networks were analysed by considering the content of interaction and its potential relations to the alters' profession and clinical function. Using the gathered information on different functions of ego-alter interactions, the multiplicity of the ego-alter relationships is calculated (Jansen, 2006). In this thesis, relationships serving more than one purpose are counted as multiplex. Intense relationships associated with multiple functions are called strong ties (Jansen, 2006). Strong ties have been proven to be beneficial in acquiring tacit knowledge because implicit knowledge can be more easily transferred through strong ties (Hansen, 2002; Lehtinen et al., 2004). Naturally, to maintain strong ties, a higher investment of time and resources is needed, which puts a limit to the number of strong ties an individual may be able to maintain in a network. Weak ties, on the other hand, have been related to a bigger capacity for innovation and the possibility to acquire new information (Gruber et al., 2008; Hansen, 1999; Perry-Smith & Shalley, 2003). However, there are intense discussions about the definition of weak and strong ties as well as the corresponding benefits, constraints, and implications (Avenarius, 2010; Krackhardt, 1992; Stegbauer, 2010). The percentage of multiplex contacts for every respondent's network was calculated and used in the further analysis.

The diversity of the alters was calculated using the *index of qualitative variation* (*IQV*) (Agresti & Agresti, 1978). This index can take on values from 0 to 1, with 0 representing zero diversity and 1 indicating that the observations are evenly spread across all potential categories. Having a wide-spreading and diverse network might be beneficial in gaining access to resources (Gruber et al., 2008) as well as providing more possibilities to handle demanding daily tasks

(Hirschmann, 2014). The *IQV* was calculated for gender, profession, and workplace. To determine the ego-alter homogeneity, the *E-I index* was calculated (Krackhardt & Stern, 1988). Research has shown that people tend to connect with others who are similar to themselves (McPherson et al., 2001), which might lead to restrictions in resources accessible for them. These restrictions in access to valuable resources due to homophile tendencies in network formation have shown to be especially challenging for females and lower status groups (Ajrouch et al., 2005; Brass et al., 2004). The E-I index was calculated for gender, profession, hierarchical status, and workplace. It can take on values from -1 to 1, with -1 indicating that only ties to similar contacts are realized and 1 representing ties solely to dissimilar contacts. An E-I-Index of 0 indicates an equal amount of ties to similar and dissimilar contacts (Krackhardt & Stern, 1988).

In order to answer RQ 3.2 *(How do junior doctors' egocentric networks differ in regard of the junior doctors' personal characteristics (gender, family background, location of study, clinical experience, and the workplace's level of care)?)* the differences in the egocentric networks were analysed in regard of personal knowledge factors. Differences due to demographical factors like gender of ego, location of study, or level of care were analysed using the Kruskal-Wallis test and the Mann-Whitney U test. Correlations were analysed with Pearson's coefficient unless explicitly mentioned otherwise.

(2) Questionnaire on working conditions

In order to answer RQ 3.3 *(How do junior doctors perceive their working conditions regarding allocation and structure of work, time pressure, uncertainty of work contents, social stressors, conditions for professional development, participation, and equity?)*, a descriptive analysis of the received answers from the questionnaire was carried out. The average values for each of the used scales from the short version of the "instrument for the stress-related job analysis for hospital physicians" (time pressure, uncertainty on contents of work, social stressors, conditions for on-the-job training, participation, equity) (Keller et al., 2013) were calculated for every respondent and used for the further analysis.

To answer RQ 3.4 *(How does junior doctors' perception of their working conditions differ in regard of the junior doctors' personal characteristics (gender, family background, location of study, clinical experience, and the workplace's level of care)?)*, the differences in the answers due to gender, level of care, location of

study, and previous experiences at the workplace were calculated, using Kruskal-Wallis and Mann-Whitney U tests, because both tests are to be considered robust in handling non-normally distributed data and differences in sample sizes.

In order to answer RQ 3.5 *(How are the structural and relational characteristics of junior doctors' egocentric networks related to the factors of their perceived working conditions?)*, the correlations for measures of working conditions and measures of the egocentric networks were calculated using *Kendall's Tau*. Kendall's Tau seems to be the best choice for the data at hand as the results from the questionnaire do not follow a normal distribution (Kolmogorow-Smirnow) and show noticeable rank ties.

(3) Clinical vignettes

To answer RQ 4.1 *(How can junior doctors' clinical performance be described in regard of organizational knowledge, task mastery, and role clarity?)*, the received reactions to the clinical vignettes were coded using the coding scheme described in Chapter 7.2. To prepare the received answers for further analysis, scores for *organizational knowledge (OK)*, *task mastery (TM)*, and the *overall performance (PERF)* were calculated, resulting in percentage values resembling the concordance of the participants' expressed intentions with the predefined criteria. Within the theme *task mastery* we distinguished between *task mastery medical (TM^{MED})* and *task mastery metastrategies (TM^{META})*, with *TM^{MED}* double-weighted in the *task mastery* and *overall performance* score. The decision to assign *TM^{MED}* with double-weight was based on the reviewed literature and the discussions with the experienced physicians, who agreed that the medical components rated for both clinical vignettes were essential clinical actions every junior doctor should be able to perform in order to assure patient safety. Hence, this orientation on patient safety should be reflected in the calculated scores by the assigned double-weight.

For the *organizational knowledge score* the following components were defined: knowledge of guidelines (MRSA/falling out of bed), workflow (dealing with communicationally difficult patients), interprofessional collaboration (with nurses, specialists), contacting a senior physician (time and content of involvement), and contacting peers. For the *task mastery medical score* we defined taking the patient's history, performing a clinical examination, mentioning the relevant hypothesis, and ordering the appropriate tests as critical elements. For the *task*

mastery metastrategies score we defined the following criteria: organizing work to meet conflicting duties, setting priorities, delegating tasks, and asking colleagues for support. Due to the fact that the information gathered with the clinical vignettes on the theme for role clarity was rather scarce, this theme was excluded from the calculation of the overall score but elaborated by qualitative description.

In order to address RQ 4.2 *(How does junior doctors' clinical performance differ in regard of the junior doctors' personal characteristics (gender, family background, location of study, clinical experience, and the workplace's level of care)?)*, differences in the respondents' clinical performance measures due to their personal characteristics were analysed, using Kruskal-Wallis and Mann-Whitney U tests. The relationship between clinical performance scores, the calculated social network measures, and the measures of the perceived working conditions were analysed using Pearson's coefficient and Kendall's Tau, thereby addressing RQ 4.3 *(How can the relationship between junior doctors' social networks, personal knowledge factors, perceived working conditions, and clinical performance be described?)*.

8.2   Results

8.2.1 Junior doctors' social relations in the workplace

The results in the following section are presented to answer RQ 3.1 and RQ 3.2 related to Aim 3 *(Exploring the factors affecting junior doctors' learning in clinical practice.)*. Therefore, results regarding the egocentric networks are presented in the order described in Chapter 8.1.2. The research questions are addressed throughout the presentation of the results and summarized and discussed in Chapter 8.3.

(1) Describing junior doctors' social relations in their workplace

Structural characteristics

Network range. When asked about their social contacts, the respondents named between four and 17 contacts (M = 9.04; SD = 3.66). However, 13.00% of the networks only include four to five alters, 39.2% of the junior doctors named six to eight alters, and 30.4% named between nine and twelve alters. The maximum

number of contacts ($n = 17$) was named by JD13. An overview of the ego networks' structural characteristics is given in Table 7.

Table 7 Structural Network Measures in Junior Doctors' Ego Networks

ID	Network range	Named groups	Network density [D]	Normalized betweenness centrality		Cliques
				C_{nB}	Network centralisation index	
JD1	7	2	.83	.02	.01	2
JD2	5	1	.50	.43	.42	2
JD3	10	5	.42	.37	.35	4
JD4	11	3	.40	.37	.35	6
JD5	6	0	.53	.27	.23	3
JD6	7	0	.43	.38	.35	6
JD7	15	7	.16	.78	.78	4
JD8	6	0	.60	.35	.34	2
JD9	4	3	.50	.25	.25	1
JD10	8	0	.39	.29	.25	5
JD11	11	3	.13	.85	.84	2
JD12	6	4	.53	.21	.17	4
JD13	17	0	.60	.13	.12	6
JD14	6	0	.47	.40	.38	3
JD15	6	3	.67	.12	.09	5
JD16	5	1	1.0	0	0	1
JD17	9	4	.44	.36	.33	4
JD18	9	0	.94	.01	0	2
JD19	8	3	.32	.54	.52	4
JD20	11	4	.57	.21	.19	4
JD21	12	8	.56	.09	.07	8
JD22	14	2	.25	.57	.55	11
JD23	15	4	.39	.45	.44	7
M	9.04	2.48	.51	.32	.31	4.17
SD	3.66	2.29	.21	.21	.23	2.41

Notably, the participants not only named individual persons as alters, but also functional groups, in which the clinical function is more relevant than the person as an individual. For example, nurses or doctors working in a different specialty were often named as a group. In case of nursing staff, JD7 explained:

> "Well, this is not personalized; there are the assigned nurses who are responsible for this area. It's a different one every day, but they're still the responsible nurses for this area." (JD7/35)

A similar phenomenon applies for doctors on duty or doctors of other specialties. Junior doctors have no choice, who, for example, the surgical doctor on duty is. If needed, they have to call whoever is on duty, irrespective of individual preferences. Overall, 208 alters were mentioned: 58 females, 93 males, and 57 groups. Initially, 14 respondents did not mention nurses in their egocentric network. When asked about their contact to the nursing staff, five of these 14 reported that they did not need them as interaction partners since they themselves had previous nursing experience or had doubts about their competence. The remaining nine respondents added the nursing staff, mostly as a group, to their network.

Network density. The network density provides information about the connectedness of alters. A network density of 1 implies that all possible connections between the alters in the network are realized. The results on network density range from D_{min} = .127 to D_{max} = 1. In general, the found egocentric networks seem rather dense (M = .51, SD = .21).

Centrality. The ego betweenness centrality provides information about the position of the ego in the network. The normalized ego betweenness centrality takes on values from 0 to 1, with 0 indicating that no single actor is more central than another and 1 representing a star shaped network graph. The normalized ego betweenness centrality for the respondents shows a wide range from C_{nB} = 0 for JD16 to C_{nB} = .845 for JD11 (M = .32, SD = .21). Whereas JD11 seems to have a rather central position in his network (Figure 7), the information flow in the network of JD16 would not suffer too much if the ego, i.e. JD16, was not included in the network. The network betweenness centrality index supports the results for the normalized ego betweenness centrality measures.
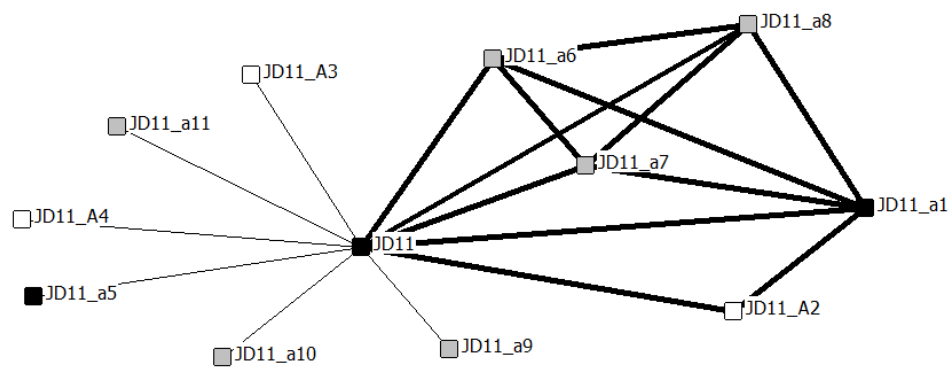
Note: Different colours represent different genders of network contacts (grey = female, black = male, white = groups). Thickness of the links represents intensity of contact. Capital "A" in actor-ID signifies a functional group.

Figure 7   Visualization of High Density and Low Centrality in Egocentric Network of JD11

A significant correlation can be found between density and normalized betweenness centrality on ego level (r = -.910, p < .001) and network level (r = -.894, p < .001), supporting the fact that networks with high density most likely have lower centrality because all contacts are connected to each other. In these cases, the flow of information is not set on one single person. In networks with lower density and high normalized ego betweeness centrality the junior doctors seem to have a bridging function between nurses as well as senior and chief physicians.

  "What we discuss with them [i.e. the nursing staff] about the patients is most often communicated by us [i.e. the physicians] to the senior and chief physicians. Communication very rarely works directly from the nurses to the senior physicians." (JD3/66)

Cliques. Cliques describe subgroups in social networks consisting of a minimum of three interconnected actors. In analysing cliques, regions of maximum density within the network can be identified and described. In the respondents' networks the number of identified cliques ranges from one to 11 (*M* = 4.17, *SD* = 2.41). A significant correlation between network range and the number of cliques can be found (*r* = .639, *p* = .001), indicating that in bigger networks more cliques are formed. Taking a closer look at the emerging cliques, it becomes apparent that they seem to relate to the medical specialty and clinical experience of the alters. Moreover, cliques representing the "everyday team", such as ward teams, can be found in the calculated cliques. A visual example for the different functions found within the cliques in junior doctors' egocentric networks is given in Figure 8, which presents the cliques in the egocentric network of JD3.
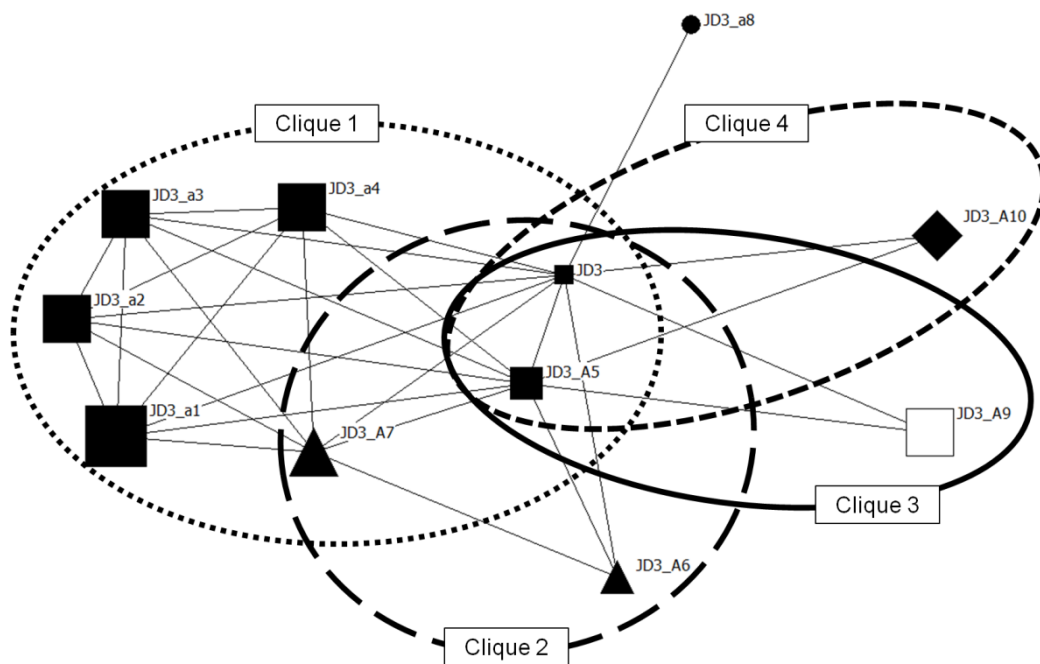
Note: Different colours represent different professions (black = physicians, white = nurses). Different shapes represent different workplaces (circle = different hospital, square = same department as JD, triangle = same specialty but different department, diamond = same hospital but different specialty). The bigger the nodes, the more clinical experience. Capital "A" in actor-ID signifies a functional group.

Figure 8   Cliques in Egocentric Network of JD3

Clique 1 mainly includes contacts from the same specialty with a considerable amount of clinical experience. In Clique 2 the residents from JD3's own and the adjacent internal medicine department as well as the senior physicians from the

adjacent internal medicine department are included. The "everyday team" of JD3, including the nursing staff and fellow residents, is represented in Clique 3. Clique 4 includes the group of consultants from diverse specialties (JD3_A10) as well as JD3's fellow residents (JD3_A5), because JD3 as well as her peers consult with specialist when necessary for the patients' treatment. The contact JD3_a8 is a friend JD3 completed her studies with and who works at a different hospital, which explains the missing relations of JD3_a8 to any of the found cliques.

Relational characteristics

Content of interaction. Referring to the previously described literature review and the results from the first study, different contents of interaction were measured in the junior doctors' social networks. The respondents were asked to indicate to whom they go for advice, who explicitly acts as teacher for them, and who provides emotional support. All respondents named alters for each category. In relation to all mentioned contacts ($N = 208$), 71.6% of the interactions concerned advice, 36.5% were related to explicit teaching and 45.7% to emotional support (Table 8). The majority of advice (88.9%) and teaching (92.1%) was given by the named physicians or groups of physicians in the respondents' networks. The named physicians are also the main source of emotional support with 74.7% (nurses = 21.1%, other health professions/organizational staff = 4.3%).

Table 8   Overview of the Content of Ego-Alter Interaction

Content of ego-alter interaction (N = 208)	Frequency	Percent[a]
Advice	149	71.6
Teaching	76	36.5
Emotional support	95	45.7

Note: [a]Due to the multiplicity of the relations, the results do not aggregate to 100%, reference parameter is the total number of studied ego-alter relationships.

Taking a closer look at the relationship between professional status and content of interaction, the analysis confirms a medium correlation between professional status and advice (*Cramer-V* = .44*, p* < .001), teaching (*Cramer-V* = .55*, p* < .001) as well as emotional support (*Cramer-V* = .42*, p* < .001). These results indicate that different status groups are relevant for different interaction contents. Table 9 presents the relation between professional status of the alter and the content of ego-alter interaction. Whereas senior physicians are mainly contacted for advice

(87.3%) and teaching (72.3%), the latter is less relevant in peer to peer relation-ships (15.7%). Fellow residents are asked for advice (65.7%) and also seem very important for emotional support (64.3%).

Table 9   Content of Interaction in Relation to Status of the Interaction Partner

| | | Content of ego-alter interaction | | | | | |
| | | Advice | | Teaching | | Emotional support | |
Hierarchical status	n	f	%	f	%	f	%
Residents	70	46	65.7	11	15.7	45	64.3
Colleague with specialty degree	22	20	90.9	10	45.5	6	27.3
Doctors on duty	7	7	100	0	0	0	0
Senior physician	55	48	87.3	40	72.7	15	27.3
Chief physician	11	9	81.8	8	72.7	4	36.4
Nursing staff	32	17	53.1	5	15.6	20	62.5
Organizational staff	7	0	0	1	14.3	3	42.9
Family and friends	3	2	66.7	1	33.3	3	100
Σ	207	149	80.0	76	36.7	96	46.4

Note: Psychologist due to single mentioning not included.

Other residents seem to be the first point of contact in respondents' everyday clinical work. Contact with their peers most often is very intense and character-ized by mutual support on practical as well as emotional level. Especially at resi-dent level, the boundaries between working relationships and friendships are floating as JD5 explained: "One has to know that I am also friends with most of them" (JD5/76). Moreover, the complexity of the task at hand and the availability of an interaction partner influence the decision about who to ask for advice:

"Well, if I don't know what to think about an ECG, for example, then I first ask my colleagues. If it's something I haven't seen before. If it's some-thing they also haven't seen before, I show it to my senior physician and if nobody knows what to do, we go to our chief physician. It's a step-by-step process. If I have a super complex question or if I know that the others also don't know it, then I take it directly to the senior physician." (JD3/70)

Doctors on duty are contacted for advice, which relates to the previously mentioned fact that doctors on duty are mostly named as a group with focus on their clinical function and not so much on the individual person. They are contacted when needed to secure the appropriate care for the patient, but are less relevant in explicit teaching of knowledge and skills or for emotional support.

