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## Understanding clinical reasoning: A phenomenographic study with entry-level physiotherapy students

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### ABSTRACT

**Introduction:** Entry-level students' conceptualizations of clinical reasoning can provide a starting point for program planning related to clinical reasoning development with a focus on patient-centered care

**Objective:** The aim of the study is to explore how physiotherapy students understand clinical reasoning midway through their education. Nine physiotherapy students were interviewed at the end of their third semester

**Methods:** Semi-structured individual interviews were conducted, recorded and transcribed verbatim. A phenomenographic approach to qualitative data analysis, seeking to explore variations in students' conceptions was applied

**Results:** The students' ways of understanding clinical reasoning could be described as: 1) the cognitive process of the physiotherapist; and 2) the relational process of the collaborative partnership between the physiotherapist and the patient. A contrastive analysis shows how the cognitive and relational perspectives are developed through the relationships among three dimensions of clinical reasoning: 1) problem-solving; 2) context of working; and 3) own learning

**Conclusion:** By identifying the critical variation in students' conceptions of clinical reasoning, focus can be placed on pedagogical arrangements to facilitate students' progression toward a person-centered approach.

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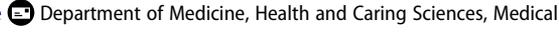
Clinical reasoning; students; learning; phenomenography; education

## Introduction

Clinical reasoning (CR) concerns thinking and decision-making in professional practice. This is often referred to as a core skill by physiotherapists and other health professionals for solving clinical problems, as well as to establish rapport with patients (Higgs and Jones, 2008; Smith, Higgs, and Ellis, 2008). Clinical reasoning is described as a complex, interactive phenomenon, contextualized to the unique situation and workplace of the practitioner, the patient, and the practice model (Edwards et al., 2004). Skills in clinical reasoning are claimed to be of utmost importance to reduce errors and ensure patient safety. Core dimensions of clinical reasoning are described as practice knowledge, cognition and metacognition (Higgs and Jones, 2008). Previous research on clinical reasoning predominantly addresses the cognitive processes of the therapists' thinking and decision-making (Hendrick, Bond, Duncan, and Hale, 2009; Norman, 2005). Hypothetico-deductive reasoning, pattern recognition and narrative reasoning are well

known examples. Hypothetico-deductive reasoning is described as a cognitive investigative reasoning process (Edwards et al., 2004; Jones, Jensen, and Edwards, 2008). Pattern recognition is the cognitive process of forming, recognition and reconstruction of patterns as described by Barrows and Feltovich (1987). Narrative reasoning is described as a collaborative process between the therapist and patient. The therapist's focus in the narrative model of reasoning is directed toward understanding and gaining insight into patients' stories. The aim of narrative clinical reasoning is also to understand the patients' abilities to make choices and their perspectives on treatment and recovery. Professional-patient collaboration is necessary to achieve patient-centered clinical practice (Bleakley, 2005; Edwards et al., 2004; Mattingly, 1991).

Students and novice physiotherapists have difficulty integrating the patients' needs and experiences with their own reasoning and decision making in practice (Cruz, Caeiro, and Pereira, 2014; Cruz, Moore, and

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Cross, 2012; Hendrick, Bond, Duncan, and Hale, 2009; Smith, Higgs, and Ellis, 2008). The collaborative dimensions of clinical reasoning include the co-production of reasoning and decision-making in the patient's own health care process (Batalden et al., 2016). Clinical reasoning has also been suggested as a useful way of articulating and understanding core competences, roles and responsibilities in interprofessional health care (Gummesson, Sundén, and Fex, 2018; Kiesewetter, Fischer, and Fischer, 2017).

Ways of clinical reasoning have been shown to differ between novices and experts across various types of patient encounters. Students and novice physiotherapists most often apply a hypothetico-deductive reasoning strategy when faced with complex problems (May, Greasley, Reeve, and Withers, 2008; May, Withers, Reeve, and Greasley, 2010). Expert reasoning strategies are, on the other hand, characterized by pattern recognition, drawing on previous experiences of similar cases and narrative reasoning (Edwards et al., 2004). A qualitative study by Wainwright, Shepard, Harman, and Stephens (2010) described these differences between novice and experienced physiotherapists. Novice physiotherapists were shown to draw on informative factors, such as academic content and faculty mentorship, anticipated patient behavior, personal experience and reflection-in-action. Experienced physiotherapists were shown to draw on directive factors such as medical records, observation of the actual patients' movements, problem-solving psychosocial abilities and on reflection-in-action.

