Clinical Reasoning in Medicine: A Concept Analysis

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Abstract

Background: Clinical reasoning plays an important role in the ability of physicians to make diagnoses and decisions. It is considered the physician's most critical competence, but it is an ambiguous concept in medicine that needs a clear analysis and definition. Our aim was to clarify the concept of clinical reasoning in medicine by identifying its components and to differentiate it from other similar concepts. It is necessary to have an operational definition of clinical reasoning, and its components must be precisely defined in order to design successful interventions and use it easily in future research.
Methods: McKenna's nine-step model was applied to facilitate the clarification of the concept of clinical reasoning. The literature for this concept analysis was retrieved from several databases, including Scopus, Elsevier, PubMed, ISI, ISC, Medline, and Google Scholar, for the years 1995–2016 (until September 2016). An extensive search of the literature was conducted using the electronic database. Accordingly, 17 articles and one book were selected for the review. We applied McKenna's method of concept analysis in studying clinical reasoning, so that definitional attributes, antecedents, and consequences of this concept were extracted.
Results: Clinical reasoning has nine major attributes in medicine. These attributes include: (1) clinical reasoning as a cognitive process; (2) knowledge acquisition and application of different types of knowledge; (3) thinking as a part of the clinical reasoning process; (4) patient inputs; (5) context-dependent and domain-specific processes; (6) iterative and complex processes; (7) multi-modal cognitive processes; (8) professional principles; and (9) health system mandates. These attributes are influenced by the antecedents of workplace context, practice frames of reference, practice models of the practitioner, and clinical skills. The consequences of clinical reasoning are the metacognitive improvement of reasoning and tacit knowledge production.
Conclusion: The present concept analysis tries to clarify the concept of clinical reasoning in medicine and reduces the ambiguity of this concept to design successful interventions and use it easily in future research.
Keywords: CLINICAL REASONING, MEDICINE, CONCEPT ANALYSIS, MCKENNA'S MODEL

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Introduction

Clinical reasoning (CR) is an important aspect of health professional education and effective practice (1). It plays an important role in the ability of physicians to make diagnoses and decisions (2). It is considered a central component of physician competence (3) and an integral part of clinical practice (4), so it is one of the major determining factors of clinical competence and physicians' expertise. (2). It refers to 'the cognitive process that is necessary to evaluate and manage a patient's medical problem' (5). It is often associated with but not identical with diagnostic reasoning, clinical decision-making, judgment, medical

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problem solving (6, 7), and is often used interchangeably with these terms (8, 9). For example, clinical reasoning is known as medical problem solving or clinical decision (10). Research on clinical reasoning is a growing field, but it lacks a clear conceptual definition that is applicable in research and clinical practice. It is a vague concept that is often expressed synonymously with other concepts. Therefore, this study focused on a concept analysis. Our aim was to clarify the concept of clinical reasoning in medicine by identifying its components to make it possible to differentiate it from other similar concepts, in order to design successful interventions and use it easily in future research. For this reason, we aimed to analyse clinical reasoning as a specific concept.

Methods

Concept analysis helps to differentiate a concept from similar and dissimilar concepts and to refine and define a concept that emanates from research, practice, and theory (11). McKenna's nine-step model was applied to facilitate the clarification of the concept of clinical reasoning in this study. McKenna's model involves selecting the concept of the interest, defining the aims of the analysis, identifying meaning of the concept, determining the defining attributes, identifying a model case, identifying alternative cases (borderline, related, and contrary cases), identifying antecedents and consequences, considering context and values, and identifying empirical indicators.

The literature for this concept analysis was retrieved from several databases, including Scopus, Elsevier, PubMed, ISI, ISC, Medline, and Google Scholar, for the years 1970 to 2016 (until September 2016). A vast search of the literature was conducted using the electronic database. The following keywords were included in our search: clinical reasoning, clinical judgment, clinical decision making, and problem solving. These key terms were combined with diagnostic reasoning, therapeutic reasoning, and clinical inference. Our search was limited to studies published in English or Persian. Studies conducted in nursing, physiotherapy, and other clinical domains except medicine were excluded. We searched for data until no new attribute for clinical reasoning in medicine and its related concepts were found in the literature.

The resulting literature was initially screened by reviewing titles and abstracts for relevance. As many as 95 articles were extracted in the initial search; 15 articles were identified irrelevant; and the rest were studied regarding the concept of clinical reasoning. Finally, 17 articles and one book were selected for the review. We applied McKenna's method of concept analysis in studying the clinical reasoning so that definitional attributes, antecedents, and consequences of this concept were extracted.