Senior physicians appear to be pivotal contacts for the respondents. They report to their senior physicians what examinations they undertook, what their hypothesis on the status of a patient is, and discus treatment plans with them. Depending on the availability of the responsible senior physicians, the contact often also has an emotional component. However, the major content of interaction between the respondents and the named senior physicians was receiving advice and teaching:

> "The senior physician, for example [JD20_a5], [provides] some background information, going more into depth; information which has less to do with everyday problems." (JD20/91)

Chief physicians were only mentioned by some of the respondents. Direct contact to the chief physician seems more likely in smaller hospitals and if the junior doctor is working on a private ward. Chief physicians were in most cases not seen as a primary or everyday contact. In the view of JD19, the chief physician is a person commanding respect and she states:

> "One tries to appear professional and won't tell him [i.e. the chief physician]: 'Well, today I've done everything wrong again.'" (JD19/67)

Some of the respondents regarded the chief physician as the last resort, someone to go to when nobody else is able to answer a question or solve a medical problem.

Although most of the junior physicians referred to the nurses as a functional group, the mentioned nurses were valued for their advice especially at the very beginning:

> "Yes, absolutely. The nurses teach us practical stuff. Which drugs to prescribe and if this is how it's really done in everyday practice and if the dosage is insanely wrong or not." (JD19/71)

The relationships to the nursing staff were less personalized than the contacts to fellow residents. Additionally, frequent rotations and different working schedules of nurses and physicians were mentioned as hindering personal relationships with the nursing staff. However, on a professional level it seems to have limited impact which nurse is at the ward, because the clinical function appears to be more important than the personal relationship. Considering the emotional support the respondents received from the nursing staff, the role of the individual became more dominant:

> "For example, the nurses. There are people in the nursing staff who recognize if a physician has a problem, an emotional one, and could use some nice words; and there are others who don't like the physician anyway and definitely won't find a single nice word. It's difficult." (JD7/113)

The mentioned family members were working in the medical domain as physicians or in case of JD23 as a physical therapist and osteopath. The named family members provided the respondents with medical advice as well as emotional support.

Multiplicity. It turned out that 85.5% of the alter-ego relations can be described as multiplex. The alters mentioned by the respondents are not merely work contacts but most of them serve additional functions. Table 10 gives an overview of the extent of multiple contacts within the networks sorted by professional status of the alter. Comparing the different professional groups (physicians, nurses, other health professions, organizational staff) with the multiplicity of the relationships to ego, the Kruskal-Wallis test reveals significant differences between these groups ($p < .05$). Looking at these differences in more detail with a post-hoc Mann-Whitney U test with Bonferroni correction, the pairwise comparison shows significant differences between the group of physicians and the group of other health professions ($Z = -2.970$, $p < .05$). The relationships to physicians appear to address more functions than those to other health professions.

Table 10   Multiplex Ego-Alter Relationships in Junior Doctors' Ego Networks

	Uniplex		Multiplex		Two dimensions		Three dimensions		Four dimensions	
	f	%	f	%	f	%	f	%	f	%
Resident	11	15.7	59	84.3	22	31.4	31	44.3	6	8.6
Colleague with specialty degree	0	0	22	100	11	50.0	8	36.4	3	13.6
Senior physician	1	1.8	54	98.2	18	32.7	24	43.6	12	21.8
Chief physician	1	9.1	10	90.9	2	18.2	5	45.5	3	27.3
Nursing staff	9	28.1	23	71.9	9	28.1	9	28.1	5	15.6
Family	0	0	3	100	1	33.3	1	33.3	1	33.3
Organizational staff	4	57.1	3	42.9	2	28.6	1	14.3	0	0
Doctor on duty	0	0	7	100	7	100	0	0	0	0

Note: Psychologist (n = 1) not included. Uniplex relationships = work related contact, Multiplex relationships = contact + at least one function of contact.

Diversity. In order to gain a better understanding of the underlying patterns of relationship formation in junior doctors' social networks, the respondents' egocentric networks were analysed in regard of their diversity. Differences between the egocentric networks in regard of diversity already become apparent when visualizing the egocentric networks in consideration of the alters' attributes. In Figure 9 the egocentric network of JD7 is visualized as an example for a rather heterophile and diverse network, whereas in Figure 10 the egocentric network of JD10 is visualized as an example for a rather homophile and less diverse network.
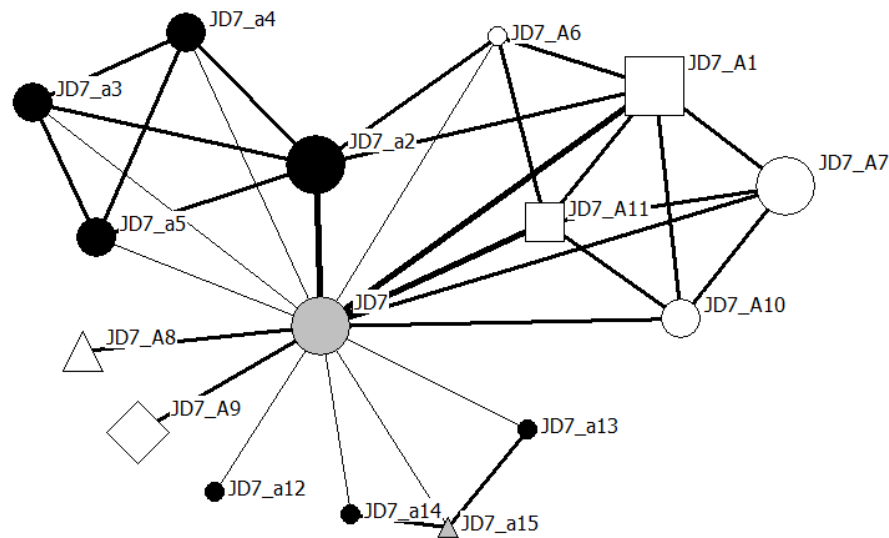
Note: Thickness of the links represents intensity of contact. Different node colours represent differ-ent gender of network contacts (grey = female, black = male, white = groups). Node shape repre-sents profession (circle = physician, square = nurse, triangle = other health professions). Node size represents workplace (big = same department as JD, medium = same specialty but different de-partment, small = different specialty but same hospital). Capital "A" in actor-ID signifies a functional group.

Figure 9   Visualization of Heterophily in Egocentric Network of JD7
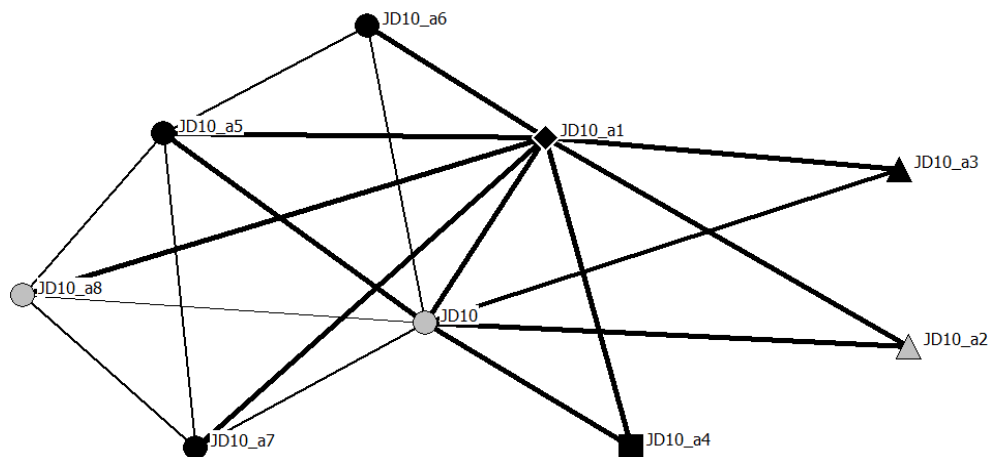
Note: Thickness of the links represents intensity of contact. Different node colours represent different gender of network contacts (grey = female, black = male). Node shape represents clinical function (circle = resident, square = colleague with specialty degree, triangle = senior physician, diamond = chief physician). All contacts are physicians and work in the same department.

Figure 10   Visualization of Homophily in Egocentric Network of JD10

To quantify the diversity of the contacts mentioned by the respondents, the *index of qualitative variation* (*IQV*) was calculated. The resulting *IQV* values, indicating the heterogeneity within the mentioned contacts of every respondent, are presented in Table 11. The *IQV* takes on values between 0 and 1, with 0 resembling no variation within the considered variable and 1 representing maximum variation.

Table 11   Heterogeneity Measures in Junior Doctors' Ego Networks

ID	*IQV gender*[a]	*IQV gender with group*[b]	*IQV profession*[c]	*IQV workplace*[d]
JD1	.64	.86	.33	0
JD2	.75	.84	0	.43
JD3	.64	.87	.24	.77
JD4	1	.99	.57	.42
JD5	0	0	0	.67
JD6	.49	.37	.33	.33
JD7	.44	.84	.69	.88
JD8	.89	.67	.37	.37
JD9	0	.56	.50	.50
JD10	.75	.56	0	0
JD11	.75	.89	.75	.40
JD12	1	.75	.37	.37
JD13	1	.75	.59	0
JD14	1	.75	0	.67
JD15	.89	.92	.37	0
JD16	.75	.84	0	.43
JD17	.96	.96	.26	.59
JD18	.89	.67	.66	0
JD19	.64	.89	.29	.75
JD20	.98	.99	.57	.57
JD21	1	.75	.37	.76
JD22	.56	.67	.19	.78
JD23	.79	.91	.45	.79

Note: IQV range from 0 to 1. [a]gender (3 categories: male, female, group), [b]gender without group (2 categories: male, female), [c]profession (4 categories: physician, nurse, other health professions, organizational staff), [d]workplace (4 categories: same department as JD, same specialty in different department, different specialty in same hospital, different hospital/private practice).

To describe the homophily between the respondents and their alters, the *E-I index* was calculated for every egocentric network as presented in Table 12. The *E-I index* gives information about ego's tendency to connect with similar others and ranges from -1 to 1, with -1 indicating that only links to similar contacts are realized and 1 representing only contacts to dissimilar contacts. An *E-I index* of 0 indicates an equal amount of links to similar and dissimilar contacts.

Table 12   Homogeneity Measures in Junior Doctors' Ego Networks

ID	E-I index gender[a]	E-I index profession	E-I index status	E-I index workplace
JD1	.71	-.71	.71	-
JD2	-.20	-	.20	-.60
JD3	.20	-.80	.40	-.20
JD4	.27	-.46	.27	-.64
JD5	-	-	.67	-.33
JD6	-.71	-.71	.43	-.71
JD7	.87	-.33	.73	.47
JD8	-.33	-.67	.67	-.67
JD9	1	-.50	0	-.50
JD10	.50	-	0	-
JD11	.64	-.09	1	-.64
JD12	.67	-.67	.33	-.67
JD13	.06	-.41	.41	-
JD14	0	-	-.67	0
JD15	.67	-.67	0	-
JD16	.60	-	.60	-.60
JD17	.56	-.78	.56	-.33
JD18	-.33	.11	.33	-
JD19	.75	-.75	.25	-.25
JD20	.27	-.46	-.09	-.46
JD21	.67	-.67	.67	0
JD22	-.43	-.71	-.29	-.14
JD23	.60	-.60	.33	-.07

Note: E-I index range from -1 to 1. No results presented where only one trait in a specific category is realized in the network. [a]Gender categories: male, female, group.

Notably, JD5 is the only respondent in whose network only male alters are present (IQV^{gender_a} = 0), which explains why the *E-I index* for gender cannot be calculated for JD5. The *E-I index*^{gender} indicates males to be more homophile in their gender relations, but no significant evidence could be found for this. Concerning the gender diversity in the egocentric networks, one also has to take into account that there is a significant correlation between clinical function and gender (*Cramer's V* = .418, *p* < .001), as 74.5% of the mentioned senior physicians and all of the mentioned chief physicians (*n* = 11) are male. Also there is a highly significant correlation between profession and gender (*Cramer's V* = .315, *p* = .002): the majority of the mentioned physicians is male and physicians are the main interaction partners for the respondents. This strong focus on intraprofessional contact is supported by the *E-I index*^{profession}. The *E-I index* for profession could not be calculated for five of the respondents (JD2, JD5, JD10, JD14, and JD16) and the $IQV^{profession}$ for these respondents showed no variation ($IQV^{profession}$ = 0) as they only named physicians as relevant network contacts. Only JD18 shows heterophile tendencies in regard of profession (*E-I index*^{profession} = .111). For all other junior doctors the *E-I index*^{professsion} takes on negative values, indicating more links to their own profession than to others. The *E-I index* for clinical function presents a different picture. It takes on negative values for only three respondents (JD14, JD20, and JD22). No significant correlation between clinical experience of the ego or the number of completed rotations and the *E-I index* for clinical function could be found. Also the level of care of the respondents' workplace does not seem to influence connections to alters in different clinical functions. Considering the diversity of workplaces, the $IQV^{workplace}$ spreads from 0 to .88. All of the mentioned contacts working in the same department as ego can be found for five of the networks (JD1, JD10, JD13, JD15, and JD18). Moreover, all the *E-I indices*, except the one for JD7, take on negative values, indicating that most of the respondents have more contacts in their own department than to other departments or hospitals.

An overview of the correlations between the structural and relational network characteristics is presented in Appendix 6, Table 22.

(2) Differences in junior doctors' egocentric networks in regard of their personal characteristics

RQ 3.2 is concerned with the differences in junior doctors' egocentric networks and how they correspond to their personal characteristics and knowledge factors. As explained in the theoretical framework (Chapter 4.3), the factors considered to relate to junior doctors' clinical learning and performance are:

- gender of the junior doctor,

- family background (relatives working in the medical domain),

- location of study (Germany/other),

- completed rotations (non/1-3/more than 3),

- level of care the employing hospital provides (basic/medium/maximum).

Considering the structural characteristics of the respondents' egocentric networks, our test showed no significant differences in regard of the mentioned personal characteristics and knowledge factors. No significant differences could be found for gender, familial background, location of study, amount of completed rotations as well as level of care considering the range, density, centrality, and number of cliques in the respondents' egocentric networks.

Taking a closer look at the relational characteristics, significant differences were found in a Mann-Whitney U test considering the participants' location of study for $IQV^{workplace}$ (Z = 2.792, p = .004) and for $E\text{-}I\ index^{workplace}$ (Z = -2.880, p = .002). Junior doctors who completed their studies in Germany tend to show more diversity and heterophily in regard of their contacts' workplace. For all calculated *IQV values* and *E-I indices* as well as the percentage of multiplex relationships in the egocentric networks, no significant differences could be found in regard of gender, familial background, completed rotations, and level of care (Mann-Whitney U test for gender and familial background; Kruskal-Wallis test for completed rotations and level of care).

8.2.2 Junior doctors' perceived working conditions

The results on how the respondents perceive their working conditions are presented and organized to answer RQ 3.3 *(How do junior doctors perceive their working conditions regarding allocation and structure of work, time pressure, uncertainty of work contents, social stressors, conditions for professional development, participation, and equity?)* and RQ 3.4 *(How does junior doctors' perception of their working conditions differ in regard of the junior doctors' personal characteristics (gender, family background, location of study, clinical experience, and the workplace's level of care)?).*

(1) Overview on junior doctors' perceived working conditions

To gather information on junior doctors' working conditions we used four self-constructed questions on allocation and structure of work as well as six scales with 15 items from the short version of the *instrument for the stress-related job analysis for hospital physicians* (Keller et al., 2013): *time pressure* (2 items), *uncertainty on work contents* (2 items), *social stressors* (2 items), *conditions for on-the-job training* (5 items), *participation* (2 items), and *equity* (2 items).

Rating the overall satisfaction with their working situation on a scale from 1 (not satisfied) to 5 (fully satisfied), the respondents seem to be rather satisfied with their working situation (*M* = 4.00, *SD* = .756). Nevertheless, 54.5% of them have to work between 5 and 10 hours overtime per week and 31.8% indicate to work even more than 10 hours overtime per week, which is crucial because the amount of overtime significantly correlates with junior doctors' overall satisfaction with their working situation (τ_b = -.427, *p* = .027).

> "Well, yes I work long hours. Today I've been there till half past five, well, that's on average, per week, well, between five and ten hours, I think. However, I don't care because now, at the very beginning, if I want to know about things then I don't go home at five just because I want to go home, but I stay because I want to learn something." (JD8/203)

Considering the comment of JD8 on working long hours, there seems to be a tendency to accept unpleasant working conditions as long as the junior doctors feel they get some benefit out of it.

Structure of work. In order to understand the working situation of the respondents, they were asked about their working structure and work organization. Table 13 presents an overview of the mean values and standard deviations of the questions on structure of work. Considering the explicit temporal structure of the everyday ward work, the respondents' answers showed the widest range within the scale *structure of work* with *SD* = 1.12. Whereas organizational structures seem to be communicated rather transparently (*M* = 3.83, *SD* = .98), how the work should be carried out is less clearly specified, for example the workflow on the wards (*M* = 3.39, *SD* = .99).

Table 13   Mean and SD Values for Structure of Work, Professional Development, Participation, and Equity

Scales with items	*n*	*M*	*SD*
Scale: Structure of work			
Explicit temporal structure of everyday ward work	23	3.57	1.12
Workflow on the ward is communicated transparently	23	3.39	.99
Organizational hospital structures are communicated transparently	23	3.83	.98
Responsibilities on the ward are unambiguous	23	3.35	.89
Scale: Conditions for professional development			
Sufficient opportunity to learn new things at work	23	3.74	1.05
Sufficient variety in daily work	22	4.05	.89
Specialty training gets well promoted in the department	23	3.26	1.01
Sufficient opportunity to learn from colleagues	23	3.74	.92
Professional education gets well promoted in the department	23	3.22	1.00
Scale: Participation			
Sufficient influence on working patterns	22	3.27	1.16
Sufficient influence on changes in the workplace	23	2.74	1.05
Scale: Equity			
Equal distribution of workload	22	3.59	.91
Equal distribution of work tasks	23	3.57	.95

Note: For the presented items a 5-point Likert scale was used with 1 = "absolutely disagree" and 5 = "strongly agree"

Conditions for professional development. The results for the items on junior doctors' opportunities for professional development are also presented in Table 13. They suggest higher satisfaction with informal learning opportunities than the formal structural preconditions for their learning. During the interviews, the respondents indicated that the opportunity to learn new things at work strongly de-

pends on the amount of time one has been working on a certain ward and the complexity of the patients' diseases at the specific ward. The structural promotion and support for specialty training (M = 3.26, SD = 1.01) and continuing professional education (M = 3.22, SD = 1.00) received the lowest ratings within the scale *conditions for professional development*.

Equity and participation. An overview of the mean values and standard deviations of the items in the scales *equity* and *participation* is also given in Table 13. Asked about the distribution of workload, 66.7% of the respondents answered that the amount of work is equally distributed. They also perceived the distribution of popular and unpopular daily activities to be rather fair. Regarding the opportunities to participate in decisions affecting daily working patterns, 52.4% of the junior doctors are happy with the amount of influence they have on their own working patterns. However, 36.3% of the respondents report to have not sufficient influence on changes, for example on hospital or department level.

> "*'I have enough influence on changes in our department'* – Well, that's not true at all. I'm at the very bottom of the food chain. If it was up to me, there'd be a lot of changes." (JD8/201)

Time pressure. The respondents were asked about the perceived time pressure per week and the results presented in Table 14 show that 60.9% of the junior doctors mentioned to be confronted with time pressure on a daily basis. Even more respondents (65.1%) indicated that they have to make decisions under time pressure on a daily basis.

Table 14   Frequencies for Time Pressure

	Once a week	Several times a week	Daily	Several times a day	Permanently
Scale: Time pressure (n = 23)			*f* (%)		
Having time pressure	1 (4.3)	8 (34.8)	6 (26.1)	6 (26.1)	2 (8.7)
Having to make decisions under time pressure	2 (8.7)	6 (26.1)	9 (39.1)	5 (21.7)	1 (4.3)

Uncertainty of work contents and social stressors. The detailed results for the scales *uncertainty of work contents* and *social stressors* are given in Table 15. The respondents indicated that to make decisions based on insufficient informa-

tion was a common challenge in their clinical practice. These challenging situations happened several times a month for 45.5% of the junior physicians and for 31.8% of them even several times a week. Additionally, half the respondents reported to make decisions with hardly predictable consequences several times a month.

