Clinical reasoning and its application to nursing: Concepts and research studies

Maggi Banning *

Brunel University, School of Health Sciences and Social Care, Mary Seacole Building, Uxbridge UB8 3PH, Middlesex, United Kingdom

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Summary
Clinical reasoning may be defined as “the process of applying knowledge and expertise to a clinical situation to develop a solution” [Carr, S., 2004. A framework for understanding clinical reasoning in community nursing. J. Clin. Nursing 13 (7), 850–857]. Several forms of reasoning exist each has its own merits and uses. Reasoning involves the processes of cognition or thinking and metacognition. In nursing, clinical reasoning skills are an expected component of expert and competent practise. Nurse research studies have identified concepts, processes and thinking strategies that might underpin the clinical reasoning used by pre-registration nurses and experienced nurses. Much of the available research on reasoning is based on the use of the think aloud approach. Although this is a useful method, it is dependent on ability to describe and verbalise the reasoning process. More nursing research is needed to explore the clinical reasoning process. Investment in teaching and learning methods is needed to enhance clinical reasoning skills in nurses.

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Clinical reasoning; Professional judgement; Clinical reasoning strategies; Nursing practice

Introduction
Clinical reasoning is an essential feature of health care practise that focuses on the assimilation and analysis of health care evidence that is differenti- ated according to its usefulness, efficacy and application to a selective group of patients. This process then informs the decisions that are made pertinent to patient management (Matteson and Hawkins, 1990; Simmons et al., 2003).

Clinical reasoning may be viewed as the hallmark of the expert nurse (Fowler, 1997) and an essential component of nursing competence which is often demonstrated in experienced nurses...
working in various nursing specialisms. The alternative view is that clinical reasoning skills are used by nurses at all levels to inform decisions about the level of nursing care offered to patients (Fisher and Fonteyn, 1995). There are merits of both positions. This paper aims to explore the concept of clinical reasoning and to provide some analysis of the reasoning strategies used by nurses, how clinical reasoning has been examined in nursing research through the use of the think aloud approach.

Reasoning

Reasoning is a process that pertains to the thought processes, organisation of ideas and exploration of experiences to reach conclusions. Reasoning may be viewed as a form of thinking that is often apparent during the presentation of ideas or discourse in which the logistics of an argument are collated in a logical manner in order to reach a rational conclusion.

There are several forms of clinical reasoning; each has its own merits (Burns and Higgs, 2000; Burns and Grove, 2005). Problematic reasoning involves identifying a problem and its influential factors and recognising solutions that may be used to solve the problem (Burns and Grove, 2005). This approach to clinical reasoning can be used to assist nurses to identify nursing diagnoses and to implement nursing interventions that can be used to solve problems.

Theoretical reasoning begins inductively considering a hypothesis using a hypothetico-deductive stance and terminates in a conclusion or a decision (Carr, 1981). In contrast practical reasoning usually terminates in an action, e.g. the result of care planning (Greenwood and King, 1995). The procedure involved is similar to theoretical reasoning as the process begins "logically but only through the hypothetico-deductive manipulation of propositions at progressively decreasing levels of inclusiveness and generality" (Greenwood, 1998, p. 845).

Operational reasoning focuses on the "identification of and discrimination among many alternatives and viewpoints" (Burns and Grove, 2005, p. 7). The focus of this form of reasoning is on the actual process and the identification of opposing views that may be used to determine a solution to the problem (Barnum, 1998). In nursing research operational reasoning can be used to assess and debate the suitability of research methods or data analysis techniques to the research question (Kerlinger and Lee, 2000). This approach to clinical reasoning can be used by nurses to assist patients and their families to develop realistic and measurable goals with respect to their management and nursing care.

Inductive reasoning is a reasoning approach that moves from the specific to the general where instances are combined to form purposive statements (Chin and Kramer, 1999) and where the premises of an argument are believed to support the conclusion, but do not ensure it (Wikipedia, 2007). Inductive reasoning can be used to assess the nursing care of orthopaedic patients who have an altered health state due to sustaining a fracture. The presence of the fracture is stressful for the patient. In this instance, inductive reasoning is used to illustrate that the presence of the fracture is stressful and can be viewed as an altered state of health.