The emphasis on clinical reasoning skills as core competencies of physiotherapists make such skills central learning objectives of entry-level physiotherapy education worldwide. According to the World Confederation for Physical Therapy (2011) guidelines for physical therapist entry level education, the curriculum should prepare the students to meet the physical therapist's practice expectations, which include the capabilities of "clinical judgment and reflection to identify, monitor and enhance clinical reasoning to minimize errors and enhance clients/patient outcomes" (p. 13). In addition, students should also be prepared to consistently apply current knowledge and consider a patient/client perspective in the management of care. Sandborgh et al. (2020) argued the need for inclusion of behavioral competencies as core content of physiotherapy curricula. Behavioral competencies are considered necessary in order to reach the goals of the World Confederation for Physical Therapy guidelines, as well as of the International Classification of Functioning, Disability and Health

(ICF) (World Health Organization, 2001). Elvén, Hochwälder, Dean, and Söderlund (2019) showed that cognitive and metacognitive capabilities and positive attitudes were important predictors of physiotherapy students' clinical reasoning skills. Elvén, Hochwälder, Dean, and Söderlund (2019) findings also indicated that curricula with behavioral medicine competencies were associated with positive outcomes at all clinical reasoning levels. However, the way clinical reasoning is defined, taught and assessed in undergraduate physiotherapy curricula varies considerably across programs, during theoretical studies, as well as in clinical placements (Christensen et al., 2017; Montpetit-Tourangeau et al., 2017).

Ritchhart and Perkins (2005) suggested that when entering clinical practice, students often face challenges because they lack a deeper understanding of facts and concepts relevant to the clinical situation they encounter. Physiotherapy students also lack reflective and critical thinking skills important for clinical reasoning (Christensen, Jones, Edwards, and Higgs, 2008). The issue of how to facilitate the learning of clinical reasoning skills in the undergraduate education of physiotherapists, hence stands out as an important area for physiotherapy educators. A qualitative interview study of physiotherapy students' experiences with clinical reasoning in clinical placements by Wijbenga, Bovend, and Driessen (2019) showed three themes of importance for students learning clinical reasoning: 1) the learning environment, including the clinical setting, the health care team and patient-related activities; 2) the clinical supervisor/teacher; and 3) the individual student's development of clinical reasoning. Other studies have focused on the variation in how undergraduate students conceptualize clinical reasoning as a phenomenon (Cruz, Moore, and Cross, 2012; Hendrick, Bond, Duncan, and Hale, 2009). Gilliland and Wainwright (2017) suggested that one step toward understanding how physiotherapy programs best can support students' development of clinical reasoning is to examine how they engage in clinical reasoning. This suggestion is also the rationale for the present study. The present study applies a phenomenographic framework and approach to the research on learning.

Phenomenography emphasizes that the understanding of students' ways of thinking are important for teachers' pedagogical planning. Marton (1986) argued that "*encouraging teachers to pay attention to students' ways of thinking and to facilitate students' realization that there are different ways of thinking may be one of the most important pedagogical implications of a phenomenographic view of learning.*" The aim of the

study is to explore how physiotherapy students midway through their entry level education understand clinical reasoning.

## Method

### Study context

This study was conducted in Sweden with students from a program in physiotherapy. Swedish undergraduate physiotherapy education follows a 3-year national curriculum, leading to a Bachelor's degree approved by the Ministry of Education and Research. For an overview of Swedish physiotherapy education see Häger-Ross and Sundelin (2007). The local curriculum of the physiotherapy program in this study is aligned with the national curriculum, embedding clinical reasoning in a theoretical framework comprising three cornerstones. These are: 1) International Classification of Functioning, Disability and Health (ICF) (World Health Organization, 2001); 2) bio-psycho-social perspective; and 3) person-centered model of care where the patient is seen as a partner in shared reasoning and decision-making (Batalden et al., 2016). Clinical reasoning is introduced gradually from the beginning of the studies and is integrated through problem-based learning activities (PBL). PBL emphasizes students' own responsibility for learning (Barrows, 1985; Bate, Hommes, Duvivier, and Taylor, 2014).