Results

Identifying Meaning of the Concept

As a starting point, we looked at a medical dictionary definition of clinical reasoning and then examined what theorists or researchers have said about the clinical reasoning. Clinical reasoning defined as " higher order thinking in which the healthcare provider, guided by best evidence or theory, observes and relates concepts and phenomena to develop an understanding of their significance" in Mosby's medical dictionary (12), and as "The use of a patient's history, physical signs, symptoms, laboratory data, and radiological images to arrive at a diagnosis and formulate a plan of treatment" in Taber's Cyclopedic medical dictionary (13).There are some meaning of this concept in literature, such as " the set of complex thought and decision-making processes (14), the interpretation of unfolding, contextual, necessarily interpretive (15), integrate and apply different types of knowledge, to weigh evidence, critically think (16, 17), context-dependent way of thinking

and decision making (18, 19), processes of gathering data (1, 19).

Defining Attributes of the Clinical Reasoning Concept in Medicine

The defining attributes distinguish the concept from similar or related concepts. There may be a list of several defining attributes for each concept (11). The concept of clinical reasoning has been used and defined in different ways in the articles. We considered these similarities and dissimilarities and attempted to define attributes of clinical reasoning in a flexible way. In this step, we used two strategies, test for necessity and test of sufficiency. Test of necessity used to see if the defining attribute also applies to the contrary example, then it is an imprecise attribute for the concept being analysed and it can be dropped from the list. In the test of sufficiency, the entire list of defining attributes is considered and, if a contrary case can be identified that meets all the attributes, then an essential attribute has been omitted (11). Clinical reasoning defining attributes include the following:

(1) Clinical reasoning as a cognitive process
(2) Knowledge acquisition and apply different types of knowledge
(3) Thinking as a part of clinical reasoning process
(4) Patient inputs
(5) Context-dependent and domain- specific process
(6) Iterative and complex process
(7) Multi-modal cognitive process
(8) Professional Principles
(9) Health system mandates

Clinical Reasoning as a Cognitive Process:

Clinical reasoning is a cognitive process that includes gathering, analysing, interpreting patient information (15, 19-21), elicitation of patient preferences, expectations, and clinical goal Setting (22), recall, or activation of physician‘s background knowledge (4), integrating, and applying relevant archived codified, and tacit knowledge (16), cyclic/ gathering of patient information guided by hypothesis list leads to gradual unfolding of clinical picture (21), Final judgment and decision about diagnosis (1), produce therapeutic option lists (23), evaluating and weighting competitive options (diagnostic, therapeutic, or preventive) and manage the decisions (1, 4), final judgment and final decision about therapy (24).

Knowledge Acquisition and Apply Different Types of Knowledge

Knowledge acquisition and apply different types of knowledge is the defining attribute of clinical reasoning. Clinical reasoning and clinical knowledge are interdependent (25) and some forms of knowledge, such as tacit knowledge, codified knowledge, statistics, and epidemiological knowledge are used in the clinical reasoning process and need to gain and apply in this process (1, 15, 17, 19, 23–25). These forms of knowledge are inputs to the clinical reasoning process.

Thinking as a Part of Clinical Reasoning Process

Thinking is an inseparable part of the clinical reasoning. Symbolic processing, dialectical thinking, reflective thinking, and critical thinking are some forms of thinking used in clinical reasoning process (14, 26, 27).

Patient INPUTS

Patient inputs are one of the elements included in the definition of clinical reasoning (22), and any definition of clinical reasoning without considering patient inputs, clinical data, and client preferences, are not a complete definition.

Context-Dependent and Domain-Specific Process

Clinical reasoning is a context dependent (1, 15, 18, 19, 22, 28) and domain specific process (23). Although the principles of clinical reasoning are quite similar in different areas of

knowledge, the application of these principles in practice depends on the scope and content of that field.

Iterative and COMPLEX PROCESSES

Clinical reasoning process is an iterative and ongoing, not a linear process (1, 29). It consists of a complex deployment of numerous cognitive processes (29), and is a complex abstract and practice phenomenon (1, 25).

Multi-Modal Process

Clinical reasoning is a multi-modal, analytical and intuitional, cognitive process, depending on the individual's expertise, the modality of clinical reasoning process will be changed (4, 15, 19, 24, 30).

Professional Principles

Physician's practice must comply with the professional principles (18). However, it should be mentioned that, these principles also determine boundaries of clinical reasoning.