Table 15 Frequencies for Uncertainty of Work Contents and Social Stressors

	n	Less than once a month	About once a month	Several times a month	Several times a week	Daily
Scales with items				*f* (%)		
Scale: Uncertainty						
Make decisions without enough information	23	2 (8.7)	2 (8.7)	11 (47.8)	7 (30.4)	1 (4.3)
Make decisions with hardly predictable consequences	21	3 (13.0)	3 (13.0)	12 (52.2)	2 (8.7)	1 (4.3)
Scale: Social stressors						
Excessive demands from patients or relatives	23	0	4 (17.4)	9 (39.1)	5 (21.7)	5 (21.7)
Accusations from patients or relatives	23	7 (30.4)	6 (26.1)	7 (30.4)	3 (13.0)	0

The results on the scale *social stressors* reveal that experiencing excessive demands from patients or relatives is very common for junior doctors. Having to deal with accusations from patients or relatives is a task 39.1% of the respondents face several times a month. Also, clinical experience in months shows a negative correlation with accusations from patients and relatives (r = -.444, p = .038), indicating that more experienced physicians less often feel confronted with accusations from patients and relatives.

In order to prepare the received results from the questionnaire about perceived working conditions for further analysis, the summarized values for every scale for each respondent were calculated; they are presented in Appendix 6, Table 23.

(2) Differences in junior doctors' perceived working conditions in regard of their personal characteristics

Looking for differences in the results on perceived working conditions (scale level) in regard of the respondents' personal characteristics and knowledge factors, a Kruskal-Wallis test reveals significant differences for the amount of completed rotations and the perception of *conditions for professional development* (p < .05). However, a detailed analysis with a post hoc Mann-Whitney U test with Bonferroni correction was not able to prove significant differences between the groups. A Kruskal-Wallis test also showed significant differences on the scale *conditions for professional development* for different levels of care (p < .05). A post hoc Mann-Whitney U test with Bonferroni correction revealed significant differences between respondents working in basic and medium care level hospitals (Z = -2.627, p = .008). The results indicate that junior doctors working in a basic care setting rated their conditions for professional development higher than respondents working in medium care settings. No significant differences could be found for *conditions for professional development* in regard of gender, familial background, and location of study. Also for the other scales no significant differences could be found in regard of gender, family background, location of study, completed rotations, and level of care (Mann-Whitney U test for gender, family background, and location of study; Kruskal-Wallis test for completed rotations and level of care).

Looking at the results on an item level, a Mann-Whitney U test showed significant differences between male and female respondents in having to make decisions with insufficient information (*scale: uncertainty*) (Z = 2.537, p = .018). The male respondents more often seem to feel they have to make decisions without having enough information to do so. Differences due to the location of study became apparent in a Mann-Whitney U test for the item "influence on own working processes" (*scale: participation*) (Z = -2.236, p = .029) and for the item "excessive demands from patients or relatives" (*scale: social stressors*) (Z = -2.057, p = .047). Differences considering the amount of completed rotations could be found with a Kruskal-Wallis test for the items "responsibilities on the ward are unambiguous" (*scale: structure of work*), "sufficient influence on changes in the workplace" (*scale: participation*), "equal distribution of work tasks" (*scale: equity*) and "professional education gets well promoted in the department" (*scale: professional development*) (p < .05). A post hoc Mann-Whitney U test with Bonferroni correction revealed significant differences between respondents who

had completed no rotation and respondents who had completed two to three rotations for the items "responsibilities on the ward are unambiguous" (Z = -2.672, p = .010) and "professional education gets well promoted in the department" (Z = -2.916, p = .003). For the other two items related to *equity* and *participation* the post hoc Mann-Whitney U test with Bonferroni correction showed no significant differences between the groups. However, differences could be found considering the hospitals' level of care for the items "explicit temporal structure of everyday ward work" (*scale: structure of work*), "sufficient influence on changes in the workplace" (*scale: participation*), "specialty training gets well promoted by department", and "professional education gets well promoted in the department" (*scale: professional development*) (Kruskal-Wallis test, p < .05). A post hoc Mann-Whitney U test with Bonferroni correction revealed significant differences for the item "specialty training gets well promoted by department" between respondents working in basic care settings and medium care settings (Z = -2.694, p = .008), and respondents working in basic care and maximum care settings (Z = -2.11, p = .010). For the other differences found in the Kruskal-Wallis test, the post hoc Mann-Whitney U test with Bonferroni correction showed no significant differences between the groups. It seems that smaller hospitals working at basic care level put more focus on junior doctors' specialty training. No significant differences on item level could be found in regard of the family background of the respondents.

8.2.3 Relations between junior doctors' social relations and their perceived working conditions

The results related to RQ 3.5 *(How are the structural and relational characteristics of junior doctors' egocentric networks related to the factors of their perceived working conditions?)* are presented in Table 16 and Table 17. Only the significant correlations are displayed. All correlations at scale level are presented in Appendix 6, Table 24.

Kendall's Tau-b was calculated to identify relationships between the structural and relational characteristics of the junior doctors' egocentric networks and the results of the scales from the questionnaire on perceived working conditions (Table 16). Considering the structural network characteristics, the results show a strong negative correlation between network range and the scale *uncertainty* (τ_b = -.406, p = .014), indicating that respondents with more network contacts perceive

less uncertainty in their daily clinical activities. The results furthermore give evidence for a negative relationship between the number of cliques in the egocentric networks and the scale *participation* (τ_b = .333, *p* = .044) as well as the scale *social stressors* (τ_b = -.387, *p* = .019), indicating that a high number of cliques may give the junior doctors more opportunity to participate in changes in their own working patterns and workplace and may as well reduce the confrontation with excessive demands or accusations from patients and relatives.

Table 16 Significant Correlations between Egocentric Network Measures and Perceived Working Conditions Scales

Correlations	τ_b	*p*
Network range * uncertainty	-.406	.014
Number of cliques * participation	.333	.044
Number of cliques * social stressors	-.387	.019
IQV gender (M/F) * social stressors	-.358	.029
E-I index status * equity	.377	.023
E-I index workplace * uncertainty	-.362	.047

Considering the relational egocentric network characteristics, a significant negative correlation between *IQV*[gender(M/F)] and *social stressors* can be found (τ_b = -.358, *p* = .029). Having a gender-diverse network hence is associated with a lower degree of excessive demands or accusations from patients and relatives. Junior doctors who realize relationships to different professional status groups within their egocentric networks seem to feel that the amount of work and also the working tasks are rather equally shared between the responsible personal (τ_b = .377, *p* = .023). We also found a significant negative relationship between *E-I index*[workplace] and *uncertainty* (τ_b = -.362, *p* = .047), which indicates that the perceived uncertainty is lower if the junior physician maintains contacts to actors from a variety of different workplaces.

To get more detailed information about the relationship between the structural and relational egocentric network characteristics and the perceived working conditions, we also calculated Kendall's Tau-b at an item level. The found significant results are presented in Table 17. In concordance with the results on scale level, on item level we found a significant negative relationship between network range and the item "having to make decisions with insufficient information" (*scale: uncertainty*) (τ_b = -.424, *p* = .013). Network density showed no correlations on scale

level, but on item level higher network density is related to perceived lower influence on changes in the own working patterns (τ_b = -.346, p = .039) and lower chances to learn new skills and procedures at work (τ_b = -.328, p = .047). The normalized egocentric betweenness centrality, which also showed no significant correlations on scale level, is positively related to sufficient opportunities to learn new skills and procedures at work.

Table 17   Significant Correlations between Egocentric Network Measures and Perceived Working Conditions Items

Correlations	τ_b	p
Network range * make decisions without enough information (UC)	-.424	.013
Network density * sufficient influence on working patterns (P)	-.346	.039
Network density * sufficient opportunity to learn sth. new at work (PD)	-.328	.047
Centrality * sufficient opportunity to learn sth. new at work (PD)	.332	.044
Cliques * responsibilities on the ward are unambiguous (SW)	-.358	.040
Cliques * sufficient influence on working patterns (P)	.348	.047
Cliques * accusations from patients or relatives (SoSt)	-.444	.010
IQV gender (M/F) * excessive demands from patients or relatives (SoSt)	-.353	.038
IQV gender (M/F) * accusations from patients or relatives (SoSt)	-.337	.048
E-I index workplace * make decisions without enough information (UC)	-.452	.017

Note: Scales: UC = uncertainty, P = participation, PD = professional development, SW = structure of work, SoSt = social stressors.

Respondents with high betweenness centrality indicate that they feel they have sufficient opportunities to learn something new at work (τ_b = .332, p = .044). The found associations between the number of cliques and the scales *participation* and *social stressors* are also present on an item level. Additionally on item level, a high number of cliques relates significantly to rather ambiguous communication of responsibilities on the ward (τ_b = -.358, p = .040). The found association between the $IQV^{gender\ (M/F)}$ and the scale *social stressors* is also present on an item level as is the relationship between $E\text{-}I\ index^{workplace}$ and *uncertainty*.

8.2.4 Junior doctors' clinical performance, social relations, and working conditions

In the following, the results for the junior doctors' performance in the clinical vignettes are presented and organized to answer the research questions related to Aim 4 *(Understanding junior doctors' clinical performance considering their social relations, personal knowledge factors, and perceived working conditions.)*. The used coding scheme for the clinical vignettes is presented in Appendix 5.

(1) Addressing RQ 4.1 *(How can junior doctors' clinical performance be described in regard of organizational knowledge, task mastery, and role clarity?)*, the results from both clinical vignettes are described for the predefined factors related to clinical performance, organizational knowledge, task mastery, and role clarity. The calculated scores for organizational knowledge as well as task mastery are also presented.

(2) RQ 4.2 *(How does junior doctors' clinical performance differ in regard of the junior doctors' personal characteristics (gender, family background, location of study, clinical experience, and the workplace's level of care)?)* is answered by looking at the relations between junior doctors' clinical performance and their gender, family background, location of study, completed rotations, and the level of care their hospital provides.

(3) In order to address RQ 4.3 *(How can the relationship between junior doctors' social networks, personal knowledge factors, perceived working conditions, and clinical performance be described?)* we combine the found results about junior doctors' egocentric networks (Chapter 8.2.1), their perceived working conditions (Chapter 8.2.2), and their clinical performance, considering organizational knowledge, task mastery, and role clarity.

To clarify and emphasize the found results, examples from the interviews are presented. These examples are cited with the code for the interview partner (e.g. JD8 is the code for interview partner eight), referenced to the exact passage in the transcript, and the corresponding clinical vignette (V1 = Vignette 1, V2 = Vignette 2). As all interviews were conducted in German, the author translated the interview passages used as examples into English. It took the respondents about nine minutes to solve V1 (*SD* = 3) and eleven minutes to solve V2 (*SD* = 2). For the first clinical vignette 14 respondents mentioned the relevant working hypothesis (mesenteric ischemia), whereas for the second clinical vignette 18 respon-

dents worked with the right hypothesis (pulmonary embolism) in mind. We found an average overall score of .64 (*SD* = .09) for the first clinical vignette and of .61 (*SD* = .12) for the second vignette. No significant relationships between the scores (Pearson correlation) were found.

(1) Junior doctors' organizational knowledge, task mastery, and role clarity

Organizational knowledge

To deal efficiently with the challenges presented in the clinical vignettes, the junior doctors needed to show organizational knowledge. The necessary organizational knowledge was coded in the main categories *knowledge of guidelines, knowledge of workflows,* and *interpersonal relations*. The number of participants who mentioned elements within these categories is presented in Table 18 for both clinical vignettes.

Table 18   Overview of the Results for Organizational Knowledge

Categories	Vignette 1 *n*	Vignette 2 *n*
Guidelines		
MRSA (V1) / falling out of bed (V2)	12	12
Workflows		
Ensuring / speeding up diagnostic process	6	0
Language barrier (V1) / dementia (V2)	13	14
Interpersonal relations		
Contact to nursing staff	8	12
Calling a specialist	18	5
Senior physician not involved	4	2
Senior physician informed / contacted for reassurance	19	18
Senior physician contacted in case of uncertainty	3	7
Senior physician contacted to perform diagnostic procedure	1	1
Getting advice from colleagues	3	10

Not all of the participants mentioned the *guidelines* to be considered in case of an MRSA patient (V1) or if a patient has fallen out of bed (V2). Some of the respondents did not at all refer to this information given in the clinical vignettes. Over half of the respondents realized the increase of complexity in the cases due to the language barrier in V1 and the dementia of the patient in V2. Those partici-

pants who mentioned the language barrier also suggested ways to deal with this challenge.

> "It depends on the nurses on the ward at this moment. If she [i.e. the patient] is Turkish, we have a Turkish-speaking nurse. If she's nearby I'd just fetch her to translate. Often this also works with relatives. One has to be a bit creative. We also have a list of translators."(JD3/88/V1)

For both cases the respondents sought interprofessional contact to nurses and physicians of other specialties, with the latter being mostly surgical consults. The purpose of contacting nurses was mainly to delegate tasks or to gather information about the current condition and complaints of the patient.

> "I'm waiting for the laboratory results, the blood gas and lactate, and I send a nurse to check the vitals every ten to 15 minutes, even though this is going to annoy her. But I'm going to spell it out for her that this has to be done." (JD14/65/V1)

> "And I'd order the nurses to take record of the fall. I'd ask if she has seen something. If there's blood or if the patient has injured his head. And depending on the response of the nurse, I'd take action." (JD6/121/V2)

Almost all respondents indicated that they would contact their senior physician to inform him/her about the case and to get reassurance on the actions they had taken so far. Some respondents ($n(V1)$ = 2, $n(V2)$ = 5) reported that they were overstrained with the medical challenges within the presented cases and that they would have contacted their senior physicians for advice on how to proceed in diagnosing and treating the patient. However, for the first vignette four and for the second vignette two of the respondents stated they would not contact their senior physician. Those respondents were sure to have taken the right measures for the patient and thought that their senior physician would not have done anything different or that the case was too minor as to be discussed immediately.

> "However, I'd think about this as a surgical case and wouldn't call the senior physician because I think he wouldn't do anything different right now." (JD5/96/V1)

"I wouldn't inform the senior physician because he wouldn't have time anyway. I'd inform the surgical doctor on duty that I have a patient who's getting a CT and has highly striking laboratory results and highly striking results from the clinical examination. My senior physician wouldn't be interested because this is a surgical case. So, the senior physician's out." (JD7/161/V1)

To handle the described scenarios in both vignettes, some of the junior doctors would ask their colleagues for advice, more often so in Vignette 2 (n = 11). Advice from colleagues was especially relevant to them in case of uncertainty, for example in the interpretation of diagnostic findings or just to talk the case over and get someone else's opinion about it.

"If I was feeling uneasy about it, I'd consult my colleagues. At first an experienced colleague, just to ask him how he thinks about it, to get some advice […]." (JD21/107/V1)

The calculated scores for organizational knowledge for the first vignette range from OK_V1_{min} = .17 to OK_V1_{max} = .83 (M = .54, SD = .17) and from OK_V2_{min} = .17 to OK_V2_{max} = 1 (M = .52, SD = .24) for the second vignette.

Task mastery

Task mastery includes the concrete actions the respondents need to take in order to solve the medical problem at hand as well as metastrategies enabling them to proceed with the concrete tasks. Referring to the necessary steps of clinical reasoning and decision making described in Chapter 3.3, the main categories for the theme *concrete actions* are: history taking, clinical examination, formulating and evaluating hypotheses, ordering tests, and therapy.

Not all respondents mentioned the anamnesis and clinical examination of the patient. In the case of the patient in V1, only 15 respondents explicitly reported taking the patient's history, but all respondents mentioned performing a physical examination. In the second clinical vignette 13 respondents mentioned talking to the patient and 19 would examine the patient. Differences were found in the elaborateness of the described physical examination. While some of the junior doctors only mentioned that they would examine the patient, others described a targeted examination, thereby considering the information given in the clinical vignettes. A similar pattern could be observed in regard of the anamnesis. In both

cases the anamnesis was impeded either by the language barrier (V1) or the dementia of the patient (V2). Not all of the respondents who suggested talking to the patient described the questioning in regard of the aforementioned difficulties. Also, a high variance in the detailedness of the described anamneses was observed.

> "Well, examine her, ask her." (JD13/125/V1)

> "The patient complains about abdominal pain, which she must have told me in some way or another; so I try again to find out—with gestures or maybe she even understands the words—whether the abdominal pain is accompanied by nausea, where the abdominal pain is located, if she had to vomit, if she has diarrhoea or constipation [...]." (JD20/95/V1)

All respondents formulated hypotheses based on the information they gathered on the patient from the clinical vignettes. The number of junior doctors who named the diagnosis we had in mind when we developed the clinical vignettes was lower for V1 ($n = 14$) than for V2 ($n = 18$). Some of the respondents who reported uncertainties regarding the diagnosis or treatment of the patients presented in the clinical vignettes mentioned contacting a colleague or their senior physician for advice and help.

> "At this point I would confer with someone. It's not an acute myocardial infarction. We have the increased d-dimers—well, a pulmonary embolism—in the ECG could be some hints for that, but if it doesn't show it, then it doesn't show it. Well, strange. Some kidney failure. I don't know anymore." (JD8/175/V2)

No significant correlation could be found between the tendency to contact others (nurses, seniors, specialist, or colleagues) to help with the case and naming the right hypothesis regarding the patients' health problems. Just one of the four junior doctors who indicated that they would not contact their senior physicians reported the right diagnosis in V1. For V2 the two respondents who would not contact their senior physician were not able to name the right cause for patient's problems.

For both clinical vignettes there is a notable difference in the amount of diagnostic measures the junior physicians would want to take. For the first clinical vignette the respondents ordered more laboratory parameters than for the sec-

ond vignette (V1: *M* = 16.48, *SD* = 6.48; V2: *M* = 11.13, *SD* = 5.07). As the amount of ordered laboratory parameters gives no information on the quality of the ordered measures, we calculated the percentage of right decisions made by the respondents in regard of the laboratory parameters they ordered. As baseline we used the laboratory parameters deemed necessary by the experienced physicians as described in Chapter 7. The percentage of right decisions, however, shows higher values for the second clinical vignette (V1 = 74.0%, V2 = 79.8%). It also became apparent that the amount of laboratory tests ordered and the specific parameters ordered depend on the responsible senior physicians' preferences.

> "PCT, hm, hard to decide. One senior physician always wants to know it, others don't. Hm, in this case maybe, yes. Well, let's say 'PCT: yes'. It's expensive, but why not." (JD12/151/V1)

Some of the respondents also referred to predefined sets of laboratory parameters they usually order irrespective of the specific situations, because that is how it is done at their clinical workplace. "[...] and just an abdominal-lab. Well, that's a standard profile in our hospital." (JD15/95/V1)

Only nine respondents talked about beginning a treatment with pain medication considering the abdominal pain of the patient in V1. For the patient in V2, 18 junior doctors would begin a treatment for shortness of breath by giving him oxygen and letting him inhale. For the first vignette, the calculated scores for *task mastery* considering the medical domain-specific skills and knowledge range from $TM^{MED}\_V1_{min}$ = .37 to $TM^{MED}\_V1_{max}$ = .97 (*M* = .64, *SD* = .15) and for the second vignette $TM^{MED}\_V2_{min}$ = .27 to $TM^{MED}\_V2_{max}$ = .83 (*M* = .61, *SD* = .16).

An overview of the found results concerning the *meta-strategies in task mastery* (TM^{META}) is presented in Table 19.

Table 19 Overview of the Results for Meta Strategies in Task Mastery

Categories	Vignette 1 n	Vignette 2 n
Structuring work	5	3
Setting priorities	13	21
Asking colleagues for support	10	6
Delegating tasks	12	8
Involving the student	3	1

The majority of the respondents mentioned "setting priorities" as an important aspect in dealing with the various demands encountered in the clinical vignettes. In both clinical vignettes the respondents had to deal with temporal constraints due to conflicting duties (e.g. mandatory course, teaching nursing staff) and they set priority on the treatment of the patient.

> "Well, most likely this would put me under pressure, but in the end it's an acute situation with a patient who needs to be taken care of before one can go to the mandatory course. And that's what I'd tell the chief if he asked. That due to an emergency on the ward, I couldn't be on time." (JD15/143/V2)

Some respondents also reported sharing their ward work with one or two colleagues and therefore time conflicts are solved by helping each other out.

> "Or I ask a colleague—usually we're in pairs on the ward—if she can take care of the patient or if she can take over the teaching of the nurses. If she has time for it. Well, it depends on the situation." (JD17/125/V1)

Additionally, the junior doctors talked about delegating tasks in order to make better use of their own time. They would delegate tasks to nursing staff or, if they feel students present at the ward are competent enough, to them as well.