### Participants

In autumn 2016 all 36 students at the end of the third semester of the physiotherapy program of six semesters in total were invited to participate in the study and nine students, one male and eight females gave their informed consent to do so. The participating students were between 22–26 years of age, and their previous

experiences of health care work outside the physiotherapy program varied. The students were given information orally as well as in writing about the study and were invited to ask for more information if needed. The students were assured that their participation in the study would not impact on their assessment or result of the course. The Regional Ethical Review Board gave an advisory statement with no ethical objections to the study (11/01/16).

### Data collection

A semi-structured, individual interview guide was designed, inspired by Hendrick, Bond, Duncan, and Hale (2009) and Cruz, Moore, and Cross (2012). The content was customized to the conditions of the present study. Two pilot interviews were conducted with physiotherapy students not participating in the study, after which the interview guide was slightly revised. The interviews were conducted after the students had completed their first longer clinical placement (6 weeks). All interviews were carried out by the second author (KV) at the time Director of Studies, a formal and administrative role at the program, and not a member of the teaching staff. None of the authors was involved in the students' assessments or grading. All interviews were recorded, ranged from 45 to 65 minutes and were conducted under undisturbed conditions at the university campus.

The participants were asked to describe their understanding of clinical reasoning and how they achieved that understanding, by giving examples and elaborating on the subject (Table 1). The general follow-up probes were inspired by Hendrick, Bond, Duncan, and Hale (2009) and Stenfors-Hayes, Hult, and Dahlgren (2013). To ensure richness in the data the interviewer used different general probes such as: "Can you tell me more about.?", "How does it happen?"; and "How did you do

**Table 1.** Interview guide.

<i>What does 'clinical reasoning' mean to you?</i>		
Consider a patient (or patient situation) about whom you can develop your reasoning.		
<i>During your studies/ the educational programme/ clinical placement</i>		
What have you learned about clinical reasoning?		
Supported development?	Hindered development?	Own responsibility/initiative?
Helped the most?	Challenges?	Educators' roles/importance?
Strengths?	Limitations?	The patient's role?
	Missed out?	
<i>Possible general probes</i>		
Can you tell me more about ... ?		
How does it happen?		
How do you act?		
What did you do then?		
How did you know what to do?		

then?” The interviewer also summarized what had been said regularly during the interviews to make sure that the interviewer interpreted the student correctly.

### Data analysis

The phenomenographic consecutive steps of the analysis followed the ones described by Sjöström and Dahlgren (2002) (Table 2). The analysis was primarily conducted by the second author. All the recorded interviews were transcribed verbatim. In the first step, the transcripts were read several times in their entirety in order to obtain familiarity with the material. The most important and significant answers or quotes in relation to the research question for each participant were then compiled in the second step of the analysis. The quotes were translated from Swedish and lightly edited for readability in English. In the third step, the answers were condensed to find the central parts of longer answers or a dialogue. In the fourth step, the condensed answers were scrutinized and compared in collaboration between the first and second author. Condensed answers were then preliminary grouped according to differences and similarities. The first three steps were repeated several times manually and using NVivo, a software program for qualitative and mixed-methods research. From the preliminary grouping of condensed answers, the ways of understanding clinical reasoning were articulated into two descriptive categories in collaboration between all authors in the sixth step of the analysis. The articulation of each category was re-read several times and compared against the interview transcripts to ensure that no answers could fit into both categories. Preliminary labels were given to the categories. As the final seventh step, the two ways of understanding were contrasted with each other. Common dimensions of clinical reasoning were identified, and the differences in how these dimensions were related were described. The categories portraying the described ways of understanding and the variations between them together form the result of a phenomenographic analysis, called the outcome space (Marton and Booth, 1997).