Health System Mandates

Physicians must consider health system mandates while deciding about patients. These mandates are developed strategies and policies for the health sector in view of the circumstances, priorities, and constraints unique to each country (18). Clinical practice guidelines (31), standards, and task descriptions are the most usual forms of health system's requirements.

Identifying a Model Case

A model case is a pure instance of the concept being used and should contain all the defining attributes. The model case helps us to ensure that we have the defining characteristics (32). A 40-year-old man with hemoptysis and dyspnea until two months ago visited an internal medicine physician. He was smoking a pack of cigarettes a day for about 20 years, and says that his blood pressure is 'a little high'. He didn't use any medications, but obviously feared for his health. Besides, his father had a heart attack and died at the age of 52. On physical examination and crackles on auscultation of the lungs, diffuse Rhonchi, and wheezing at the upper part of the left lung be heard. The patient's blood pressure is 150/96 mmHg. Based on the signs and symptoms of the patient, and the awareness of the high prevalence of chronic obstructive pulmonary disease (COPD) in smokers, the physician ordered CBC, ESR, FBS, and lipid profile tests for his patient. His laboratory test results showed that Hemoglobin 9(g/dl), greatly increased ESR, Cholesterol 180 mg / dl, and FBS 100 mg / dl. The physician was reflecting on the patient's medical condition, and he considered the patient's condition seriously and started re-analysis of the patient condition. According to the local wheezing relation with the space occupying lesion, and physician visited more young patients suffered from lung cancer recently, he ordered X-ray imaging of the lungs. A 2-cm mass can be seen in the left upper lobe. The physician ordered a biopsy. The results showed non-small cell lung cancer (NSCLC) in stage 2. He decided to prescribe surgery plus chemotherapy, and radiotherapy. In addition, he thinks about mono-clonal antibodies in the patient's treatment regime. According to the principle of autonomy, he says the patient about treatment options, their consequences, and complications, and asked for his preferences, and expectations for treatment. Finally, according to high cost and low effectiveness of mono-clonal antibodies, and no recommendations for these drugs in national guidelines, he didn't t prescribe them. Attention to local wheezing is the lesson that he learns from the management of this patient. This case illustrates the attributes of clinical reasoning. In the case model, the physician is gathering, analysing, interpreting patient information (clinical reasoning as a cognitive process), he learns about the importance of local wheezing and attention to recently diseases which he diagnosed (knowledge acquisition and applying it). He thinks about

cost effectiveness of the drugs and reflects on patient's condition (thinking as a part of clinical reasoning process). He orders tests, X- ray, and biopsy, and gathers clinical and para clinical data (patient inputs). He knows about the local wheezing relation with the space occupying lesion (context-dependent and domain-specific). The patient had many signs and symptoms and physician diagnose his disease (complex process). He re- analysis patient's condition and moves from intuitional to analytical mood (Multi-modal process). He says the patient about treatment options, their consequences, and complications, and asked for his preferences, and expectations for treatment (professional principles). He is aware of the national guideline (health system mandates).

Identifying Alternative Cases (Borderline, Related, and Contrary Cases)

Alternative cases provide examples of what is not the concept (11).

- Contrary cases

The contrary case represents what is *not* the concept being analysed (11) and is a clear example of 'not the concept' (32).

A 40-year-old man with hemoptysis and dyspnea until two months ago visited a person who claims the traditional Chinese treatment. The man takes his pulse and he examines some part of his body, then he claims that vital energy of patient's body is imbalance. He prescribes acupuncture and energy therapy for six months. After six months, the patient went to the emergency unit because of seizure. His primary symptoms are diagnosed because of non-small cell lung cancer (NSCLC) and his seizure because of Brain metastases.

In the contrary case, we can't see none of the defining attributes of clinical reasoning in his practice.

- Related cases

In this case, all the defining attributes are missing but the concept is still seen as similar in meaning to the concept being analysed (11). Clinical skills (such as history taking, physical examination and perform basic procedures) are sometimes assessed instead of clinical reasoning, but they haven't any of clinical reasoning defining attributes.

- Borderline cases

This example is similar to a model case, but some of the defining attributes are missing (11). Critical thinking is not dependent on the domain, or the final clinical judgment is a product of the clinical reasoning process, not clinical reasoning.

- Invented cases

This case is a case that takes the concept out of its normal context and places it in an invented, out-of-the-ordinary, situation (11).

The physician's rationalization to justify his or her practice is not clinical reasoning, but it is sometimes labelled as clinical reasoning.