> "I'd ask the medical student to go out of the room so that he can reach the file because I'm in isolation with the patient. And I'd ask him to read the laboratory results out to me and the results of the ultrasound [...]." (JD5/82/V1)

Although the respondents would apply metastrategies in *task mastery,* they realized that these strategies sometimes came with costs. These costs might be having to let the nursing students wait for their teaching (V1) or upsetting their chief by not showing up to mandatory seminars (V2). The calculated scores for *task mastery* considering the metastrategies for V1 range from $TM^{META}\_V1_{min} = 0$ to $TM^{META}\_V1_{max} = .75$ ($M = .44$, $SD = .25$) and for V2 from $TM^{META}\_V2_{min} = 0$ to $TM^{META}\_V2_{max} = 1$ ($M = .41$, $SD = .23$). For V1 we calculated an average score for *task mastery* of .60 ($SD = .12$) and for V2 of .57 ($SD = .13$).

Role clarity

Although the theme *role clarity* was not in the focus of the clinical vignettes, the junior doctors reported related aspects while working with the clinical vignettes. An overview of the number of respondents who referred to elements of *role clarity* is presented in Table 20.

Table 20   Overview of the Results for Role Clarity

Categories	Vignette 1 n	Vignette 2 n
Dealing with expectations	1	5
Dealing with responsibility for patient	1	1
Dealing with own shortcomings	6	8

Considering the conflicting duties the respondents were confronted with in the clinical vignettes, they had to set priorities and in all cases they set the priority on the treatment of the patient. However, while setting these priorities, some of the junior physicians also thought about the expectations of their superiors and how the set priorities might fit with these expectations.

> "If I can give reasons to the chief why I can't go there, then it won't be a problem. And if it was, well, they maybe would come down on me. It all depends on the chief. With my chiefs, if I can give reasons why I don't turn up there, they wouldn't tear me apart. However, if they did, I wouldn't be working there for too long, I think." (JD8/147/V2)

In V1 six and in V2 eight junior doctors admitted uncertainty in regard of their own abilities and indicated that they would seek for help. Reasons for their shortcomings mostly were that they had not performed a specific procedure before or that they had forgotten their theoretical knowledge or practical skills concerning the task at hand.

> "Well, I can't remember which kinds of ileus we have (laughs). Within the last two years, I wasn't concerned with gastroenterology or surgery and right now I just can't remember which kinds of ileus there are." (JD12/157/V1)

In order to deal with their shortcomings, they applied different strategies. Mainly they talked about asking a colleague or a superior for help and advice.

"Well, in this case I'd ask a colleague from the [clinic for gastroenterology] what to do about this. Although it's absolutely embarrassing. But as I've said before, I haven't been working at the [clinic for gastroenterology] up to now." (JD12/173/V1)

JD16 (105/V1) mentioned looking things up:

"The question, well, missing peristaltic sounds, supposedly paralytic ileus. Hm. Now I need to think. No, most likely I would take out my mobile and search for the actions I need to take in case of a paralytic ileus."

(2) Differences in junior doctors' clinical performance

Looking into the differences between the scores due to the respondents' personal characteristics, the first vignette revealed no significant findings. For the second vignette we found significant gender differences regarding the score for *OK_V1* (Mann-Whitney U test, $Z = 2.541$, $p = .012$), with men showing higher scores ($M = .65$, $SD = .18$) than women ($M = .42$, $SD = .23$) in this regard. Differences due to the location of study were found in a Mann-Whitney U test for the *overall score* of V2 ($Z = 3.068$, $p = .001$), *TM_V2* ($Z = 2.421$, $p = .013$), and for TM^{META}_V2 ($Z = 2.295$, $p = .034$), with junior doctors who completed their studies in Germany showing lower values for task mastery as well as the overall score in V2. Additionally, for *TM_V2* a Kruskal-Wallis test revealed differences due to the *level of care* ($p < .05$). However, a post hoc Mann-Whitney U test with Bonferroni correction revealed no significant differences between the groups. Differences due to *level of care* could also be found for TM^{MED}_V2 (Kruskal-Wallis test, $p < .05$). A post hoc Mann-Whitney U test with Bonferroni correction revealed significant differences between respondents working in basic care level and maximum care level hospitals ($Z = -2.515$, $p = .010$). Respondents in basic care showed higher scores for TM^{MED}_V2 ($M = .77$, $SD = .84$) than respondents working in maximum care settings ($M = .54$, $SD = .16$).

Going more into detail, special attention was paid to the laboratory tests the respondents would order, as over-ordering is a very common problem among junior physicians. For both vignettes significant differences could be detected concerning the amount of ordered laboratory parameters in relation to the level of care (Kruskal-Wallis test, $p < .01$). In a post hoc Mann-Whitney U test significant differences between medium level of care and maximum level of care could be

found for V1 (Z = -3.161, p = .002) as well as for V2 (Z = -3.062, p = .002). This indicates that the respondents in medium care settings ordered significantly more laboratory parameters than the respondents in maximum care settings. This result surprises considering statements like the one from JD15, who works at a hospital of maximum care: "Well, let me put it that way: we're a university hospital, we don't always stick to the absolute essentials" (JD15/100/V1). However, regarding the amount of right decisions made in ordering laboratory parameters, no significant differences could be found between the groups.

(3) Interrelatedness of clinical performance, social networks, and perceived working conditions

Answering RQ 4.3*,* the results on the relationship between junior doctors' social network measures, their perceived working conditions, and their clinical performance are presented. Considering junior doctors' structural network characteristics, no significant relationship to the calculated performance scores could be found. The network range, density, and centrality as well as the number of cliques seem not significantly linked to the received answers in solving the clinical vignettes. An overview of the significant relationships between the social network measures and the scores on performance is presented in Table 21; all found correlations are displayed in Appendix 6, Table 24.

Table 21   Significant Correlations between Egocentric Network Meassures and Clinical Performance Scores

Correlations	r	p
Vignette 1		
E-I index gender * organizational knowledge	-.497	.019
E-I index gender * overall score	-.381	.024
E-I index status * task mastery metastrategies	-.586	.003
Vignette 2		
E-I index gender * task mastery medical	.461	.031
E-I index gender * task mastery metastrategies	-.669	.028
E-I index profession * task mastery metastrategies	.640	.004
E-I index workplace * organizational knowledge	-.682	.001
E-I index workplace * overall score	-.542	.016

For the first clinical vignette the *E-I index^gender* is negatively related to the organizational knowledge score as well as to the overall score, which indicates that gender-diverse networks are associated with lower scores on organizational knowledge. However, considering these results, we have to keep in mind that groups are also represented within the *E-I index^gender* and that the majority of the named contacts were male. In the first vignette we also found that *status diversity* within the junior doctors' social networks is negatively associated with their TM^{META} scores.

For the second clinical vignette *E-I index^gender* is significantly positively related to the medical components of task mastery (*r* = .461, *p* = .031), whereas *E-I index^gender* and the metastrategies in task mastery are significantly negatively related (*r* = -.669, *p* = .028). Hence, having a gender-diverse network is associated with better scores in regard of TM^{MED}, but not with the usage of *metastrategies in task mastery*. The results also indicate that junior doctors who can rely on contacts to different professional groups show higher scores concerning *metastrategies in task mastery*. Network diversity in terms of different workplaces is significantly negatively related to junior doctors' organizational knowledge scores (*r* = -.682, *p* = .001) as well as the overall score (*r* = -.542, *p* = .016).

For the relationship between junior doctors' perceived working conditions and their performance in V1, a significant relationship was found between the scale *participation* and the *overall score* in V1 (τ_b = .415; *p* = .009). For V2 we found a significantly negative relationship between the scale *time pressure* and the *organizational knowledge* score (τ_b = -.407; *p* = .015). The found relationship indicates that junior doctors who perceive their working environment as inflicting them with time pressure show lower scores on organizational knowledge. We also found a significantly positive relationship between the scale *working structure* and *organizational knowledge* in V2 (τ_b = .350, *p* = .038), indicating that a transparent work organization corresponds to higher scores on organization knowledge.

8.3 Discussion

The discussion of the results is organized in concordance with the presented aims and research questions of this study. The first paragraph discusses the found results on the factors affecting junior doctors' learning in the workplace, their social relations, and their perceived working conditions. The second paragraph addresses the fourth aim of this thesis, which is concerned with the understanding of junior doctors' clinical performance in relation to their social relations and their perceived working conditions.

Junior doctors' egocentric networks

Relating to RQ 3.1 and RQ 3.2, we found that our respondents' egocentric networks are rather dense and homophile and focus on intraprofessional contacts as well as on the pivotal role of the clinical function. The respondents' egocentric networks showed no significant difference in the structural network patterns due to personal knowledge factors. Whether junior doctors work in a small hospital or a university hospital seems to have little influence on network measures such as range, density, or centrality. This is also true for junior doctors' location of study or gender. We suppose that the basic needs of junior physicians at the beginning of their career are similar and that they form network patterns which help them to cope with the challenges of clinical practice. Furthermore, due to their professional role and hierarchical status, junior doctors might encounter similar opportunities for social interaction and thereby build up similar social networks, irrespective of their work setting. However, it is also possible that within the limited number of assessed personal characteristics, the distinguishing factors concerning the structural network characteristics were not included in the study. Looking at the relational network characteristics, a slightly different pattern becomes apparent. It seems that social contacts of junior doctors who completed their studies in Germany are more diverse in terms of their contacts' workplaces. Nevertheless, for all respondents we found a strong tendency to intraprofessional contacts. This tendency is further supported by the fact that 14 of the respondents initially did not even mention the nursing staff in their social networks. However, after having been questioned about it, most of them included other health professions in their network. It becomes evident that the primary focus regarding their own learning is within their own profession and specialty. These findings are in concordance with an observational study conducted in the field of palliative care,

finding that informal learning through intraprofessional contacts accounts for 84.8% of all learning events observed and nurse-led informal learning only for 15.2% (Varpio et al., 2014, p. 1225). Similar observations were made by Tasselli (2015), who reported that knowledge transfer in social networks of physicians and nurses is more likely to be within the own profession than outside. Tasselli (2015) also could show that junior doctors are likely to act as "inter-professional knowledge brokers" (p. 864) because their status allows them to seek out information from a diverse range of professions and contact individuals of different hierarchical status, which enables them to gain access to valuable knowledge. Although most of the participants in our study recognized the advice and help they received from the nursing staff, it seems that those interactions and learning events are rather unconscious to them. This obliviousness might be explained by the "strong sense of their disciplinary and professional membership" (Hewett et al., 2009, p. 1736), which hospital doctors often express as being the most influential part of their professional identity. This strong sense of specialty membership might also be an explanation, for the fact that the found egocentric networks showed only a limited number of contacts in other medical specialties as well as contacts going beyond the own hospital. It seems as if the tacit knowledge necessary to junior doctors at the beginning of their clinical career was gathered through a dense network of intraprofessional contacts. For novices, like the respondents in our study, Gruber et al. (2008) proposed that rather small and dense social networks might best fulfil their needs in the socialization process at the beginning of their professional development. Additionally, the junior doctors—as newcomers—might not yet have had sufficient opportunity to form bigger social networks. Within the junior doctors' egocentric network, the pivotal role of peers as well as the senior physicians for advice and learning becomes obvious. We found that the structure represented in the egocentric networks mirrors, at least to some extent, the structures found in the clinical workplace. This structural resemblance is noticeable in the cliques within the networks. The focus on clinical function might contribute to the explanation of some of the found effects, especially regarding gender homophily, because the senior and chief physicians who, due to hierarchical working structures are pivotal contacts for junior doctors, are still mostly male. In the junior doctors' egocentric networks in turn, gender and other personal characteristics seem not as important as the clinical function of the contact person. Junior physicians simply cannot choose in their daily clinical practice whether the surgical doctor on duty is male or female. Taking into account the rather high number of male physicians in higher clinical positions, the

found gender-heterogeneous networks of female junior doctors are inherent to the system. The individual seems to be of importance for the junior physicians only in case of emotional support.

Junior doctors' working conditions

Relating to RQ.3.3 and RQ 3.4 we found that overall the respondents seem to be rather happy with their working conditions and tend to accept unpleasant working conditions as long as they have the feeling they get some benefit out of it. The participants seem to be aware of their current position as learners and, as JD8 put it, their position "at the very bottom of the food chain" (JD8/201), which affects the amount of influence they have on changes on working patterns. Hence, they seem to have adjusted their expectations in awareness of their position within the hospital system. As expected from the results of previous studies (Bauer & Groneberg, 2014, 2015; Brennan et al., 2010), stressful working conditions, such as working under time pressure and having to deal with uncertainties in decision making, are common encounters for junior doctors.

At hospitals with basic care level the respondents seem to be more satisfied with the learning opportunities at site than in hospitals with medium care level. Buddeberg-Fischer, Klaghofer, Zivanovic, Vetsch, & Buddeberg (2006) report similar results for Swiss residents working in internal medicine and surgery regarding the differences in the training opportunities due to hospital size. Additionally, in smaller hospitals junior doctors feel they have more influence on their work. This finding might be explained by the fact that smaller hospitals need junior doctors to be able to perform autonomously very soon, as the amount of physicians available is not as high as in bigger hospitals. In smaller hospitals, junior doctors are hands on right from the very beginning, thus their training is at the best interests of smaller hospitals in need of capable workers. Kendall et al. (2005, p. 620) reason:

> "[...] many people consider the teaching provision better in smaller peripheral hospitals than in the larger central hospitals. The former are better organized, give junior doctors more time, and more individual contact with their seniors, provide more detailed feedback and follow-through of patients, and give exposure to a broader range of conditions and situations."

Pimmer et al. (2013) argue that in lager hospitals junior physicians remained longer "in the role of participant or student and benefited from the highly specialised knowledge of a large number of experts in different specialties" (p. 468), which might at the same time cause the junior doctors to perceive their learning opportunities as rather limited. Being in the student-role might withhold meaningful learning experiences from junior doctors because they are "protected" from challenging situations and the respective responsibility. On scale level we found no further differences in junior doctors' perceived working conditions due to their personal characteristics. Looking at the item level, we found that differences in the perceived influence on own working patterns as well as receiving excessive demands from patients and relatives depended on the location of study, which might indicate different cultural socializations of the participants (Hafferty & Franks, 1994; Haidet & Stein, 2006; Jarvis-Selinger et al., 2012). Experience in terms of completed rotations only differentiated between the *perceived ambiguity of responsibilities on the ward* and the *promotion of professional education on the ward*. The more experience the respondents had, the more they perceived the working structure as clear, which might be explained by their increased system knowledge and their experience in "how things are done" at the specific site.

Relations between egocentric networks and perceived working conditions

RQ 3.5 concerns the relationships between social network measures and perceived working conditions. The found results indicate that junior doctors' egocentric networks relate to their information gathering and professional development as well as to their social integration in the workplace and the confrontation with social stressors. The conducted study revealed that junior doctors' network range is negatively related to the scale *uncertainty*, indicating that lager social networks might enable junior doctors to gather enough information to make informed decisions in their daily practice. Heterogeneity in regard of the workplace of the junior doctors' contacts also seems linked to more access to information and therefore reduced uncertainties. Having the opportunity to fall back on a variety of social contacts from different departments, specialties, or even hospitals, seems to enable the junior doctors to acquire the knowledge necessary to make an informed decision. The found results correspond to the findings in the review of Dawes & Sampson (2003) on physicians' information seeking behaviour, stating that physicians frequently consult with their colleagues to get reassurance, emotional support, and tacit knowledge. From research on knowledge in social networks in

different domains we also know that wide-spreading social networks can be vital in the acquisition of new information (Granovetter, 1973; Vaughan, Sanders, Crossley, O'Neill, & Wass, 2015).

In concordance with these previous findings, we also found that dense social networks are related to perceived fewer opportunities for new learning experiences, whereas a high betweenness centrality is positively related to these opportunities. The found relationships regarding network density and information gathering are well in line with research on the distribution of innovation (Jippes et al., 2010) and health professionals' interprofessional knowledge exchange in social networks (Tasselli, 2015), which show that benefits for knowledge exchange and learning are bound to a central network position.

Looking at the perceived social integration, our results suggest that the number of cliques in the network is positively related to the perceived influence on own working patterns. It seems that a higher number of cliques might give junior physicians the leverage and lobby needed to initiate changes. High network density, in contrast, was associated with lower influence on the perceived amount of influence on changes of own working patterns. Other studies have linked dense social network structures to internal network closure, hindering the innovative behaviour (Perry-Smith & Shalley, 2003). However, which network structures are appropriate in the process of change has to be studied in a longitudinal setting, as different network structures might refer to different phases within an innovative or change process (Kijkuit & van den Ende, 2010).

The results also indicate that junior doctors with status-heterogeneous egocentric networks perceive the workload and tasks as rather equally distributed. A status-diverse social network might help junior doctors to get a better overview of the distribution of different tasks, thereby increasing the understanding of their colleagues' responsibilities and reducing prejudice towards other professional groups. In our study, junior doctors with a higher number of cliques mentioned fewer confrontations with accusations from patients and relatives, leading to the conclusion that cliques might support the junior doctors in dealing with social stressors by providing the necessary information to avoid social stressful situations with patients and relatives or by providing support in these situations. Similarly, gender-heterogeneous networks are related to lower values on the scale *social stressors.* This result might be explained by the fact that although the majority of senior physicians is male, in order to be informed about the patient situation and therefore be able to react appropriately, contacts to peers and nurses

are necessary and those professional groups, especially the nursing staff, are mostly female.

Interplay of factors related to junior doctors' professional learning and clinical performance

Addressing RQ 4.1, we assessed junior doctors' clinical performance in terms of organizational knowledge, task mastery, and role clarity with two clinical vignettes and found no significant correlations between the performance scores of the first and the second clinical vignette. Junior doctors who are able to care efficiently for a patient with abdominal pain might not be able to show appropriate behaviour when encountering a patient with chest pain. This finding is well in line with the described conception of learning as an active, social, and situated process (Chapter 4). However, the same medical task dependency could be observed considering the organizational knowledge factors and the metastrategies. This found medical task dependency is somewhat striking because in their general notion those elements of task mastery metastrategies are surely bound to the specific hospital context, but rather independent of the medical problem at hand and should be applicable irrespective of the patients' medical condition. In our study we could not show a generic structure of those themes, but rather that organizational knowledge and task mastery metastrategies are also bound to the specific medical task. The medical task at hand seems to be the dominant component even for the application of organizational knowledge and strategies in task mastery. Looking at these results, the framework of residents' learning in the workplace of Teunissen, Scheele et al. (2007), with the task as starting point for all clinical learning, comes to mind. In this framework the task incorporates cultural as well as medical knowledge elements and emphasizes the interrelatedness of clinical learning, practice, and performance.

Nevertheless, we found noticeable differences in how the respondents solved the clinical vignettes in regard of the contact they would seek to their senior physician, the amount of medical tests they would order, and how they would deal with conflicting duties and additional challenges in the patients' condition. Addressing RQ 4.2, we found that the assessed personal characteristics of the junior physicians did not sufficiently explain the found differences in the respondents' answers to the clinical vignettes. For the first clinical vignette we found no significant differences due to personal characteristics. For the second clinical vignette

men showed higher values on the organizational knowledge score. Furthermore, in the second vignette the location of study contributed to the explanation of differences in the task mastery scores and the overall score, with participants who competed their studies in Germany showing lower scores. Differences in *task mastery overall* and *task mastery medical* were also found for the level of care, with respondents working in basic care settings showing higher scores than respondents working in maximum care settings. We also found that respondents in medium care settings ordered significantly more laboratory parameters than respondents in maximum care settings, but no differences in the quality of the ordered tests was found. The found differences regarding the level of care might reflect different working patterns of different hospitals which contribute to physicians' performance (Farmer, Beard, Dauphinee, LaDuca, & Mann, 2002).

Investigating the relationship between the respondents' egocentric networks and their clinical performance scores, we found no significant correlations regarding the structural network measures. Network range, density, centrality, and the number of cliques in the networks were not associated with the calculated performance scores. In contrast to our study, in his literature review Tasselli (2014) found some studies supporting a relationship between structural network measures and performance on individual, team, and organizational level. However, the results on the relationship between performance and structural social network measures that Tasselli (2014) presents are not focused specifically on junior doctors' social networks, but research indicates that social networks of junior doctors (i.e. novices) differ from those of more experienced physicians (i.e. experts) (Gruber et al., 2008; Tasselli, 2015). Hence, the relationship between social network measures and performance might also differ.