### Findings

The findings show two qualitatively different ways of understanding clinical reasoning: clinical reasoning based on the cognitive process of the physiotherapist; and based on the relational process of the collaborative partnership with patient and physiotherapist. In the first part of this section the significant features of each way of understanding are described and exemplified with quotations from the interviews. The second part of this section contrasts the two ways of understanding to identify the qualitative differences between them.

#### *Clinical reasoning as based on the physiotherapist's cognitive process*

A characteristic feature of this category was that the physiotherapist alone was described as the active part, responsible for thinking, reasoning and making decisions in the encounter with the patient. The reasoning was described from an “I” perspective and with a focus on moving forward in the patient-related actions. The starting point for clinical reasoning as reflected by the answers pertaining to this category was to gather information in different ways, in different stages of the work process. Typically, the answers referred to information gathered partly from what was visually noted (e.g. if the patient looked tired) but also from what could be read in the medical record. Other sources of information referred to included what could be felt with manual palpation and what could be retrieved from the patient history. The information gathered was described as necessary for the physiotherapist to define the problem and what was central to the situation. The goal of clinical reasoning in this category focused on which examinations and actions to carry out. i.e. what the physiotherapist would do “to” the patient. No active interaction between physiotherapist and patient was expressed in the answers pertaining to this category.

(. . .) you meet the patient and you see how they feel, see if they have, what's the problem. Whether they need to cough, or they need to get up and walk. So, based on if

**Table 2.** Consecutive steps of the phenomenographic analysis (Sjöström and Dahlgren, 2002).

Familiarization	All transcripts were read to become acquainted with the empirical material
Compilation	All answers from all respondents to each question was compiled in order to identify the variation between answers
Condensation	Individual answers were condensed to identify the central parts of longer answers or dialogue
Grouping	Preliminary grouping of similar answers into categories
Comparison	The categories were re-read to establish borders between them. Some revisions were made.
Naming	Preliminary names were given to the categories. Some of the earlier steps were repeated several times before determining the final labeling of the categories.
Contrasting	The unique character of every category and the resemblances and differences between categories were described.

they look alert or tired, if they feel unwell or not, you decide; Should we get up and walk, should we just sit on the bedside ... so you decide what action to take, what to do with the patient ... and then you evaluate in the meantime based on what you saw from the start. (P1)

(...) [clinical reasoning is] how you think and reason and how you act in ... a patient meeting as well as a patient situation based on ... sort of what you see and what, what you find (...) (P3)

The answers describe how the definition of what the patient's problem comprised was verified through a stepwise problem-solving process, that was seen as central for productive clinical reasoning.

I think clinical reasoning is ... what I choose to do with the patient I have in front of me ... That I get some things out of my history taking that I choose to look in to further ... and that you choose what is relevant to the problem through the whole clinical examination ... and also set goals and interventions. (P6)

For me clinical reasoning is ... well a kind of a way of processing problems ... If you take it from when a patient comes to me, I figure out what the problem is and then make my plan based on what I find and my previous experiences ... and personalize ... and set goals and

interventions. (P5)

The answers also emphasized the importance of context in terms of organizational conditions such as work routines, material and personnel resources as important for clinical reasoning. Work routines and personnel resources determined time frames that affected the physiotherapists' ways of carrying out relevant history taking and examination for correct diagnosis and treatment decision making.

(...) you have different care teams, you have different kind of wards, you have different resources ... so based on how the ward looks or what everything around you looks like, you have to figure out the best results for the patient. (P2)

I have been in a surgical /ward ... where they do heart and lung surgery and many patients undergo the same, same procedure and you already have a thought before surgery what you will do with them ... so you already have a plan before they come from surgery(P5)

The answers also reflected students' difficulties in analyzing and evaluating the collected information at the different stages of examination and assessment. The difficulties led to insecurity, but also were a driving force for learning. Common sense and logical thinking were seen as resources when knowledge and experience were lacking.

I think that, the more patients you meet, the more different patients you meet, the more you have to reason about ... Yes, but (as I said to the patient), I had a patient at that time that looks like your case a bit, so we can try this and see if we can proceed like this. (P2)

A feature of this category was also a belief that increased knowledge and experience from decision-making and acting in work with similar cases and different patients, would lead to learning and increased security in clinical reasoning (student P2).