Dialectic reasoning involves looking at situations in a holistic way. "A dialectic thinker believes that the whole is greater than the sum of the parts and that the whole organises the parts" (Burns and Grove, 2005, p. 7). This form of reasoning focuses on the identification and exploration of opposing factors that are then combined in order to explore problems. The merger of factors into a single solution is thought to be more a powerful tactic than the independent assessment of factors. In nursing, dialectic reasoning would involve assessing the strengths and weaknesses of a patient’s problem rather than identifying the patient according to their pathophysiological condition(s).

Clinical reasoning in nursing revolves around the process of making professional judgements, evaluating the quality and contribution of available evidence to enhance problem solving and to consider to what extent the evidence available is sufficient to make decisions on diagnostics and treatment options relevant to the nursing care requirements of the individual (Higgs et al., 2001). It is viewed as a multidimensional, recursive cognitive process that employs formal and informal strategies to assemble and analyse patient information that is then evaluated relative to its significance and contribution to patient management (Simmons et al., 2003). According to Higgs et al. (2001) the decisions that nurses make relevant to the individual health care needs of the patient can be facilitated by the merger of professional judgment and clinical reasoning. Both of which are supported by intuition and knowledge gained from professional experience.

Reasoning strategies

Clinical reasoning pertinent to nursing depends on the development of cognition or critical thinking and metacognition or thinking about thinking. Both of these are inextricably linked to the process of clinical reasoning (Kuiper and Pesut, 2004).
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Metacognition refers to higher order thinking process that involves the active control of cognitive (thinking) processes and the assessment of to what extent cognitive outcomes have been achieved in relation to learning situations (Flavell, 1987; Wikipedia, 2006). Metacognition is generally thought of as ‘thinking about thinking’ and comprises metacognitive regulation or strategies that are used to control or oversee cognitive activities and goals. Metacognitive knowledge can be factual, explicit or implicit (Wikipedia, 2006); these knowledge forms are used in metacognitive processing to enhance participation in cognitive activities to achieve cognitive goals and outcomes (Brown, 1987). During this process individuals will use inductive logic to simultaneously assemble and evaluate patient information and supportive evidence before making judgements about nursing care (Higgs et al., 2001; Simmons et al., 2003).

During clinical reasoning, there is ‘an interaction among the individual’s cognition, the subject matter, and the context of the situation where the thinking occurs’ (Fowler, 1997, p. 349; Lewis, 2007). Nurses use multiple cognitive processes such as making judgements on the use of evidence based on past experience but also on underpinning knowledge, judging client situations, hypotheses generation, diagnostic reasoning and reflection. Metacognition is thought to control cognitive processes (Pesut and Herman, 1992). Although the importance of clinical reasoning cannot be underestimated, it continues to be a poorly defined construct which has been assessed using limited measurement tools. Current nursing research has used a variety of approaches to differentiate the variety of clinical reasoning strategies employed by nurses at varying stages of professional development. The available evidence demonstrates that the clinical reasoning skills employed by nurses have also been labelled as problem solving, clinical judgement, information processing, diagnostic reasoning, and decision-making (Farrell and Bramadat, 1990).

The clinical decision making processes of experienced nurses (Bucknall, 2003; Lauder et al., 2001; Carr, 2004) and pre-registration student nurses (Thompson et al., 2005) has been assessed using a variety of research approaches.

Thompson et al. (2005) and Lauder et al. (2001) used a factorial design to assess student and qualified nurses ability to make judgements. Both studies illustrate the usefulness of using this research approach to assess the ability of nurses to make judgements in relation to patient self-neglect (Lauder et al., 2001) and response to stimulated hypovolemic shock (Thompson et al., 2005). Although Thompson et al. (2005) study illustrated the variability of student responses to clinical data; the small sample size is reflected in the rather high standard deviation data. The results of study may reflect the insufficient time provided for students to assimilate information and apply new theory to clinical examples. Larger replicative studies are needed to justify the results found and to assess the merits of using this approach to investigate clinical decision making.