We found significant relationships between relational network characteristics and the first as well as the second clinical vignette. The results support the gender dependency of organizational knowledge in the first vignette and show negative associations between a status-diverse network and task mastery metastrategies. The latter might reflect the nature of the defined metastrategies, which include sharing the task with peers and getting their help in organizing work accordingly as well as setting priorities. The defined metastrategies involve peers and eventually the nursing staff but only in a limited way superiors or specialists. For the second clinical vignette, profession-diverse egocentric networks are positively associated with task mastery metastrategies, indicating that a profession-diverse network might enable junior doctors to delegate tasks and ask for sup-

port. However, having a diverse network in regard of contacts from different departments is negatively associated with organizational knowledge and the overall score in the second clinical vignette. It seems that only the contacts within their own department enable the junior doctors to gather the context-bound tacit knowledge necessary to overcome organizational constraints and follow the required guidelines. This finding is well in line with research on advice seeking in social networks, which indicates that not only competence but also the availability of an interaction partner is an important criterion in asking someone's advice (Borgatti & Cross, 2003; Cross et al., 2001). Research has also shown that close social interactions are necessary to facilitate the transfer of tacit knowledge, which seems more likely within the boundaries of one department than across departments and specialties (Borgatti & Foster, 2003; Hansen, 1999). Looking at the relationship between the clinical performance scores and the perceived working conditions for the first clinical vignette, we found that the feeling of participation is positively related to overall performance. For the second vignette we found a negative relationship between time pressure and the organizational knowledge score. The found relationship indicates that junior doctors who perceive their working environment as inflicting them with time pressure show lower scores on organizational knowledge. As knowledge of workflows and "who to ask for advice" are major components of organizational knowledge, time pressure may reduce the opportunities to get to know colleagues, superiors, nurses, and specialists well enough to estimate their competence and therefore hinder advice seeking. We also found that transparent working structures relate positively to the scores on organizational knowledge in the second clinical vignette, indicating that with distinct organizational patterns junior doctors are more aware of the workflows and potentially supportive interaction partners.

From the discussed results two major issues become apparent: the task dependency of junior doctors' clinical learning and performance, and the pivotal role of structural patterns in junior doctors' clinical learning and performance. As expected, the medical task at hand determines junior doctors' clinical performance regarding the medical skills and procedures, but the medical task also seems to determine whether the junior doctors are able to apply adequate metastrategies in task mastery and can access their organizational knowledge. Additionally, the medical task at hand seems to influence the usefulness of social contacts and the way junior doctors use their social network to handle challenging medical tasks. We also found that the junior doctors' social networks strongly relate to the formal

and informal structural patterns of the workplace, to the extent that common tendencies to homophile behaviour are neglected. The results further indicate that structural patterns of the workplace, such as level of care, seem to determine the perceived opportunities for professional development as well as the performance showed in the clinical vignettes. In Chapter 9.2. both issues are further elaborated, adding the insights gained from the experienced physicians (Chapter 6).

9 Combined Discussion and Limitations of the Studies

The combined discussion of the findings from both studies aims to broaden the understanding of junior doctors' clinical learning and performance by taking into account the perspective of the experienced physicians as well as the junior doctors themselves. At first, the main findings of both studies are presented in the order the studies were conducted and conformities as well as differences in the results are highlighted. In the combined discussion, the focus is put on the recurring themes within the results of both studies.

9.1 Summary of the Main Findings

In our first study we interviewed 12 experienced physicians from hospitals of different care levels in Southern Germany and found that the respondents regarded social interactions, personal knowledge, and the structure of work as key factors in junior doctors' professional development. The availability of contact persons, a supporting and fear-free working climate as well as the provision of a save learning environment by organizing the working patterns accordingly were frequently mentioned. Different contact persons in the clinical workplace were identified to fulfil different functions in junior doctors' professional development, with superiors being mainly responsible for teaching of medical facts and giving legal reassurance, nurses giving advice and teaching practical skills, and peers also giving advice and providing emotional support. Furthermore, the respondents in the first study emphasized the critical balance between giving enough responsibility to the junior doctors to allow meaningful experience while at the same time not overwhelming them. Consequently, the experienced physicians viewed the internal medicine specialty training as a highly individualized process which depends on the junior doctors' personal engagement as well as their ability to rightfully estimate their own competences. The results of the first study highlighted the interrelatedness of social interaction, personal knowledge, perceived working conditions, and clinical performance.

In our second study we were interested in the junior doctors' perspective on their own learning and how it relates to their clinical performance. Therefore, we interviewed 23 junior doctors working in hospitals of different care levels in

Southern Germany. We assessed their egocentric networks as well as their perceived working conditions and asked them to solve two clinical vignettes. In general notion, all respondents reported similar egocentric network patterns. The junior doctors in this study showed rather dense and homophile networks concentrating on intraprofessional contacts for advice and learning. Additionally, the egocentric networks seem to mirror the hospitals' working structures by focusing rather on the clinical function of the respective network contact than on personal characteristics. Looking at the perceived working conditions, in hospitals of basic care level the respondents mentioned to have more influence on changes in their working patterns and felt that their hospitals put more emphasis on their specialty training than in hospitals of medium care. Time pressure seemed to be a common problem in all hospital settings. We found significant relationships between the respondents' social network measurements and their perceived working conditions, indicating that specific network characteristics are associated with perceived participation, equity, and social stress at the workplace. Additionally, structural characteristics of social networks seem related to the learning opportunities at site. Looking at the respondents' answers to the clinical vignettes, we found no significant correlation between the scores of the two vignettes, but noticeable differences in how the junior physicians handled the tasks, especially for the second clinical vignette. Addressing the interrelatedness of the results, we found significant relationships between the relational characteristics of junior doctors' egocentric networks and their performance scores in the clinical vignettes, indicating that network diversity may facilitate but also hinder clinical performance, depending on the content of diversity. Whereas having a heterophile network in regard of status might reduce the options in delegating tasks and setting priorities, a heterophile network in regard of professional disciplines might enhance these options.

In general, the results of the second study are in line with the interrelatedness of social interaction, working conditions, personal knowledge, and clinical performance discussed in study one. However, some differences between the perspective of the experienced physicians on junior doctors' learning and the statements of the junior doctors themselves could be found. While all experienced physicians emphasized the importance of the contact to the nursing staff for junior doctors' clinical learning, over 50% of the questioned junior doctors initially did not mention the nurses in their egocentric networks. The experienced physicians' concerns about working hours regulations and specific demands of the Genera-

tion Y were not supported by the junior doctors' statements. All junior doctors acknowledged working long hours, but they also claimed not to care much about that as long as they have the opportunity to learn. Additionally, as the results of the interviews with the experienced physicians already indicated and those of the second study confirmed, different interaction partners relate to different interaction contents. Peers are mainly contacted for advice and emotional support, nurses for advice and sometimes emotional support too, whereas teaching is mainly done by experienced physicians, senior physicians, and chief physicians. Regarding the critical balance between giving enough developmental space and clinical responsibility while avoiding overstraining junior doctors, the respondents in the second study seemed rather content with their situation. Especially in solving the clinical vignettes, the junior doctors showed confidence that their senior physicians would help them if needed, but would not interfere with their decisions and support them in taking on the responsibility for the patient.

9.2 Combined Discussion of the Main Findings

In discussing the found results from both studies, three recurring themes which struck as pivotal elements in junior doctors' clinical learning and performance as well as their consequences are elaborated:

- task dependency of junior doctors' clinical learning and performance,

- structural patterns in junior doctors' clinical learning and performance,

- individual capabilities of junior doctors and their teachers.

Task dependency of junior doctors' clinical learning and performance

In both studies the task dependency of junior doctors' clinical performance appeared as a crucial element. The experienced physicians in the first study referred to the concept of progressive independence (Kennedy et al., 2005) in junior doctors' learning in the workplace, thereby claiming that junior doctors' professional development is fostered by gradually entrusting them with tasks of increasing difficulty. Following this concept, junior doctors are slowly given more and more responsibility while simultaneously supervision is reduced. The experienced physicians also stated that the decision to allocate a certain task to a junior doctor depends on the concordance of the task-specific affordances with the esti-

mated abilities of that junior doctor. In our second study we found no significant relationships between the junior doctors' approach in solving the first and the second clinical vignette, which suggests that the ability to show high levels of awareness of organizational knowledge, medical knowledge, or metastrategies in a case of abdominal pain does not necessarily reflect the ability to show the same performance in a case of shortness of breath. For the medical skills and procedures this seems sensible, as the reactions to abdominal pain and shortness of breath afford different cognitive registers, but for organizational knowledge about workflows (e.g. talking to nurses or specialists) as well as metastrategies in task mastery (e.g. delegating tasks, setting priorities) the underlying medical condition also seems the dominant factor. In regard of the found results and theoretical models of learning in clinical practice described in Chapter 4.2, the framework of Teunissen, Scheele et al. (2007) comes to mind. In this framework the actual clinical activity is the starting point for residents' learning in clinical practice. The clinical activity the junior doctor is engaged with incorporates not only the medical-related knowledge and skills but also organizational knowledge and strategies to handle challenging situations. In the light of the found results, the organizational knowledge acquired through the engagement in one activity might not be directly applicable to another situation but is redefined in further clinical activities and therefore through further learning experiences.

In this regard, our findings relate well to the ongoing discussions about individualized concepts on postgraduate medical education (Hodges, 2010). These individualized training concepts, although they are clearly preferred by the interviewed experienced physicians, can have considerable shortcomings regarding the transparency of the training programme and the regulation of working structures. However, the basic assumption of individualized postgraduate training programmes that, in order to stimulate learning, the level of task difficulty has to be adjusted to the individual trainees' level of competence before assigning a task, is widely advocated in the medical education community (Berberat et al., 2013; Cate, 2005; Hauer et al., 2013). Overall, the results of the studies indicate that in order to support junior doctors' clinical learning and performance, we should take a closer look at task-specific and individualized training programmes.

Structural patterns in junior doctors' clinical learning and performance

Formal and informal structural patterns are also focal recurring themes in the results of both studies. The experienced physicians referred to the formal structure of working hours regulations, which some of them perceived as a threat to junior doctors' clinical learning due to the limitations on experiences accessible in the remaining working time. They remained ambivalent regarding the amount of formal regulation necessary in junior doctors' training structure as well as clinical practice. Next to their critical perspective on working hour regulations, the experienced physicians also remained sceptical towards explicit training schedules and rather preferred custom-fit training scenarios for each resident in dependency of the individual capabilities. In summary, the experienced physicians pleaded for individualized concepts and feared constrictions to their freedom in working and clinical training through overregulation of working structures and residency training. Füllekrug (2008) also described this fear of loss in physicians' professional autonomy as one key element in the difficulties faced in the implementation of physicians' working hours regulations.

In the second study we found that the informal structures of junior doctors' social networks correspond to the formal and informal working structures found in clinical practice. In their literature overview on social networks in the organizational context, Brass et al. (2004) reason that social networks form along the organizational requirements and work flows. In our study the respondents also indicated forming social contacts because the daily clinical structures demand it, thereby neglecting individual preferences. The primacy of work organization at a specific site, including the individual wishes and preferences of the responsible senior physicians, was repeatedly mentioned. It seems that to avoid conflict and possible negative ramifications, junior doctors do as they are told by their responsible physicians, even if they are not fully convinced of the necessity or correctness. Hierarchical structures are still a dominant feature in the medical domain (Currie & White, 2012).

However, as discussed in Chapter 8.3, we were able to link some of the found network structures to positive outcomes for junior doctors in the workplace, such as reducing uncertainty, enhancing participation, opening up new learning opportunities, and facilitating some elements of clinical performance. As the informal social networks seem to develop along formal structural patterns, it might be sensible to establish distinct and unambiguous working structures and explicit organizational responsibilities, even if this is in some regard opposing to the

rather critical perspective of the experienced physicians. These transparent formal structures might support junior physicians in finding their way around the clinic and help them to develop organizational knowledge as well as to form useful social support systems.

Moreover, the results in both studies suggested differences related to the level of care provided by the hospital. For smaller hospitals, the interviewed experienced physicians referred to the possibilities of individualized support for every junior doctor, the very personal relationship between all colleagues, and the opportunity to quickly take on responsibility. In our second study we found that the level of care relates to differences in the junior doctors' social networks, working conditions, and elements of clinical performance. Although these findings relate well to other studies within the domain (Kendall et al., 2005; Pimmer et al., 2013), the cause-effect relationship in this regard still remains unclear.

The individual capabilities of junior doctors and their teachers

Another recurring theme in both studies was the capability of the individual, i.e. not only of the individual junior doctor but also the capabilities of their teachers. With capability the personal knowledge is addressed, which in Eraut's (2007, p. 406) definition referrers to everything that "persons bring to situations that enables them to think, interact and perform". The experienced physicians identified the professional self-concept, the ability to reflect, and showing proactive behaviour while trying to engage in clinical activities as necessary traits for junior doctors in their clinical learning. In our second study we looked at the relationships between junior doctors' personal characteristics, their social networks, their perceived working conditions, and their clinical performance. We found that gender, family background, and clinical experience contributed to the understanding of the found differences in junior doctors' social networks, perceived working conditions, and clinical performance, even if only to a limited extent. In this regard, our results correspond well with the theoretical models for workplace learning described in Chapter 4.2.

However, the interviewed experienced physicians also emphasized the difference between "*being* a physician" and "*doing* the work of a physician" as described by Jarvis-Selinger et al. (2012, p.1185) and referred to the corresponding duty of the junior doctors' teachers to support this developmental task. Attributes and the importance of role models and teachers for residents' professional devel-

opment are extensively described in the literature (Cruess et al., 2008; Haidet & Stein, 2006; Harden & Crosby, 2000; Kenny et al., 2003; Paice, Heard et al., 2002). Although our results from the interviews with the experienced physicians suggest that the capabilities of junior doctors' teachers are recognized as an important factor in junior doctors' learning and performance, special training for clinical teachers is seen critically or even deemed unnecessary. In contrast to the perception of the experienced physicians, some of the interviewed junior doctors in talking about their social networks referred to a lack of teaching skills in their senior physicians and experienced colleagues. Some junior doctors experienced senior physicians who—instead of supporting their medical education—were not available if needed or who made them feel stupid when they asked questions. Nevertheless, in concordance with the interviewed experienced physicians, the interviewed junior doctors generally affirmed the importance of competent clinical teachers for their clinical learning and performance. Hence, not only the personal knowledge the junior doctors bring to the situation, but also the personal knowledge their teachers show, seems relevant in junior doctors' clinical learning and consequently in their clinical performance.

9.3   Limitations of the Studies

Both conducted studies are rather explorative and descriptive. Therefore, conclusions for whole populations can be drawn only in a limited way. Both studies were conducted in the field of internal medicine, leading to two critical factors to be considered. Firstly, we face the challenge that the results found for the domain of internal medicine might not be true for other medical domains as every discipline has its own distinct cultural features which influence thinking and working patters. Although the differences among medical specialties are often humorously caricatured (McCain, Harris, McCallion, Campbell, & Kirk, 2010), in essence these differences refer to different intraspecialty self-concepts which might have influence on the results. Working as a junior surgeon, with responsibilities on the ward as well as in the operating theatre, might be accompanied by social network patterns and working conditions different to those the interviewed residents working in internal medicine showed. The second critical factor to be considered is that the domain of internal medicine is heterogeneous in its own. There is a wide range of specialisations physicians can accomplish in the field of internal medicine, such as gastroenterology, nephrology, or cardiology. So even within the specialty of

internal medicine, there are differences regarding individual specialisations which might have influence on junior doctors' social networks, their working conditions, and their clinical performance. In both studies we did not control for the specialisations practiced or pursued. Moreover, the rather small sample size and mainly qualitative design allows no broad generalization of the found results, but present us with a first insight in the interrelatedness of social networks, personal knowledge, perceived working conditions, and clinical performance of junior doctors in internal medicine specialty training in Germany. To generate universally valid statements, replication studies with a bigger sample are needed.

The conducted studies follow a cross-sectional design, which seems especially relevant for the second study, where we only took a snap-shot of the junior physicians' social networks, perceived working conditions, and clinical performance. Nevertheless, as social contacts are dynamic, it stands to reason that junior doctors' social relations evolve over time. With every rotation and change of ward they gain new acquaintances and new contacts might become more important while others loose significance, although they are still present in their egocentric networks. The perception of their working conditions as well as their clinical performance might change over time as the junior doctors change wards, get a better hold of the responsibilities related to their status, and integrate experienced medical encounters in their medical knowledge and skills. Hence, the results presented in the second study only give an insight in the relationships between the different factors affecting junior doctors' learning and clinical performance at one point in time, whereas longitudinal studies might help to improve our understanding of the interrelatedness and the cause-effect relationship of the found factors.

In both studies only a limited number of personal characteristics could be assessed, although there might be other personal traits and personal knowledge factors which have an impact on the results. This is especially true for the second study, where factors like the individual tendency to talk and articulate thoughts might have influenced the results of the clinical vignettes. Additionally, for some participants in the second study German was not their native language and even though explanations were given for unknown words, this language barrier as well as cultural differences going hand in hand with a non-German background might have influenced the answers. Future studies should keep track of these factors and include them more vigorously in the analysis.

In our second study we aimed to assess clinical performance with clinical vignettes. Assessing clinical performance, as mentioned in Chapter 7.1, is a tricky endeavour and focussing on different factors contributing to clinical performance in this assessment might lead to different results. Future studies could include team aspects or communicational factors in researching junior doctors' clinical performance. However, these elements of junior doctors' clinical performance can hardly be asses with clinical vignettes, but might be gathered by using observational studies or by including standardized patients in the study design.

Despite all mentioned constraints, the conducted studies are able to shed some light on the process of junior doctors' clinical learning and performance in relation to social interaction, perceived working conditions, and personal knowledge from the perspective of experienced physicians as well as the perspective of the junior doctors themselves. The theoretical and practical implications resulting from the conducted studies are presented in Chapter 10.

10   Practical and Theoretical Implications

In the description of the practical and theoretical implications of the conducted studies we refer to the challenges which were introduced at the very beginning of this thesis. Based on the discussed findings on junior doctors' clinical learning and performance we will deduce and explain suggestions for undergraduate medical education, postgraduate medical education, and the junior doctors themselves. The discussed findings but also the described shortcomings of the conducted studies are used as starting point for the suggested further research on professional development in clinical practice.

10.1 Implications for Postgraduate Medical Education

At a first glance, giving recommendations on changes of postgraduate medical education based on the found results seems problematic, considering the described constraints of the presented studies. However, the combination of the found results and the described theoretical insights (Chapter 3 and Chapter 4) allows us to give some suggestion on junior doctors' clinical learning and performance regarding three different areas:

- undergraduate medical education,

- hospitals and educators in postgraduate medical education,

- individual junior doctors.

Undergraduate medical education

The found results also bear some hints for the further development of undergraduate medical education. Preparing junior doctors for every aspect of their professional practice is not possible for medical schools, but fostering their awareness for the uncertainty which is inherent to the medical profession might help junior doctors especially at the beginning of their career. Bleakley & Brennan (2011) already showed that certain aspects of undergraduate medical curricula influence the perception of readiness for practice, especially regarding the handling of uncertainties. Building up strategies in how to handle the uncertainty of practice and being aware of this uncertainty could be taught in medical schools. Similar to the key concept of *evidence-based medicine*, dealing with uncertainty

could be integrated in every medical discipline. It might also be sensible to put focus on the students' abilities to correctly estimate their own competencies by reflecting on their knowledge and skills. Students should be made aware that being uncertain and having knowledge gaps is not a disgrace, but that they should seek help when they realize their own shortcomings. Although the junior doctors' social networks were dominated by intraprofessional contacts, the results indicate the value received from interprofessional collaboration in clinical learning and practice. Therefore, an early-on focus on interprofessional education might be sensible. Medical schools could promote interprofessional education, for example, by integrating combined courses for nursing and medical students into their curricula. Our results support the conclusion that knowing the other profession might help to reduce preconceptions and facilitates mutual appreciation.

Hospitals and educators in postgraduate medical education

Recommendations concerning hospital level can be put into two categories. On the one hand, our results in combination with current literature suggest some structural and organizational patterns which hospitals can provide and which might be beneficial for junior doctors' learning and clinical performance. On the other hand, we derived some information on how educational settings in the hospital can be further refined in order to support junior doctors' learning and clinical performance.