### ***Clinical reasoning as based on the relational process of a collaborative partnership between patient and physiotherapist***

The answers in this category were characterized by the view of each patient being unique. Both physiotherapists and patients were described as being active in the process of reasoning. Hence, the encounter with the patient was seen as of great importance, as well as to allow proper time for this dialogue.

A man for example, had COPD, chronic obstructive pulmonary disease. I think he had pneumonia but I'm not really sure. But then my supervisor and I went to him and we listened to how he was and how he thought the problem was and what he wanted to get out of care and what his goals were. And based on that, the patient and I made up a plan of how to train with him. When I first read his medical record, he sounded very sick, but then when I met him, I discovered ... Yes, but he can do more than you think, so the patient and I had to adapt the training very much to him. What we had planned to do from the beginning might not have been relevant, because he could do so much more than that. (P8)

Typically, the dialogue was seen as necessary to capture the meaning of what the individual patient expresses in the meeting with the physiotherapist in terms of what the patient wants to get out of the physiotherapy and what might increase or decrease the patients' motivation.

And then there was a lot of clinical reasoning, based on what my supervisor and I had read in the medical record and that, but also what we heard from the patient. The patient and I decided how to proceed and how we would plan the training and so on. (P8)

The decision-making was expressed as belonging to physiotherapists' actions and responsibilities. Hence, the dialogue with the patient was seen as forming and directing physiotherapists' actions and the subsequent processes making the patients' voices in the clinical reasoning process clearly expressed. The primary role of the physiotherapist was seen as a process of learning

to reason in order to adapt ways of thinking, reasoning and acting to achieve the best care for the patient, as illustrated in the quotation below.

I want the patient to achieve his or her goals or to get well and I want to understand why, or what the patient wants to achieve and how, how I can help in the best way. And in order for me to be able to help in the best possible way, I have to think, or reason clinically in order to get the best result. ./ You have the theory behind what you have read . . . the same as with experience . . . what you have learned helps you to reason in a good way . . . you have to know why you do things to be able to reason about it . . . If you don't know, then you have to reason your way to how it should be . . . you still have to think a little bit logically to do that. (P8)

### **Contrastive analysis**

The two ways of understanding described were characterized as either emphasizing the cognitive process, or the relational process of clinical reasoning. In the contrastive analysis, we describe how the differences in understandings are built up through the way three common and interdependent dimensions of clinical reasoning are related to each other. The common dimensions are: 1) problem-solving; 2) context of working; and 3) own learning.

When emphasizing the cognitive process of clinical reasoning, the dimension of problem-solving was described as the physiotherapist's step-by-step process with a predetermined and clear structure to rely on. Predefined steps such as defining the problem, examining the patient, setting goals, implementing interventions and evaluation of progress, were mentioned in the descriptions, and often given in a logical sequence. The dimension of problem-solving in this instance was linked to the context of working referred to. The informants holding a cognitive process view of clinical reasoning referred to the context regarding possibilities and limitations of the physical environment, such as the design of the wards. The physical environment was perceived as influencing how the physiotherapist could conduct the problem-solving process through history taking, clinical examination and decisions regarding treatment.

Informants holding a relational process view of clinical reasoning, instead described the problem-solving dimension of clinical reasoning as embedded in the interactions between physiotherapists and patients. The interactions were seen as decisive and important for obtaining the patients' perspectives, their descriptions and perceptions of what the problem meant to them. Understanding clinical reasoning as a relational process

also meant that the context of working was seen as relational, referred to as the patient's experienced situation. The third dimension of clinical reasoning found in both ways of understanding concerns the students' own learning processes. Typically, the answers indicate that learning is an important dimension of clinical reasoning. Understanding clinical reasoning as a cognitive process meant that limited knowledge and practical experience of similar cases were seen as influencing ways of thinking, reasoning and making decisions in patient-related work. A qualitatively different way of emphasizing the importance of learning was displayed in the relational understanding of clinical reasoning, where learning was described as an ongoing process. In this process, the integration of connections to theory, the understanding of the patient's experienced situation and problem in context were considered important driving forces for continued learning.