In her study of community-based nurses, Carr (2004) identified a clinical reasoning strategy that embedded a four-stage framework that is dependent on the underpinning philosophy of care provided and the service organisation involved. The strategy is imbued by signalling responses employed when undertaking a patient’s needs assessment. Relevant signals are filtered and patient assessment skills are reviewed. A framing procedure is used to negotiate patients’ needs and for need identification. The patient’s needs are interpreted and collaborative decisions are made. The final stage involves of the development of action options and whether interventions are needed. These stages reflect the practical reasoning response identified by Greenwood (1998).

Bucknall (2003) assessed clinical decision-making strategies employed by critical care nurses and found these to be context specific. This is in agreement with the view of Fisher and Fonteyn (1995). The physiological assessment of patients in critical care situations is highly dependent on technology, so it is not surprising that critical care nurses relied on the precise information provided by the intensive technologies used in critical care settings. Decision making was positively enhanced by role models and peer support.

Intuition

Benner (1984) was among the first nurse theorists to highlight the relevance of intuition to reasoning skills and to correlate forms of knowledge such as experiential and theoretical to the trajectory of professional nursing practise. It was subsequently proposed that clinical reasoning centres on the synthesis of specific knowledge forms; empirical, aesthetic, personal and ethical forms (Rew, 2000), experience and intuition (White et al., 1992; Radwin, 1998; Claxton et al., 2002), task complexity, education, and level of risk (Fonteyn and Grobe, 1992; Fonteyn, 1995). Proficient clinical reasoning skills can enhance the quality of nursing practise provided through the precision of decision-making. Professionals make decisions using a variety of pre-existing knowledge forms which are supported
by the use and integration of evidence. Such knowledge forms include: propositional, process, personal, functional (Eraut, 1994), technical, experiential, empirical, ethical/moral, aesthetic, emancipatory and intellectual (Higgs et al., 2001). Nurses use these forms of knowledge interchangeably to inform reasoning and decision making processes that are employed on a daily basis.

Intuition is viewed as an insight or understanding of a situation or event as a whole that cannot be logically explained (Rew and Barron, 1987). Schrader and Fischer (1987) also refer to intuition as a type of knowing that seems to come unbidden, and is often described as a ‘hunch’ or ‘gut feeling’ or the immediate knowing of something without the conscious use of reason. The intuitive individual may identify a problem, its existing variables and the relationship between the variables in order to offer explanations and to make associations between the variables.

Intuitive thoughts may arise when the nurse knows something about a patient that cannot be verbalized, that is verbalized with difficulty or for which the source of knowledge cannot be determined (Young, 1987). The lack of scientific rationale behind these hunches or decisions may devalue and cause discomfort with the process and highlight the difficulties encountered communicating the basis of intuitive decisions (Thompson and Dowding, 2001). As a result of these difficulties, there is no way of knowing whether ‘sophisticated conceptualisations . . . are actually used in the cognitive methods individuals deploy’ (Thompson and Dowding, 2001, p. 612). Such conceptualisations may not have a scientific relevance (Luker and Kendrick, 1992) but are imbued by a combination of tacit and personal knowledge (Benner, 1984). Although the knowledge that underpins intuition can be context specific (Fisher and Fonteyn, 1995), competence based and is often difficult to articulate (Reber, 1993), it is an effective method which underpins expert-led decision making (Benner et al., 1998).

Experienced nurse clinicians develop a sense of saliency with regard to intuitive thought and problem-solving which is based on the utilisation of considerable quantities of personal knowledge and experience (Jacavone and Dostal, 1992), but is also related to the complexity of judgements to be made and the time available to make clinical decisions (Hammond et al., 1964). Decision making may involve matching prototypes from initial observations to generate a diagnostic hypothesis (Gilhooley, 1990) and amalgamating information together to form concrete patterns which are then stored in the long term memory and used to inform reasoning (Greenwood, 2000).