In regard of the structural patterns in junior doctors' learning and clinical performance, it seems as if all residents might benefit from transparently communicated workflows. Whether these workflows are written guidelines or transferred via direct communication does not really matter—the important part is their existence. Clearly stated workflows and transparent organizational structures reduce uncertainty and in our study are related to a lower amount of overtime, which might also be interesting for hospitals from an economical perspective. Explicit working structures give reassurance when and who to call for advice and support. This in return might reduce junior doctors' uncertainty (and sometimes even fear) that when calling a senior physician they might get turned down or their competency might be challenged. Additionally, the system of clinical rotations should be refined, and take into account that the development of meaningful interaction and trust needs some time. To be able to know who you need to ask if you have a certain question, you need to be able to estimate the knowledge of your contact

partners, but being able to estimate the knowledge of someone takes time. Hence, having a system of permanent change in ward teams as well as permanent rotations might restrict junior physicians' opportunities to build meaningful relationships and therefore the potential of social learning experiences is impeded. It also takes some time to get acquainted with ward-specific working processes and common diseases at a certain ward. Giving junior doctors the time to learn these ward-specific patterns might be beneficial for their learning as well as the quality of care they are able to provide. However, to stimulate their learning, a balance must be found between giving the junior doctors enough time to get to know the demands and challenging them with new tasks. With the found results no recommendation on the appropriate time of rotations can be made, but a system of permanent change of environment seems to be hindering junior doctors' learning and clinical performance and should therefore be reconsidered.

Revising the rotation system goes hand in hand with other recommendations on the structure of the educational setting. The experienced physicians in our study suggested a supportive and fear-free learning environment as a necessary precondition for junior doctors being able to learn and subsequently showing efficient clinical performance. In order to provide junior doctors with such a supportive clinical environment, it seems necessary to make the staff explicitly aware of their status within the junior doctors' professional development as well as the junior doctors' status as learners (Burford et al., 2013; Kilminster et al., 2011).

As junior doctors are learning while performing, establishing a supportive feedback culture might be helpful. Junior doctors should get feedback on their performance from more experienced staff in a timely and appreciative manner. However, seizing the ongoing discussions about a competency-based specialty training, the process of feedback becomes even more vital. Defining competency-based outcome criteria, maybe even bundles of entrustable professional activities, might support the more experienced staff with a structured basis for their feedback and enable them to assess what junior doctors are actually capable to do rather than count the number of procedures their trainees have executed. However, these educational strategies in specialty training put new challenges on the senior staff which is responsible for junior doctors' specialty training. They need to be aware of their role as teachers and feedback providers and subsequently some training for clinical teachers might be necessary. In contrast to undergraduate medical education, where medical teachers are more and more obligated to take courses in didactics, didactical teacher trainings are not very

common in medical specialty training. Our interviews with the experienced physicians showed that teacher training is often not even perceived as necessary. However, some of the junior doctors—in contrast—complained about the lack of didactical and communicational competencies of their responsible senior physicians. Although some experienced physicians rejected the necessity of clinical teacher training, based on our results we encourage hospitals to prepare their experienced staff for their role as educators in residency training and to offer them didactical trainings especially on strategies for workplace-based teaching and assessment. These didactical trainings might be accompanied by some elements on cultural diversity. Looking at the increasing numbers of physicians from foreign countries (Bundesärztekammer, 2014a), cultural diversity in the health professions seems to be one of the big future challenges and is so far only sparsely integrated in the discussions about the future of medical specialty training in Germany. Establishing awareness for the opportunities and challenges of this cultural diversity might be beneficial for the junior doctors' professional development as well as the hospitals' working cultures.

Individual junior doctors

Due to the current labour market situation in healthcare, junior doctors who have completed their undergraduate medical education have the opportunity to choose between a wide range of job openings and employers. As our studies revealed differences in learning opportunities in regard of the workplace, junior doctors should think about their future career ambitions, inform themselves about the specialty training programmes offered, and choose their first workplace in concordance with their ambitions and training needs. For a scientific career naturally a university hospitals is the right choice (Hakimi et al., 2010), but if no scientific ambitions are present, smaller hospitals should also be considered, as the learning opportunities and early hands-on experiences can be very valuable in one's own professional development.

The experienced physicians as well as the junior doctors named individual agency as an important factor in getting access to learning resources. Junior doctors are not victims of the structural properties and the learning offerings of the workplace, but they have the chance to facilitate their own learning opportunities through active engagement and showing interest. It might be sensible for them to explicate their professional networks in order to identify valuable and accessible

learning resources within their network. Having a distinct conception of the knowledge lying within every single interaction partner might help them to get the appropriate information in a fast and efficient manner.

Furthermore, junior doctors should be more aware of their social contact to the nursing staff, because this contact might provide valuable educational benefits and practical support. The experienced physicians also emphasized the support junior physicians can receive form experienced nurses as long as they are able to maintain a good relationship with them. Therefore, it might be sensible for junior doctors to analyse their social network patterns and to work on relationships that can help their professional development.

10.2 Implications for Further Research

The conducted studies allowed us a broader insight in junior doctors' learning and clinical performance in relation to their social contacts in the workplace, their perceived working conditions, and personal knowledge. However, the discussion of the results as well as the described limitations of both studies hint towards new research questions and further studies which are also needed to confirm and generalize the described findings.

Further research should look at the cultural differences and their consequences in junior doctors' medical education and performance. Considering the ongoing discussion on shortage of physicians in Germany and the increasing number of residents from foreign countries completing their residency training in German hospitals, dealing with cultural diversity is a challenge already faced by many hospitals. As mentioned in Chapter 2, there are some efforts to formulate mandatory standards for medical schools on international and European level (World Federation for Medical Education, 2003) which might help reducing differences in residents' medical knowledge at the beginning of their training. However, the question on cultural differences and language barriers still persists, despite the legal regulations on mandatory language competence levels for physicians from foreign countries. Discussions with the residents from foreign countries who participated in the second study revealed that these regulations are, due to the shortage of staff, applied rather generously. Although the foreign junior doctors in the sample indicated cultural differences in working structures, none of them referred to a formalized support system for foreign junior physicians at their

hospital. Further research focussing on cultural diversity in junior doctors' learning in practice might broaden the understanding of junior doctors' clinical learning and performance.

The found differences in perceived learning opportunities in regard of hospital size should be also further investigated. We found differences in the perceived learning opportunities due to the level of care provided by the hospital. However, the question whether those differences result in better outcomes in terms of patient care could not be answered. Furthermore, we have no answer to the question why the junior physicians perceived the smaller hospitals as being more supportive regarding their professional development. In this context it would also be interesting to take a closer look at the hidden educational aims of the different hospitals: whereas university hospitals educate their junior doctors to become medical specialists as well as scientists, hospitals of basic care can solely concentrate on the medical aspects of residency training. It might be worthwhile investigating whether the described differences in daily business affordances as well as educational focus relate to different outcomes and perceived learning opportunities.

The presented studies in this thesis were conducted in the domain of internal medicine. Further research should investigate whether the found patterns can be transferred to other medical disciplines and if differences between the disciplines can be identified. Comparing conservative and interventional disciplines might be valuable, as the structure of work shows quite some differences, which in turn might influence the social interactions in the workplace as well as the working conditions. Investigating different specialties might help us to find and distinguish generic and specialty-specific factors affecting junior doctors' learning and performance in the workplace. Having a concise understanding of generic and speciality-specific factors relevant in junior doctors' clinical learning and performance might help in refining models for residents' workplace learning as well as support the development of custom-fit postgraduate curricula.

Further understanding of junior doctors' learning and clinical performance could be gained by a longitudinal research design. The conducted studies allowed us to take a look at junior doctors' professional development at one point in time only. To understand the mechanisms of the development of the social networks as well as changes in clinical performance and perceptions of working conditions, more data gathering points seem helpful. A longitudinal study design could help to describe the dynamics in the social networks and the linked encul-

turation processes. Additionally, our interviews with the experienced physicians indicated that residents change from the role *newcomer* into the role *teacher* pretty fast. With longitudinal studies it would be possible to research the changes in junior doctors' social networks accompanying this change of roles.

In our study with junior doctors it became apparent that their social interactions are dominated by intraprofessional contacts. Nurses and other health professions were less obvious to the respondents as potential resources for professional development. However, interprofessional collaboration is acknowledged as a key component of efficient and high-quality health care (Zwarenstein & Bryant, 2000), which is why further researching interprofessional collaboration at an early career level with a social network perspective might help us to gain more insight in these structures of interactions. In our study as well as in the research of Tasselli (2015), junior doctors occupied positions with noticeable betweenness centrality in their social networks, facilitating the communication between the profession of nurses and doctors. It might be valuable to gather more information about the preconditions and consequences of this brokerage position related to junior doctors' clinical learning and performance. Also it might be worthwhile to investigate whether the junior physicians are aware of their position and if there are educational or performance benefits in making this role more obvious to them.

Finally, further research should also take a closer look at the dyadic relationship of junior doctors and their responsible senior physicians, as the responsible senior physician occupies such a pivotal role in junior doctors' learning and performance. To understand junior doctors' learning and clinical performance, it might be helpful to better understand their *teachers* as well. Senior physicians' perception of their working conditions could be taken into account to find out which clinical structures might hinder or facilitate the engagement of the senior physicians in teaching roles. Further studies could also investigate how junior doctors' teachers are integrated in the social context of work and how their social relations facilitate the learning of junior physicians.

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Index to Appendices

Appendix 1: Interview Guide Study I

Interviewleitfaden Studie I

Sind Sie damit einverstanden, dass ich unser Gespräch aufzeichne? Ihre Angaben werden selbstverständlich vertraulich behandelt. Ihre Daten werden für die Auswertung anonymisiert.

1. Angaben zur Person
- Alter
- Fachrichtung
- Berufserfahrung
  - Wie viele Jahre arbeiten Sie bereits als Ärztin/Arzt?
  - Wie häufig haben Sie bereits den Arbeitsplatz gewechselt?
  - Haben Sie bereits im Ausland gearbeitet?

- Inwiefern sind Sie in die Ausbildung von ärztlichen Berufsanfängern involviert?
  - Seit wann?
  - In welchem Umfang?
  - In welcher Art?

2. Einflussfaktoren auf Lernen und Handeln am Arbeitsplatz

1. Wenn Sie an den Beginn Ihrer klinischen Tätigkeit zurückdenken, welche Faktoren haben Ihr klinisches Handeln beeinflusst?

2. Welche Faktoren unterstützen aus Ihrer Sicht die ärztlichen Berufsanfänger zu Beginn ihrer beruflichen Tätigkeit heute?
   a. Inwiefern können ärztliche Berufsanfänger von ihren **sozialen Kontakten** profitieren und durch diese lernen?
      - Welche Rolle spielen erfahrene Kollegen/Vorgesetzte?
      - Welche Rolle spielt die Pflege/andere Berufsgruppen?

   b. Welchen Einfluss hat aus Ihrer Sicht die **Strukturierung des Arbeitsumfelds** auf das Lernen der Berufsanfänger?
      - Strukturierung der Arbeit – Inhalt?
      - Strukturierung der Arbeit – Zeit?
      - Ablaufbeschreibungen, SOPs usw.?

   c. Welchen Einfluss hat aus Ihrer Sicht die **Persönlichkeit** des Berufsanfängers auf sein Lernen?
      - Fähigkeit zur Selbstreflexion?
      - Interesse und Engagement?

3. Mit welchen Herausforderungen sind aus Ihrer Sicht ärztliche Berufsanfänger zu Beginn ihrer beruflichen Tätigkeit heute konfrontiert?

3. Lösung der klinischen Fallvignetten

1. Empfinden Sie den Fall als realitätsnah?
2. Haben Sie noch Verbesserungsvorschläge?

Appendix 2: Coding Scheme for Study I

"Experienced Physicians' Perspective on Junior Doctors' Learning"

Category	Subcategory	Description	Example
Theme: Personal knowledge related to learning at the beginning of one's own career			
Previous knowledge and skills	Medical knowledge and skills	Theoretical and practical Knowledge acquired in medical school	„Man braucht natürlich fundiertes Wissen um das Ganze umzusetzen." (E12/21)
	Knowledge of workplace practices	Theoretical and practical Knowledge required while working in a clinical setting (e.g. practical placement)	„Hab aber auch schon PJ dort gemacht vorher. Also ich hatte schon so ein bisschen Vorlauf dort und kannte die Station […]." (E1/22)
Personal traits	Ability to reflect	Self assessment, learning from errors	„Also am Anfang ist immer schwierig zu erkennen, was man eigenständig tun darf und kann und was man nicht eigenständig tun darf und kann." (E4/23)
Individual proactive-behaviour	Actively engaging in clinical activities	Actively engaging in clinical activities, wanting to do things on one's own, showing dedication	„Habe mich da quasi selbst verantwortlich gefühlt dafür." (E12/19)
	Doing the reading up	Doing necessary self-study	„Lesen von Fachzeitschriften, Finden von eigener Motivation." (E5/ 23)
Theme: Social interactions related to learning at the beginning of one's own career			
Preconditions for interaction	Availability	Availability of persons (superiors, experienced colleagues, peers, nurses) in the clinical workplace to interact with for learning purposes	„Ich war nach einem halben Jahr alleine in der Ambulanz gesessen und der zuständige Oberarzt war nicht so sehr präsent. Viel weniger als hier." (E2/24)
	Fear-free environment	Welcoming and cooperative working climate, trust in superiors and colleagues,	„ […] dass man wusste, dass jemand hinter einem steht. Dass man wusste, dass man jederzeit fragen kann, wenn man unsicher ist." (E3/17)

Category	Subcategory	Description	Example
Content of interaction	Teaching	Teaching of medical skills or knowledge, support with medical procedures, observing experienced colleagues, working alongside each other	„Dann engagierte Kollegen, die bereitwillig einem Dinge gezeigt haben aber unter Aufsicht haben durchführen lassen." (E9/20)
	Emotional support	Support concerning the emotional well-being, Balint-groups, informal discussions	„[…] dass es eigentlich immer ein nettes, gutes Team war, dass wir dann auch am Abend mal weggegangen sind. Dass man da sozusagen eine wilde Balintgruppe hatte (lacht)." (E3/17)
	Advice	Asking for or receiving advice (medical as well as personal, e.g. career planning)	„Bei der Visite wusste ich noch nichts, da habe ich halt die alten Schwestern, Stations-Schwestern gefragt: ‚wie würden jetzt der Oberarzt oder der Chef das machen?'." (E10/25)
	Reassurance	Seeking reassurance or getting reassurance on own performance, legal reassurance	„Sondern der entscheidende Punkt war, dass jemand da ist, der sagt: ‚Mach mal und ich schaue zu und überwache das, mach dir keine Sorgen.' Wenn irgendetwas falsch entschieden wird, ist das nicht so, dass es am Patienten ausgeht." (E8/18)
Interaction partners	Superiors	Interaction with superiors	„Was hat mir da geholfen? Natürlich die Oberärzte, die da da waren und mir einfach erklärt haben, wie man das machen muss und dass man es vielleicht auch mal so probieren kann." (E7/25)
	Experienced colleagues	Interaction with colleagues	„Positiv ist natürlich immer, wenn man immer jemanden fragen kann, wenn man vielleicht einen älteren Kollegen, einen erfahrenen Kollegen mit sich dabei hat. Der jetzt noch vorm Oberarzt ist, aber einem so ein bisschen Struktur geben kann. Einen da ein bisschen anleiten kann." (E1/22)
	Other health professions (esp. nurses)	Interaction with other health professions	„[…] da habe ich halt die alten Schwestern, Stations-Schwestern gefragt: ‚Wie würden jetzt der Oberarzt oder der Chef das machen?' Und dann haben die gesagt: ‚So und so' und dann habe ich gesagt: ‚Gut, dann machen wir das jetzt so.'" (E10/25)
	Peers	Interaction with peers	„Ich bin von meinen Mitassistenten ausgebildet worden, soweit das ging." (E11/43)

Category	Subcategory	Description	Example
	Family and friends	Interaction with family and friends	„Das einerseits das Elternhaus. Die Bekanntschaft zu einigen Ärzten im Umfeld." (E9/18)

Theme: Structure of work related to learning at the beginning of one's own career

Category	Subcategory	Description	Example
"Formal" training structure	Organisation of the training programme	Structure of the junior doctors' training, rotations, formal courses	„[…] dass ich da auch schon relativ viel Verantwortung rasch übernehmen musste. Also ich habe im November mein Examen gemacht und habe dann Weihnachten meine ersten Dienste dann gemacht auf der Intensivstation mit beatmeten Patienten und so." (E1/22)
	Time for initial orientation	Getting time to adjust to new environment, introductory programme	„Man lief halt mit. Und hat geguckt, was bei den Visiten so passiert ist, aber für die meisten Aufklärungsgespräche wurde man dann sehr schnell alleine losgeschickt." (E2/24)
	Abilities of clinical teachers	Qualities of clinical teachers, abilities necessary to facilitate own learning, guidance, knowledge of teaching methods	„Es gab damals einen Oberarzt, der sehr im Detail auch anleitend war. Aber trotzdem einem sehr viel Freiheit gewährt hat. Jetzt nicht nur von den Entscheidungen her, sondern auch von der Patientenführung. Das heißt also, nicht alles an sich gerissen hat." (E9/20)
Work-organisation	Workload	Influence of the amount or difficulty of work on own learning	„Ja, weil man kann natürlich nicht am Anfang, wenn man da neu ist, immer gleich um 4 Uhr heim gehen. Da ist zu viel, was auf einen einstürmt und da braucht man einfach länger am Anfang. […] Der Schritt vom gemütlichen Studentenleben in das Berufsleben. Das ist schon eine andere Nummer." (E10/39)
	Working hours	Influence of working hours on own learning	„Vielleicht die Arbeitszeiten. Dass es halt einfach damals noch ganz klar war, dass man bis Acht in der Klinik sitzt, wenn es sein muss." (E3/17)
	Level of responsibility	Own duties in relation to level of own competence	„Wenn irgendetwas falsch entschieden wird, ist das nicht so, dass es am Patienten ausgeht. Das ist glaube ich prinzipiell ganz wichtig zum Lernen, dass man einen geschützten Raum hat, wo man Entscheidungen erst mal treffen muss und nicht nur zuguckt wie andere Entscheidungen treffen." (E8/18)

Category	Subcategory	Description	Example
Theme: Personal knowledge related to junior doctors' learning			
Previous knowledge and skills	Medical knowledge and skills	Theoretical and practical knowledge acquired in medical school	„[…] er muss natürlich ein gewisses Grundwissen mitbringen (..) Wenn er das hat, hängt es so ein bisschen von der Persönlichkeit ab. Wie rasch man das dann umgesetzt bekommt." (E1/30)
	Knowledge of workplace practices	Theoretical and practical knowledge required while working in a clinical setting (e.g. practical placement)	„PJ in dem Fach zu machen, in dem man hinterher anfängt, ist schlau. […] auch gleich an dem Ort." (E2/34 - 36)
Personal traits	Humanness	Dedication to und compassion for patients, empathy	„Er muss von der Persönlichkeit aufgeschlossen sein. Also nicht nur lernwillig, sondern er muss insbesondere den Patienten gegenüber aufgeschlossen sein." (E9/38)
	Passion for the job	Awareness for responsibility	„Ich denke, es muss nicht so verrückt gearbeitet werden, wie vor 30 Jahren in den Universitätsklinika, weil das eben auch nicht der Patientensicherheit zuträglich ist. Auf der anderen Seite sind Patienten krank und vertrauen sich einem an und wenn man da halt um fünf Uhr einfach den Kugelschreiber fallen lässt, weil dann die Arbeitszeit zu Ende ist, wird man einfach der Berufung Arzt nicht gerecht." (E8/39)
	Ability to reflect	Self assessment, Learning from errors	„Ein wichtiger Punkt ist die Reflexionsfähigkeit, die manche Leute besitzen und manche nicht besitzen und die in beide Richtungen auch immer wieder zu Problemen führt. Dass sich Leute überschätzen und Leute unterschätzen." (E4/51)
	Team-skills	Respect for all professions in the health sector	„Wichtig ist natürlich, dass man alle Mitarbeiter respektiert." (E12/29)
Individual proactive-behaviour	Asking questions	Showing interest, actively asking questions regarding own shortcomings of medical, structural, or legal knowledge	„Deswegen sind mir eigentlich die lieber, die viel fragen, weil man dann auch Feedback hat, was er eigentlich weiß, was er kann." (E7/31)