### **Discussion**

When viewing the findings of this study in relation to previous research on clinical reasoning, we can note that students' ways of understanding both reflect features that have been shown as characteristic of novice physiotherapists as well as of more experienced physiotherapists. Cognitive-based clinical reasoning, based on aspects of the cognitive process of the physiotherapist, appears basically understood as an operating scheme or a step-by-step problem-solving process. This way of understanding resembles novice physiotherapists' clinical reasoning, described in the findings of Wainwright, Shepard, Harman, and Stephens (2010) as mostly relying on informative factors, such as academic content and expected patient behavior. The way of understanding clinical reasoning as being cognitively based is also consistent with earlier research showing that students, in general, were therapist centered (Cruz, Moore, and Cross, 2012; Hendrick, Bond, Duncan, and Hale, 2009) and primarily used a hypothetico-deductive reasoning strategy (May, Greasley, Reeve, and Withers, 2008; May, Withers, Reeve, and Greasley, 2010). Similar findings were also described by Hendrick, Bond, Duncan, and Hale (2009) who showed that physiotherapy students in early entry-level study years had a less holistic and sophisticated view of clinical reasoning than more experienced students.

The understanding of clinical reasoning as a relational process in the present study showed, however, a different pattern of relationships between the aspects of problem-solving, working context and own learning, indicating an integrated understanding of clinical reasoning as a collaborative partnership with the patient. The individual patient's perspectives on his/her situation, problem

and goals were taken into account, were seen as necessary in order for the physiotherapist to know how to facilitate the process. This pattern was more in resemblance with what in previous research has described as characteristic of more experienced physiotherapists. Experienced physiotherapists relied on directive factors (Wainwright, Shepard, Harman, and Stephens, 2010) such as taking the starting point in the various circumstances of the actual patient in front of them (Nesbit, Randall, and Hamilton, 2016). The understanding of clinical reasoning as a relational process described in the present study suggests that it was possible to establish a way of understanding the complexity of clinical reasoning and to integrate important dimensions thereof at the point of the third semester of the entry-level education. According to Elvén, Hochwälder, Dean, and Söderlund (2019) curricula with behavioral medicine competencies are associated with positive outcomes at all clinical reasoning levels. The findings of the present study indicate that the educational design of the local physiotherapy program, where a bio-psycho-social perspective is included, supports students' learning of clinical reasoning skills in this respect.

### **Implications for a clinical reasoning curriculum**

How can physiotherapy educators help physiotherapy students develop a collaborative way of understanding clinical reasoning in their entry-level education? Reflecting on the intended learning outcomes in the clinical reasoning curriculum at the physiotherapy program in this study, it is notable that some outcomes are focused on the development of a professional attitude and good communication, but on the other hand, several objectives are only focused on technical skills for the student to provide correct examinations, interventions and assessments. The objectives do not make explicit that these different objectives are closely interrelated to inform a person-centered approach. A recent study by Fritz, Söderbäck, Söderlund, and Sandborgh (2019) showed that the integration of a behavioral medicine approach into clinical physiotherapy practice was dependent on multiple determinants. Some determinants on the micro-level were the physiotherapist's knowledge, skills and self-awareness. Other determinants were the patients' expectations on the role of the physiotherapist, or whether the patients were active or passive agents in the treatment process (Fritz, Söderbäck, Söderlund, and Sandborgh, 2019). A clinical reasoning curriculum designed in collaboration with educators from both clinical and academic settings could stimulate a shared

understanding of the phenomenon clinical reasoning, as well as of the clinical practice communities in which students participate in during clinical placements.

Sandborgh et al. (2020) provided several important examples of such collaborative curriculum development. One such example was how experienced physiotherapists could be involved in revision of the local curriculum (e.g. in the development of clinical competency portfolios for students' practice and checklists for assessment purposes).