Identifying Antecedents and Consequences

Antecedents are those events that precede the occurrence of the concept. An antecedent may contribute to the occurrence of the concept, it may be associated with its occurrence or it may need to be present for the concept to be present (11).

Clinical reasoning 's antecedents in this study determined workplace context, practice frames of reference and practice models of the practitioner (24), and clinical skills such as emotional skills, reflective skills, communication skills, critical thinking skills and traits (14, 15, 24).

Consequences are those events or outcomes that happen after the occurrence of the concept (11). Clinical reasoning's consequences are the metacognitive improvement of reasoning and tacit knowledge production in this concept analysis. Clinical reasoning is applied to evaluate the consequences of the intervention and to begin a new cycle of clinical reasoning (19). Physicians integrate and apply different types of knowledge to arrive at a diagnosis during the clinical reasoning (16), as a result of this process, when they encounter with new

case, they can produce new tacit knowledge and then integrate these new knowledge with prior knowledge and store them as knowledge structures in the memory and retrieval these structures from memory (1).

Considering Context and Values

A concept has different meanings depending on the context in which they are used (11) Although the concept of clinical reasoning is quite different from various schools of traditional and complementary medicine, however, since the concept of clinical reasoning in modern medicine (Orthodox) is a similar concept with universal acceptance, context and values do not change the definition of clinical reasoning. It should be noted that this does not mean that the process of clinical reasoning IS independent of the values and context.

Identifying Empirical Indicators

Empirical indicators are explicit referents for appraising or measuring the existence of the concept. This step is often referred to as the operationalization of a concept (11) (Table 1).

Table 1. Empirical indicators of the clinical reasoning

1.Clinical reasoning as a cognitive process
- Clinical judgment:
▪ Mini-Clinical Evaluation Exercise (mini-CEX) (33, 34)
▪ Script concordance test (35-37)
▪ Chart-stimulated recall (38)
- Clinical decision making:
▪ Key feature (39-41)
▪ Chart review (38)
▪ Clinical encounter cards (CEC) (33)
▪ Blinded patient encounters (33)
▪ Case-based discussion (CbD) (33)
▪ Chart stimulated recall (38)
2. Knowledge acquisition and apply different types of knowledge
● Short Answer Questions (SAQ) (42)
● Extended Matching Items (EMI) (42, 43)
● Script concordance test (35-37)
● Oral examination (44)
3. Thinking as a part of the clinical reasoning process
● Chart-stimulated recall (38)
● California Critical Thinking Skills Test (CCTST) (45)
4. Multi-modal cognitive process
● Intuitional: Puzzle Test (PT) (46)
5. Professional Principles
● Mini-Clinical Evaluation Exercise (mini-CEX) (34)
● Clinical work sampling (CWS) (47)

Discussion

The aim of this concept analysis was to define and clarify the concept 'clinical reasoning' in medicine. McKenna's nine-step model was used to investigate the concept 'clinical reasoning' that is a cognitive and dynamic process. It helped clear the ambiguity associated with the concept by presenting nine defining attributes. Researchers in the field of nursing and medicine have provided various definitions of the concept of 'clinical reasoning'. In nursing, the concept of clinical reasoning is considered as the cognitive and metacognitive processes used for analysing knowledge relative to a clinical situation or specific patient (48), and a characteristic that separates professional nurses from ancillary healthcare providers (49). To the medicine, it is considered as the process of thinking critically about the diagnosis and patient management (50), the process by which health practitioners evaluate and make decisions on the diagnosis and management of a patient (1), clinical reasoning as a search for meaning (51).

Our concept analysis showed that the key attributes of clinical reasoning in medicine are clinical reasoning as a cognitive process, knowledge acquisition, application of different types of knowledge, thinking as a part of the clinical reasoning process, patient inputs, context-dependent and domain-specific processes, iterative and complex processes, multi-modal cognitive processes, professional principles, and health system mandates. Alternative cases, antecedents, and consequences of clinical reasoning were identified in this study.

Conclusion

The present concept analysis sought to clarify the concept of clinical reasoning in medicine, thereby reducing the ambiguity of this concept to design successful interventions and use it easily in future research. This study presents attributes from the medicine literature and helps prevent structural discrepancies between the concept of clinical reasoning and other related concepts such as decision-making, clinical judgment, and critical thinking. The identification of key attributes that are crucial to the concept of clinical reasoning, its antecedents, and consequences contribute to design a toolbox for clinical reasoning assessment. The use of other methods of concept analysis, such as Rodgers's evolutionary method, might produce different results.

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Conflict of Interest

The author declares no conflict of interest.

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