Category	Subcategory	Description	Example
	Actively engaging in clinical activities	Actively engaging in clinical activities, wanting to do things on one's own, showing dedication	„Also am Anfang da guckt der dem den ganzen Tag zu, was der macht. Und lernt halt so Grundlagen. Und die besprechen das auch und irgendwann, wenn er dann sagt: ‚Hey, ich will jetzt auch mal selber.', oder der Assistent, der Ältere sagt: ‚Du musst jetzt auch mal selber ran.', dann bekommt er halt mal zwei Zimmer zu betreuen." (E7/27)

Theme: Social interactions related to junior doctors' learning

Category	Subcategory	Description	Example
Preconditions for interaction	Availability	Availability of persons (superiors, experienced colleagues, peers, nurses) in the clinical workplace to interact with for learning purposes	„Das ist das A und O, dass jemand da ist, der akut ansprechbar ist und Hilfe leisten kann. Der Oberarzt kommt ja nachmittags auf Station üblicherweise und ist nicht der Ansprechpartner für alle Probleme die am Tag so einem begegnen." (E1/24)
	Fear-free environment	Welcoming and cooperative working climate, trust in superiors and colleagues	„Ich halte es immer für wichtig, weil ich das selbst persönlich so erfahren habe mit dem Chef, wenn man einen Scheiß baut, der einen sozusagen die Leviten liest, und sagt: ‚Das war jetzt Scheiße', aber einen vollkommen nicht im Regen stehen lässt. Der dann schützt auch. Man darf auch einen Fehler machen und gerne auch auf den Fehler hingewiesen werden, man darf nicht fertig gemacht werden, man darf nicht klein gemacht werden. Nach Außen hin muss der Oberarzt oder der Chef die breiten Schultern haben." (E3/43)
Content of interaction	Teaching	Teaching of medical skills or knowledge, support with performing medical procedures, observing experienced colleagues, working alongside each other	„Eigentlich in meinen Augen, indem sie mitlaufen. Indem sie sich das von einem Älteren abschauen. So Weitergabe des Feuers sozusagen." (E3/35)
	Feedback	Controlling junior doctors' work and giving feedback on progress and performance	„Das heißt, ich kann, wenn mir ein Arztbrief nicht passt, einen Kommentar reinschreiben in ein Kommentarfeld und dann ist der mit einem Klick wieder in der Arbeitsliste vom Assistenzarzt. Dann sieht der: ‚Aha, das passt dem Oberarzt nicht, das muss verbessert werden.' […]." (E8/33)

Category	Subcategory	Description	Example
	Advice	Junior doctors asking for or receiving advice (medical as well as personal, e.g. career planning)	„Die zeigt einem rechtzeitig, die sieht ja den Patienten, die ist ja häufiger am Patienten, die sagt einem der Patient wird jetzt schlecht zum Beispiel. […] Die kann auch sagen: ‚Bist du dir sicher, dass du dem jetzt dieses und jenes Medikament geben willst?' (E3/45)
	Reassurance	Junior doctors seeking reassurance or getting reassurance on their performance, legal reassurance	„Bei uns ist es ja so, der Oberarzt kommt dann immer am Nachmittag vorbei und fragt: ‚So, was gibt es heute Neues, was müssen wir besprechen?' und dann besprechen die das alle miteinander. So dass es auch nachher dann abgesichert ist." (E7/27)
	Emotional support	Support concerning the emotional well-being, Balint-groups, informal discussions	„Aber da muss man natürlich auch sagen, es ist natürlich wichtig für die jungen Leute, dass die jemand haben, der ihnen sagt: ‚Das passt so, das hast du richtig gemacht und man hätte eh nichts machen können.', weil sonst klappen die Leute ein." (E7/49)
Interaction partners	Superiors	Interaction with superiors	„Bei uns ist es ja so, der Oberarzt kommt dann immer am Nachmittag vorbei und fragt: ‚So, was gibt es heute Neues, was müssen wir besprechen?'" (E7/27)
	Experienced colleagues	Interaction with experienced colleagues	„Das Wichtigste ist, dass man halt von Kollegen, die schon auf Station erfahren sind, ähm, erst einmal mitgenommen wird. Von älteren Kollegen, Kollegen, die das schon machen, die sich auskennen im Betrieb und medizinisch schon ein bisschen was wissen. Das ist nicht immer der Oberarzt, ja, der hat auch nicht immer Zeit. Das sind primär mal die Stationskollegen." (E10/23)
	Other health professions (esp. nurses)	Interaction with other health professions	„Da [von der Pflege] kann man halt, wenn man sich als Jungarzt geschickt anstellt, viele Informationen bekommen, wie so etwas generell gemacht wird." (E8/31)
	Peers	Interaction with peers	„Ablaufpläne erhält man aus meiner eigenen Erfahrung immer, indem man guckt wie es die anderen machen und wie macht man es halt selber. Man guckt in erster Linie, wie es die Gleichaltrigen machen oder die Peers machen." (E4/31)

Category	Subcategory	Description	Example
	Family and friends	Interaction with family and friends	„Also jetzt allein von der psychischen Belastung, die ja doch auch da ist, ist ein gesundes familiäres Umfeld wichtig. Ganz klar. Ich glaube immer, dass es ganz wichtig ist, als Arzt einen Partner zu haben, der ein Verständnis für diesen Beruf hat." (E3/43)

Theme: Structure of work related to junior doctors' learning

Category	Subcategory	Description	Example
"Formal" training structure	Organisation of the training programme	Structure of the junior doctors' training, rotations, formal courses	„Das ist etwas, was immer lustig war am Uniklinikum. Da sind die jungen Assistenzärzte schon drei Monate da und dann werden sie zur Computerschulung ein, zwei Tage komplett abgezogen. Das ist sowas Hirnverbranntes, weil das haben die im Alltag schon längst alles von ihren Kollegen gelernt, wo man da wo hinklickt. Also das ist dann wirklich Zeitverschwendung. […]." (E8/27)
	Time for initial orientation	Junior doctor gets time to adjust to new environment, introductory programme	„Also die Situation jetzt, wie sie nun mal auf der Station ist, wenn da jetzt jemand Neues ist, also Berufsanfänger ist, dann soll das idealerweise sein, dass der jemanden an der Seite hat, der schon zwei, drei Jahre gearbeitet hat. Berufserfahrung hat und den so ein bisschen anleiten kann und so ein bisschen helfen kann da rein zu kommen." (E1/24)
	Time to study	Time allocated to formal training or studying for junior doctors	„Das sind sogenannte Zwangsfortbildungen, die extern auch stattfinden müssen und die innerhalb der Weiterbildungszeit eigentlich abgearbeitet werden müssen und die natürlich auch ner gewissen zeitlichen, durch Freistellung, Unterstützung bedürfen und auch meines Erachtens ner finanziellen Unterstützung bedürfen. Was manchmal bei der derzeitigen Krankenhaussituation etwas schwierig ist." (E9/26)
	Abilities of clinical teachers	Qualities of clinical teachers, abilities necessary to facilitate junior doctors learning, guidance, knowledge of teaching methods	„Das ist dem zuständigen Oberarzt und den Kollegen auf Station weitgehend überlassen, wie sie das machen. Ohne dass die selber geschult sind darin. Ich denke, wenn man irgendwo ein Handwerk erlernt, ist es deutlich mehr standardisiert, professionalisiert." (E2/32)

Category	Subcategory	Description	Example
Work-organisation	Workload	Influence of the amount or difficulty of work on junior doctors' learning	„Das ist am Anfang ein bisschen hart für die Leute, weil sie einfach mit allen internistischen Krankheiten gleichzeitig konfrontiert werden. Aber es bewährt sich. Wenn man das mal ein halbes Jahr gemacht hat, dann hat man schon das Gefühl, dass man einigermaßen kapiert, wie diese Krankheiten funktionieren. Dann fängt das Lernen erst richtig an. […] dann hat man ja noch nichts anderes gemacht. Noch keinen Ultraschall gelernt, noch kein Röntgenbild angeschaut, das sind ja alles so zusätzliche Dinge." (E7/33)
	Working hours	Influence of working hours on junior doctors' learning	„Das heißt also durch Begrenzung von Arbeitszeiten. Die ja, also ich will das jetzt nicht ankreiden, durchaus berechtigt sind, aber natürlich auch letztendlich Hindernisse in manchen Bereichen aufgebaut haben. Wer will einen übermüdeten Arzt oder einen übermüdeten Operateur im Extremfall? Anderseits will man natürlich auch niemanden sich gegenüber fühlen, der nicht kompetent ist, weil er keine ausreichende Weiterbildung genießen konnte. Also da muss man einen Mittelweg finden." (E9/44)
	Guidelines	Site-specific organisational and specialty-specific medical guidelines in facilitating junior doctors' learning	„Es gibt schon so ein paar, für ein paar Krankheitsbilder und für so ein paar Abläufe auf Station gibt es so ein paar Standardanweisungen, wobei die, ähm (..) ja (..). Weiß ich nicht, inwieweit die in der Praxis so richtig gelebt werden. Einfach weil (..) im täglichen Alltag die Zeit gar nicht da ist, das Ganze anzuschauen." (E1/28)
	Appropriate level of responsibility	Encouraging junior doctors to work on their own in consideration of their individual level of competence	„Natürlich durch die eigenen Entscheidungen, wenn dann das passiert, dann kommt man natürlich mehr voran, als wie wenn jede Entscheidung so überprotektiv vom Oberarzt abgenommen wird (..). Ich glaube das ist noch schlimmer, weil man dann gar nix lernt. Es ist glaube ich wichtig, dass man für Entscheidungen den Assistenten dann auch irgendwo Raum lässt." (E8/41)

Category	Subcategory	Description	Example
	Defined chain of command	Transparent clinical organisational structure, who to call, when to call, who is in charge of what	„Hier gibt es einen Arzt, der ist hier und einen Hintergrund und fertig. Ja. Mehr gibt es nicht. Wenn ich jetzt ein Problem habe, dass ich selber nicht managen kann als Assistenzarzt, dann ruf ich den einen Hintergrund an. Das ist die Rückfallebene. Ende." (E7/35)

Theme: Demanding clinical tasks

Category	Subcategory	Description	Example
Working under time pressure		Performing time-critical tasks, not being able to do one's work in the allocated time, not enough time to perform all the tasks at hand, prioritising tasks	„Der Zeitfaktor ist wirklich eine relevante Einschränkung. Auch gerade für einen Berufsanfänger." (E1/36)
Responsibility		Having to take on responsibility for patients' lives, being the only doctor on the ward, having to make decisions on one's own	„Deswegen passiert es eben schnell, wenn in der Klinik Personalnotstand ist, die Oberärzte nicht greifbar sind, dann ist es eigentlich eine chronische Überforderung. Da lernt man zwar auch, aber der Preis bei den Patienten ist eventuell hoch und dann natürlich auch die psychologische Belastung bei den Assistenten." (E8/41)
Non-routine situations		Dealing with new task, unfamiliar disease, emergency situations	„Klar, wenn Sie das erste Mal Nachtdienst machen, oder das erste Mal Dienst in der Notaufnahme machen. […] Notfälle, natürlich." (E6/53)
Work-life-balance		Establishing a balance between work and personal life	„Aber es ist das Problem, dass halt die nach wie vor gegebene Unvereinbarkeit von Beruf und Familie vorhanden ist und das ist auch nicht beeinflussbar." (E9/44)
Medical skills and procedures		Dealing with a lack of medical knowledge or lack of medical skills	„Solche Gespräche zu führen. Also auch zu sagen, mal ganz plakativ: ‚Sie haben Krebs.' […]. Aber solche Gespräche zu führen ist eine Herausforderung." (E7/49)

Appendix 3: Clinical Vignettes and Checklist

Clinical Vignette 1 "Frau Kubilei"

> ### „Frau Kubilei klagt über Bauchschmerzen"

Sie sind als Assistenzarzt auf einer Normalstation tätig und gehen Ihre tägliche Morgenvisite zusammen mit Ihrem Famulant. Sie sind zeitlich unter Druck, da in Kürze der Schwesternunterricht beginnt und Sie gerne Ihre Visite davor abgeschlossen haben möchten. Sie werden aufgrund des Unterrichts dann zwei Stunden nicht auf Station sein.

Sie kommen nun in das Zimmer der Patientin, Frau Fatma Kubilei, 65 Jahre alt. Sie ist türkischer Abstammung und verfügt nur über spärliche Deutschkenntnisse. Frau Kubilei ist aufgrund eines positiven MRSA Hautabstichs in der Leiste in einem Isolationszimmer. Frau Kubilei ist bei Ihnen in stationärer Behandlung wegen einer Lobärpneumonie.

Bei der Visite klagt die Patientin unerwarteter Weise über Bauchschmerzen. Sie bringt die Beschwerden durch lautes Wehklagen heftig zum Ausdruck.

Bekannte Vorerkrankungen:
oral therapierter Diabetes mellitus, Adipositas, art. Hypertonus, chron. Vorhofflimmern, Z.n. Inguinalhernien-OP vor 8 Jahren

Wie gehen Sie jetzt vor?
Bitte begründen Sie Ihr Vorgehen.

Laboranforderung

Bitte kreuzen Sie die Laborparameter an, die Sie bestimmt haben möchten:

	Analyt	angefordert
Klin. Chemie	Albumin	
	Alkalische Phosphatase	
	Bilirubin, direkt	
	Bilirubin, gesamt	
	Calcium	
	CHE	
	Chlorid	
	CK	
	CK-MB	
	CKMB-Masse	
	CRP	
	Gesamt-Eiweiß	
	Glukose	
	GOT (AST)	
	GPT (ALT)	
	Harnsäure	
	Harnstoff	
	Kalium	
	Kreatinin	
	Laktat	
	LDH	
	Lipase	
	Amylase	
	Natrium	
	Phosphat	
Gerinnung	Antithrombin	
	Quick	
	INR	
	PTT	
	Fibrinogen	
Urin	U-Status	
Hämatologie	Kleines Blutbild	
Sonstiges	PCT (quant.)	
	HbA1c	
Hormone	fT3	
	fT4	
	TSH	
Tumormarker	CA 19-9	
	CEA	
	PSA (gesamt-)	
Blutgruppe	Kreuzblut	
BGA	Venös	
BGA	arteriell	

Befund

Bei der abdominalen Untersuchung zeigten sich eine diskrete generalisierte Abwehrspannung und fehlende Darmgeräusche.

Das Sono ergab auf Grund der schlechten Schallbedingungen keinen relevanten patholog. Befund.

	Analyt	Wert	Einheit	Alle	Frauen	Männer
Klin. Chemie	Alkalische Phosphatase	65	U/l	50-136		
	Bilirubin, direkt	0,1	mg/dl	< 0,2		
	Bilirubin, gesamt	0,8	mg/dl	0,2-1,0		
	CK	85	U/l		< 170	< 190
	CRP	**10,5**	mg/l	< 3,0		
	Glukose	186	mg/dl	74-106		
	GOT (AST)	32	U/l		< 35	< 50
	GPT (ALT)	28	U/l		< 35	< 50
	Kreatinin	**1,2**	mg/dl		0,51-0,95	0,67-1,17
	Laktat	**34**	mg/dl	3,6-18,2		
	LDH	298	U/l	< 250		
	Lipase	245	U/l	73-393		
	Natrium	141	mmol/l	136-145		

	Analyt	Wert	Einheit	Alle	Frauen	Männer
Gerinnung	Quick	85	%	70-151		
	INR	1,1	ohne	0,9-1,15		
	PTT	32	sec	25,9-36,6		

	Analyt	Wert	Einheit	Alle	Frauen	Männer
Urin	U-Status	o.B.				

	Analyt	Wert	Einheit	Alle	Frauen	Männer
Hämatologie	Hämoglobin	**11,1**	g/dl		11,2-15,7	13,7-17,5
	Leukozyten	**15**	c/nl		3,98-10,0	4,23-9,1
	Thrombozyten	335	c/nl		182-369	163-337

	Analyt	Wert	Einheit	Alle	Frauen	Männer
Hormone	TSH	3,58	mIU/l	0,55-4,78		

	Analyt	Wert	Einheit	Alle	Frauen	Männer
Ven. BGA	pH	**7,2**	-			
	BE	-7	mmol/l			

Clinical Vignette 2 "Herr Schuster"

„Herr Schuster fällt aus dem Bett"

Sie sind als Assistenzarzt auf einer Normalstation tätig. Es ist bereits 17:00 Uhr und sie machen zusammen mit Ihrer Famulantin noch immer Kurvenvisite. Sie möchten zügig fertig werden, da Sie um 17:15 Uhr noch zu einer Fortbildungsveranstaltung wollen, die Ihr Chef mehr oder weniger zur „Pflichtveranstaltung" erklärt hat.

Da betritt eine Krankenschwester das Arztzimmer und teilt mit, dass der Zimmernachbar von Herr Schuster für ihn geläutet hat.

Herr Schuster ist bei Ihnen in stationärer Behandlung wegen einer Urosepsis, die sich inzwischen deutlich gebessert hat. Herr Schuster ist 79 Jahre alt. Er leidet an einer recht ausgeprägten Altersdemenz und hat Bettgitter angebracht, da er schon öfters aus dem Bett gefallen ist. Diese waren aber leider nicht hochgeklappt, so dass die Schwester ihn vor dem Bett am Boden sitzend aufgefunden hat.

Bekannte Vorerkrankungen:
Z.n. ACVB-Operation bei 3-Gefäß-KHK vor 15 Jahren, arterieller Hypertonus, Hypercholesterinämie, COPD bei Z.n. Nikotinabusus, Osteoporose, benigne Prostatahyperplasie

Wie gehen Sie jetzt vor?
Bitte begründen Sie Ihr Vorgehen.

Laboranforderung

Bitte kreuzen Sie die Laborparameter an, die Sie bestimmt haben möchten:

	Analyt	angefordert
Klin. Chemie	Albumin	
	Alkalische Phosphatase	
	Bilirubin, direkt	
	Bilirubin, gesamt	
	Calcium	
	CHE	
	Chlorid	
	CK	
	CK-MB	
	CKMB-Masse	
	Troponin I	
	CRP	
	Gesamt-Eiweiß	
	Glukose	
	GOT (AST)	
	GPT (ALT)	
	Harnsäure	
	Harnstoff	
	Kalium	
	Kreatinin	
	Laktat	
	LDH	
	Lipase	
	Amylase	
	Natrium	
	Phosphat	
Gerinnung	Antithrombin	
	Quick	
	INR	
	PTT	
	D-Dimere	
Urin	U-Status	
Hämatologie	Kleines Blutbild	
Sonstiges	PCT (quant.)	
	HbA1c	
Hormone	fT3	
	fT4	
	TSH	
Tumormarker	CA 19-9	
	CEA	
	PSA (gesamt-)	
Blutgruppe	Kreuzblut	
BGA	Venös	
BGA	arteriell	

Befund

Anamnese: Herr Schuster klagt über Schmerzen in der Brust und Luftnot.

Körperliche Untersuchung: Herr Schuster wirkt objektiv dyspnoeisch, Atemfrequenz 25/min., Auskultation des Herzens o.B., Auskultation der Lunge bds. basal abgeschwächtes Atemgeräusch, generalisiert Giemen und Brummen, Abdomen o.B., keine äußeren Prellmarken, kein Hinweis auf Frakturen, orientierende neurolog. Untersuchung unauffällig. Bds. mäßige Unterschenkelödeme.