However, the findings of the present study also call for a broader discussion of more general interest about the pedagogical arrangements and learning activities for physiotherapy students. And, more importantly, what ways those pedagogical arrangements make it possible for them to learn. Marton (2018) argued that there was a need for a more systematic and analytic approach to set up learning arrangements. *"It is not the objectives, as words, that affect the students; it is how the object is brought to life within a lecture, tutorial or other teaching-learning activities – what the student encounters is what is possible to learn."* Based on the collated empirical research evidence from phenomenographic research, empirical learning studies under different pedagogical designs demonstrate necessary conditions for students' understanding (Marton, Runesson, and Tsui, 2004). Learners need to experience a sufficient pattern of variation. The two ways of experiencing clinical reasoning as described in this study can also be found among physiotherapists in clinical practice.

A systematic review by Wijma et al. (2017) on patient centeredness in physiotherapy from the perspective of physiotherapists and patients aimed to construct a proposed conceptual framework for use in physiotherapy. The findings include the characteristics of offering individualized treatment, continuous communication, and education during all aspects of treatment, working with the patient. Further characteristics mentioned were defined goals, treatment in which the patient is supported and empowered, and a physiotherapist with patient-centered social skills, confidence and knowledge (Wijma et al., 2017). While supporting the idea of such conceptual frameworks for clinical reasoning, we would also suggest that the pedagogical arrangements need to include tasks that challenge the students to contrast their experiences of clinical reasoning across different cases. The simultaneous awareness of all identified aspects of the content to be learned, and how these are interdependent is crucial for learning and understanding (Marton, 2018).

## Methodological reflections

In phenomenography, the sampling of participants is often strategic or purposive in order to maximize the possibilities of capturing variations in experiences of a certain phenomenon in a group. The number of participants commonly varies between 10 and 30 (Trigwell, 2006). In this study, nine students were interviewed. The sampling was purposive in the sense that a given cohort of physiotherapy students, who were midway through their physiotherapy program were targeted. They were exposed to the same workshop on clinical reasoning and had their first different experiences of encounters with patients in their respective clinical placements. An analysis of the group of informants revealed three dimensions of heterogeneity: sex, age and previous experience of health care work. In order to protect the students' anonymity, the dimensions of heterogeneity among the participants were described on a general level. It should be noted that the focus of phenomenography is the variation of experiences on a group level. The individual is hence not the unit of analysis. The same participant may express more than one way of understanding the phenomenon in the interview, and in that way contribute to more than one descriptive category of understanding (Marton, 1994). Further, Marton and Booth (1997) argued that the set of categories (i.e. the described ways of understanding) should be parsimonious, presenting the variations in understanding by as few categories as possible.

Although the number of informants in this study was small, the dimensions of heterogeneity in the sample of informants and the variation in ways of understanding clinical reasoning discerned in the material were considered sufficient for a phenomenographic analysis. Following the traditions of a phenomenographic analysis, a structured process was used to ensure the trustworthiness of the analysis. Wahlström et al. (1997) described this as a process of negotiating consensus, where individual suggestions at each step of the analysis are discussed within the research team, until agreement is reached. This means that the final outcome space is the result of several revisions (Wahlström et al., 1997). In the present study, the coauthors, as well an extended group of researchers in a research seminar, were involved in different steps of the analysis to contribute to or validate the process and results.

Due to the qualitative nature of the study, the goal is not generalizability, but to contribute variations of ways of understanding clinical reasoning that could be judged in terms of transferability to similar contexts. The study was confined to a voluntary self-selection from all students invited at one entry-level physiotherapy program

at a Swedish University. A volunteer bias, and a recall bias in relation to students' experiences during their clinical placements, may have influenced students' responses in the interviews. This may have influenced the distribution of conceptualizations of clinical reasoning; however, these factors are unlikely to have changed the range of conceptualizations of clinical reasoning.

## Conclusions

Physiotherapy students' ways of understanding clinical reasoning during their third semester, midway through their entry-level education, could be described as based on the physiotherapist's cognitive process; and as based on the relational process of a collaborative partnership between patient and physiotherapist. A contrastive analysis showed differences between the cognitive and relational way of understanding clinical reasoning in how problem-solving, working context and the student's own learning processes were related to each other.

By identifying the critical variation in students' conceptions of clinical reasoning midway through the educational program, focus can be put on educational design and appropriate learning arrangements that will support and facilitate students' progression toward a person-centered approach.

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