Monitor: Hf 100/min, RR 100/70 mmHg, SO2 88%

	Analyt	Wert	Einheit	Alle	Frauen	Männer
Klin. Chemie	CK	210	U/l		< 170	< 190
	CK-MB	10	U/l	< 25		
	CRP	18	mg/l	< 3,0		
	Kreatinin	1,2	mg/dl		0,51-0,95	0,67-1,17
	LDH	310	U/l	< 250		
	Natrium	141	mmol/l	136-145		
	Troponin I	negativ				
Gerinnung	Quick	85	%	70-151		
	INR	1,1	ohne	0,9-1,15		
	PTT	32	sec	25,9-36,6		
	D-Dimere	1,6	mg/l	< 0,5		
Hämatologie	Hämoglobin	13,5	g/dl		11,2-15,7	13,7-17,5
	Leukozyten	15	c/nl		3,98-10,0	4,23-9,1
	Thrombozyten	335	c/nl		182-369	163-337
Hormone	TSH	3,58	mIU/l	0,55-4,78		

Blutgasanalytik	pH	7,5	-
	pCO$_2$	32	mmHg
	Std. Bicarbonat	19	mmol/l
	pO$_2$	68	mmHg

Checklist Clinical Vignette 1 and 2

Theme	Category	Vignette 1 Mrs Kubilei	Vignette 2 Mr Schuster
Organizational Knowledge	Knowledge of guidelines	Guidelines for MRSA*	Falling out of bed*
	Workflow	Language barriers* Speeding up the diagnostic process	Dementia*
	Interprofessional collaboration	With nursing staff* With a specialist*	
	Contacting senior physician	Senior physician not involved Senior physician informed and contacted for reassurance* Senior physician contacted in case of uncertainty* Senior physician contacted to perform special diagnostic procedure*	
	Contacting peers	Getting advice from colleagues*	
Task Mastery	Medical proceeding	History taking[#] Clinical examination[#] Hypothesis: - Mesenteric ischemia [#] - Ileus - Ulcer - Pancreatitis - Problems with the gall-bladder - Appendix - Problems with the urinary passage, bladder or gynaecological - Heart attack - Pulmonary embolism - Pseudo peritonitis, diabetes	Hypothesis: - Pulmonary embolism[#] - Heart attack - Fracture - Pleural effusion, pleurisy - Pulmonary oedema, cardiac decompensation - Pneumonia - Exacerbation of COPD - Aortic dissection
		Tests: - Laboratory - Ultrasound[#] - X-ray[#] - CT[#] - (ECG)	Tests: - Laboratory - ECG[#] - Chest x-ray[#] - CT thorax[#] - Ultrasound
		Pain therapy	Pain therapy, oxygen, COPD inhalation
	Meta-strategies	Organizing work to meet conflicting duties[#] Setting priorities[#] Delegating tasks[#] Asking colleagues to help with conflicting duties[#] Involving the student	

Checklist Clinical Vignette 1 and 2 (continued)

Theme	Category	Vignette 1 Mrs Kubilei	Vignette 2 Mr Schuster
Role Clarity	Dealing with expectations		
	Dealing with responsibility		
	Dealing with own shortcomings		

Note: Not all listed criteria are necessary or appropriate. *Used in the calculation of the Organizational Knowledge score. [#]Used in the calculation of the Task Mastery score with the medical components being double weighted.

Appendix 4: Interview Guide and Questionnaire Study II

Interviewleitfaden Studie II

Sind Sie damit einverstanden, dass ich unser Gespräch aufzeichne? Ihre Angaben werden selbstverständlich vertraulich behandelt. Ihre Daten werden für die Auswertung anonymisiert.

Bevor wir gleich mit Ihren sozialen Kontakten starten, hätte ich noch einige wenige Fragen zu Ihrer Person:

Ausbildung:

- Wie alt sind Sie?
- Liegt die Medizin in Ihrer Familie?
- Wo haben Sie Medizin studiert und wann und **mit welcher Note** haben Sie Ihr Studium beendet? – Nachfrage Mentoring!
- Haben Sie in einem Modellstudiengang studiert?
- Haben Sie zuvor bereits etwas anderes gemacht?
- Wo haben Sie Ihr PJ absolviert – Nachfrage Ausland!

Jetzige Tätigkeit

- Wo sind Sie aktuell als Assistenzärztin/Assistenzarzt tätig und wie lange arbeiten Sie bereits dort?
- Haben Sie in der Zeit bereits die Station gewechselt?

TEIL 1: Erfassung der sozialen Netzwerke

Namensgenerator:

Mit welchen Personen tauschen Sie sich im Rahmen Ihrer klinischen Tätigkeit über arbeitsbezogene Inhalte aus?

Bitte schreiben Sie die Namen der jeweiligen Personen auf die Kärtchen und geben Sie dabei an

- Profession

- Fachrichtung

- Hierarchischer Status

- Klinische Erfahrung

- Geschlecht

Bitte legen Sie diese Personen nun um sich herum.

Bitte kennzeichnen Sie mit Strichen bzw. der Dicke der Striche die Intensität des Austausches mit diesen Personen.

Welche der genannten Personen tauschen sich Ihrer Einschätzung nach untereinander aus?

Bitte geben sie mittels der Dicke der Verbindungslinien die Intensität des Austausches an.

Welche der genannten Personen fungieren als Ratgeber in medizinischen Fragen?

Bitte kennzeichnen Sie diese Personen mit einem roten Punkt.

Welche der genannten Personen tritt explizit als Lehrer für Sie auf?

Bitte kennzeichnen Sie diese Personen mit einem blauen Punkt.

Lässt sich ein Unterschied bezüglich der gelehrten Inhalte feststellen?

Welche der genannten Personen gibt Ihnen emotionale Unterstützung?

Bitte kennzeichnen Sie diese Personen mit einem grünen Punkt.

TEIL 2: Bearbeitung der Fälle

Alle Informationen die Sie zur Bearbeitung des Falles benötigen, finden Sie in der Fallbeschreibung. Bitte geben Sie Ihre Überlegungen bei der Bearbeitung des Falles laut wieder. Es geht nicht darum, dass Sie den Fall medizinisch perfekt lösen, sondern vielmehr darum, wie Sie im Verlauf zu Ihren Ergebnissen kommen und wie Sie mit der dargestellten Situation umgehen.

TEIL3: Fragebogen (ca. 5 Min)

Fragebogen Studie II

1.	**Angaben zur Arbeitsstruktur**	**trifft voll zu**				**trifft nicht zu**
1.1	Der zeitliche Ablauf des Stationsalltags ist klar geregelt.	☐	☐	☐	☐	☐
1.2	Typische organisatorische Abläufe auf Station sind transparent kommuniziert (z.B. durch Ablaufpläne oder Infomails).	☐	☐	☐	☐	☐
1.3	Informationen zu Ansprechpartnern und Verantwortlichen am Klinikum sind transparent dargestellt (Organigramme, Telefonlisten…).	☐	☐	☐	☐	☐
1.4	Die Zuständigkeiten auf Station sind klar kommuniziert (z.B. wann ist der Oberarzt zu konsultieren, welche Aufgaben hat das Pflegepersonal...).	☐	☐	☐	☐	☐
1.5	Ich habe ausreichend Einfluss auf die Gestaltung von Arbeitsabläufen von denen ich unmittelbar betroffen bin.	☐	☐	☐	☐	☐
1.6	Auf die Gestaltung von Veränderungen innerhalb unserer Abteilung habe ich ausreichend Einfluss.	☐	☐	☐	☐	☐
1.7	Wenn man alle Ärzte unserer Abteilung vergleicht, ist die Aufteilung der anfallenden Arbeitsmenge gerecht.	☐	☐	☐	☐	☐
1.8	Wenn man alle Ärzte unserer Abteilung vergleicht, ist die Übernahme von besonders beliebten und unbeliebten Untersuchungen und Ähnlichem gerecht verteilt.	☐	☐	☐	☐	☐

1.9	Wie viele Überstunden machen Sie durchschnittlich pro Woche (ohne Überstunden für Forschungstätigkeit)?
	☐ keine ☐ weniger als 5 ☐ zwischen 5 und 10 ☐ mehr als 10

2.	**Angaben zur zeitlichen Arbeitsstruktur**
2.1	Wie häufig stehen Sie unter Zeitdruck? ☐ ein Mal pro Woche ☐ mehrmals pro Woche ☐ etwa täglich ☐ mehrmals pro Tag ☐ ständig
2.2	Wie häufig müssen Sie wichtige Entscheidungen unter Zeitdruck treffen? ☐ ein Mal pro Woche ☐ mehrmals pro Woche ☐ etwa täglich ☐ mehrmals pro Tag ☐ ständig

2.	**Angaben zur zeitlichen Arbeitsstruktur (Fortsetzung)**
2.3	Wie häufig kommt es vor, dass Sie eine Entscheidung treffen müssen, ohne dass Ihnen dafür ausreichende Informationen zur Verfügung stehen? ☐ Seltener als ein Mal pro Monat ☐ etwa ein Mal pro Monat ☐ mehrmals pro Monat ☐ mehrmals pro Woche ☐ täglich
2.4	Wie häufig müssen Sie Entscheidungen treffen, bei denen Sie die Folgen nur schwer abschätzen können? ☐ Seltener als ein Mal pro Monat ☐ etwa ein Mal pro Monat ☐ mehrmals pro Monat ☐ mehrmals pro Woche ☐ täglich
2.5	Wie häufig kommt es vor, dass Patienten oder Angehörige überzogene Ansprüche an Sie stellen? ☐ Seltener als ein Mal pro Monat ☐ etwa ein Mal pro Monat ☐ mehrmals pro Monat ☐ mehrmals pro Woche ☐ täglich
2.6	Wie häufig kommt es vor, dass Patienten oder Angehörige Ihnen Vorwürfe machen? ☐ Seltener als ein Mal pro Monat ☐ etwa ein Mal pro Monat ☐ mehrmals pro Monat ☐ mehrmals pro Woche ☐ täglich

3.	**Angaben zu Weiterbildungsmöglichkeiten**	trifft voll zu				trifft nicht zu
3.1	Ich habe ausreichend Gelegenheit bei der Arbeit Neues dazuzulernen.	☐	☐	☐	☐	☐
3.2	Meine Arbeit bietet mir ausreichend Abwechslung.	☐	☐	☐	☐	☐
3.3	Die Facharztausbildung der Assistenzärzte wird in unserer Abteilung gut gefördert.	☐	☐	☐	☐	☐
3.4	In unserer Abteilung haben unerfahrene ärztliche Kollegen ausreichend Gelegenheit vom Wissen und Können erfahrener Kollegen zu profitieren.	☐	☐	☐	☐	☐
3.5	Die fachliche Fortbildung der Ärzte wird in unserer Abteilung gut gefördert.	☐	☐	☐	☐	☐
3.6	Insgesamt bin ich mit meiner Arbeitssituation zufrieden.	☐	☐	☐	☐	☐

Appendix 5: Coding Scheme for Study II

Descriptive information considering egocentric networks

Category	Subcategory	Description	Example
Groups in the network		Descriptions of groups in the network	„Das ist jetzt halt, dass wir da so ein Team aus 20 bis 30 Assistenzärzten sind. Da jetzt jeden einzelnen aufzuführen, weil die ja immer unterschiedlich in Konstellationen zusammenarbeiten. Weil man sich da schon auch immer mit den entsprechenden Assistenzkollegen austauscht, die jetzt ungefähr genauso viel Berufserfahrung haben. Da müsste man jetzt jeden einzelnen aufführen." (JD15/49)
Content of interaction	Advice	Asking or getting advice on practical procedures	„Das sind ja dann fast alle. Eigentlich sind das ja, selbst, ja, ok. Also, mal alle Konsiliare. In mancher Hinsicht ist das auch die Pflege, als Anfänger profitiert man auch ganz gut von der Pflege. Eigentlich sind das alle für mich Ratgeber im Moment noch. Also auf unterschiedlichen Ebenen halt." (JD21/89)
	Teaching	Intentional teaching situation	„Und dann würde ich sagen Stationsarzt und der andere Assistenzarzt sind dann die, die bringen einem eher so bei, wie geht man klinisch vor, was gibt man, wie diagnostiziert man Krankheiten, wie therapiert man Krankheiten. Das ist eher auch theoretisch so ein bisschen aber andererseits auch, wenn ich mitkommen und die jemanden aufklären oder schlechte Nachrichten verkünden, […]." (JD19/71)
	Emotional support	Asking or getting emotional support	„Das tun Freunde vor allem. […] Das ist auch gut, wenn die medizinisch gebildet sind, weil es einfach leichter ist sich zu unterhalten. Ähm. Dann machen das die Kollegen vor allem. Weil man sich da auf gleicher Ebene austauschen kann. Das geht eigentlich mit denen auch ganz gut." (JD3/84)
Factors affecting social interaction/learning	Availability	Availability of interaction partner influencing interaction	„Ja, das ist halt so, Herr [JD1_a3] ist nicht immer da, er arbeitet auch in einem weiteren Krankenhaus. Aber wenn er da ist, dann ist er sehr hilfreich." (JD1/36)

Category	Subcategory	Description	Example
	Structure of work/rotations	Interaction affected by structural patterns	„Mit den Oberärzten und Chefärzten aus der anderen Abteilung habe ich nur zu tun, wenn ich in der Notaufnahme bin und dann ist das ein relativ schneller Ansprechpartner. […] Im Stationsalltag brauche ich die wiederum wenig." (JD3/50)
	Friendship	Friendship affecting social interaction	„Ne, man muss halt wissen, dass ich mit den meisten Leuten bis auf die Nummer 4 auch befreundet bin." (JD5/76)
	Working climate	Working climate affecting social interaction	„Dann ein Kollege, der Facharzt ist und ich habe eigentlich am meisten Vertrauen zu diesem Kollegen." (JD2/38)
	Complexity of question/ competence of alter	Complexity of the question and perceived competence of the alter affecting social interaction	„Also, wenn ich zum Beispiel nicht weiß, was ich mit einem EKG machen soll, dann gehe ich erst zu meinen Kollegen. […] Wenn das etwas ist, was die auch noch nicht gesehen haben, dann zeige ich das meiner Oberärztin und wenn niemand weiß, dann gehen wir zum Chef. Das geht dann schon so schrittweise. Wenn ich jetzt eine superkomplexe Frage habe oder weiß, die anderen wissen das auch nicht, dann gehe ich gleich zum Oberarzt." (JD3/70)
	Individual engagement	Individual agency and engagement affecting opportunities for social interaction	„Ah ja, und die [Konsiliare] bringen einem auch etwas bei, wenn sie gerade können. Und das ist so ein bisschen, wenn man die fragt, dann erklären die schon auch, aber die würden jetzt nicht von sich aus hergehen […]." (JD3/80)

Appendix 6: Additional Results for Study II

Table 22 Correlation Matrix of Structural and Relational Network Characteristics

	1	2	3	4	5	6	7	8	9	10	11	12	13
1 Network Range	1												
2 Named Groups	.387	1											
3 D	-.401	-.349	1										
4 C_{nB}	.322	.223	-.910**	1									
5 Cliques	.639**	.273	-.390	.156	1								
6 $IQV^{gender(m/f)}$	.240	.088	.189	-.203	.190	1							
7 $IQV^{gender(group)}$	.292	.468*	-.042	.108	.025	.648**	1						
8 $IQV^{workplace}$	.243	.545**	-.535**	.536**	.260	-.248	.042	1					
9 $IQV^{profession}$	.516*	.378	-.168	.188	.028	.149	.346	-.104	1				
10 E-I index^{gender}	-.012	.595**	-.084	0	-.225	-.169	.441*	.139	.177	1			
11 E-I index^{profession}	.236	-.185	.103	.085	-.343	.061	.002	-.309	.893**	-.058	1		
12 E-I index^{status}	.130	.240	.046	.071	-.252	-.120	-.045	-.039	.329	.241	.201	1	
13 E-I index^{workplace}	.584**	.436	-.185	.180	.285	-.053	.081	.556*	.131	.195	.171	-.123	1

*$p < .05$; **$p < .01$

Table 23   Perceived Working Conditions Scale Values

ID	Structure of work	Professional Develop-ment	Partici-pation	Equity	Time Presssure	Uncertainty	Social Stressors
JD1	3.00	4.40	3.00	2.00	4.00	1.00	2.50
JD2	3.00	4.20	3.50	2.00	4.00	5.00	3.00
JD3	3.25	3.60	4.00	2.00	2.50	2.50	4.00
JD4	3.00	3.20	3.50	4.50	3.50	3.00	2.00
JD5	4.00	2.00	2.00	2.00	2.00	3.50	3.50
JD6	5.00	4.00	5.00	2.50	2.00	3.00	2.00
JD7	3.00	3.40	2.50	2.00	5.00	3.00	3.00
JD8	3.50	4.20	1.50	2.50	3.50	4.00	4.00
JD9	3.25	3.80	1.50	2.00	4.50	4.00	3.50
JD10	3.25	3.00	3.00	3.00	3.00	2.50	2.50
JD11	4.50	4.00	5.00	1.50	3.00	3.00	3.00
JD12	3.00	3.20	2.00	3.00	2.50	3.50	2.00
JD13	3.00	2.40	3.50	1.00	3.50	3.00	2.00
JD14	2.50	3.80	3.50	3.00	3.00	2.50	2.00
JD15	3.00	2.00	3.00	2.00	2.50	4.00	3.00
JD16	3.50	3.00	1.00	2.50	1.00	3.00	4.50
JD17	3.50	4.20	2.50	2.00	2.50	3.00	2.00
JD18	3.50	3.80	3.00	2.00	3.50	3.00	3.50
JD19	5.00	4.20	3.50	2.00	3.00	3.50	4.50
JD20	4.50	4.20	3.00	3.00	2.00	2.00	1.50
JD21	4.25	4.20	3.50	2.00	1.50	1.00	1.50
JD22	4.00	3.40	3.50	3.00	2.00	2.50	2.00
JD23	2.75	4.20	2.50	3.50	3.50	3.00	4.50
M	3.53	3.58	3.00	2.39	2.93	2.98	2.87
SD	0.71	0.72	1.00	0.74	0.97	0.90	0.98

Note: Scale values represent the mean values of all items related to the scale.

Table 24   Correlation Matrix (Kendall's Tau b) of Social Network Characteristics and Perceived Working Conditions

	Allocation and Structure	Profess. Develop-ment	Parti-cipation	Equity	Time Pressure	Un-certainty	Social Stressors
NW Range	.031	.039	.293	-.019	.009	-.406[*]	-.230
D	-.051	-.025	-.296	-.121	-.101	.040	-.021
C_{nB}	.017	.143	.291	.069	.168	.079	.090
Cliques	-.023	-.112	.333[*]	.247	-.247	-.268	-.387[*]
$IQV^{gender(m/f)}$	-.218	.031	.072	.194	-.079	-.138	-.358[*]
$IQV^{gender(group)}$	-.118	.204	.115	.019	.013	-.082	-.018
$IQV^{workplace}$	.070	.134	.013	.119	-.095	-.108	.092
$IQV^{profession}$	-.004	.070	.031	-.153	.296	.027	-.084
E-I index^{gender}	-.090	.014	-.301	-.193	.126	.093	.152
E-I index^{profession}	-.138	-.209	-.087	-.031	.312	.077	-.015
E-I index^{status}	.155	.103	-.078	-.377[*]	.017	-.031	.130
E-I index^{workplace}	-.138	.013	.045	-.104	.101	-.362[*]	.039

*$p < .05$; **$p < .01$

Table 25 Correlation Matrix of Network Characteristics and Performance Scores

	OK_V1	TM^{MED}_V1	TM^{META}_V1	TM_V1	PERF_V1	OK_V2	TM^{MED}_V2	TM^{META}_V2	TM_V2	PERF_V2
Network range	.079	-.094	.249	.028	.071	-.306	-.052	-.102	-.089	-.239
D	-.128	.117	-.113	.062	-.001	.026	-.090	.052	-.065	-.044
C_{nB}	.243	-.236	.070	-.206	-.089	.076	-.047	.055	-.023	.019
Cliques	.039	.031	.412	.233	.266	-.020	-.121	-.154	-.173	-.164
Multiplexity	-.129	-.010	-.248	-.133	-.209	.186	.341	-.091	.285	.351
$IQV^{gender(m/f)}$	.067	-.063	-.041	-.089	-.058	.185	-.008	-.252	-.105	.004
$IQV^{gender(group)}$	-.176	-.016	-.026	-.028	-.123	-.094	.194	-.539**	-.027	-.073
$IQV^{workplace}$	.030	-.206	.334	-.048	-.035	-.048	.015	-.339	-.117	-.129
$IQV^{profession}$	-.209	.241	-.174	.171	.069	-.306	-.083	-.04	-.094	-.243
E-I index^{gender}	-.497*	-.021	-.388	-.209	-.481*	-.394	.461*	-.469*	.293	.042
E-I index^{profession}	.361	-.234	-.143	-.322	-.140	-.134	-.119	.640**	.094	.008
E-I index^{status}	-.182	.044	-.586**	-.236	-.346	.157	.156	.253	.245	.299
E-I index^{workplace}	.050	-.059	.238	.066	.092	-.682**	-.116	-.246	-.211	-.542*

*$p < .05$; **$p < .01$