Studies using the think-aloud analysis

The think aloud approach is a qualitative tool that is employed to access cognitive processes used in clinical reasoning. It focuses on the collection of verbal data about cognitive processes pertinent to the solving of a problem. Thinking aloud is an indication of information being concentrated on at that time (Newell and Simon, 1972; Taylor, 2000). This approach has been successfully used to collect accessible information about cognitive processes using nursing and medical clinical scenarios (Corcoran and Moreland, 1988; Kuipers et al., 1988; Lee and Ryan-Wenger, 1997; Aitken and Mardegan, 2000; Greenwood et al., 2000; Offredy and Meerabeau, 2005). Inferences can be drawn from the concepts generated, information processing skills and cognitive processing prevalent in the reasoning process (Fonteyn et al., 1993) but can also be used to identify faulty reasoning (Offredy and Meerabeau, 2005).

Daly (2001) explored the clinical reasoning skills in pre-registration nurses using patient simulation and the think aloud approach. Although some students showed evidence of metacognitive processing, the majority had difficulties expressing themselves. This difficulty may result from problems of teaching reasoning and the lack of definition, testing and development of clinical reasoning skills associated with nurse education and training. Although simulations are thought to present lifelike situations (Topf, 1990), their use has been criticised for their inability to represent the complexity and unpredictability of the real-life setting and the thought processes that practitioners utilise in natural settings (Fonteyn and Fisher, 1995).

The think aloud approach has also been used to assess the reasoning skills of qualified nurses in a variety of clinical settings (Aitken and Mardegan, 2000; Simmons et al., 2003; Offredy and Meerabeau, 2005). Fowler (1997) found that nurses used a combination or multiple cognitive operators to describe the nursing care they offered, e.g. connecting, evaluating, judging, planning and explaining care. They also used an array of cognitive strategies to clinically reason, plan and implement nursing care. These focused on hypothesizing and framing using salient cues to direct thinking, inductive logic and metacognition. Fowler’s work concurs with published data (Farrell and Bramadat, 1990; Gordon, 1994). Gordon (1994) also identified additional cognitive operators such as clarifying, and verifying information or reflexive comparison.

Protocol analysis is a common method of data analysis used to analyse findings from the think aloud approach (Fonteyn et al., 1993; Aitken and Mardegan, 2000; Greenwood et al., 2000; Simmons...
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et al., 2003). The method uses assertional analysis to extrapolate statements offered, connect concepts together in order to facilitate clinical reasoning, script analysis is used to provide an overview of the cognitive process and thinking strategies that participants use during the reasoning task and finally referring phase analysis is employed to capture the vocabulary of concepts used by subjects during the reasoning process and to isolate the information that nurses used when reasoning about the assessment process (Greenwood et al., 2000). In Simmons et al.’s study nurses used thinking strategies and heuristics (mental short cuts) (Tversky and Kahnemann, 1974) to consolidate patient information and apply knowledge gained from work experience and education. Commonly used heuristics involved recognising a pattern, judging the value, providing explanations, forming relationships and drawing conclusions. Simmons et al. identified six main concepts; plan, rationale, status, test, treatment and value. Each of these moved the reasoning process forward and is linked to specific assertions; cause and effect relationships, declarative or statements of facts, evaluative judgements of significance and anticipative expectations of action. These reasoning processes and thinking strategies enabled nurses to quickly review and analyse patient information, evaluate its significance and formulate alternative actions. The data yielded support the view that the information-processing theory is the underlying conceptual framework for clinical reasoning in experienced nurses whereby the individual uses knowledge and experience to merge the information gleaned from assessment into manageable concepts as illustrated previously (Newell and Simon, 1972).

Although this view agrees with published literature (Farrell and Bramadat, 1990; O’Neill, 1994, 1995; O’Neill et al., 2005), the metacognitive aspects of clinical reasoning thinking were not apparent (Kuiper and Pesut, 2004). Simmons et al. (2003) concluded that experienced nurses could be differentiated by clinical reasoning skills rather than years of nursing experience. One should not negate the value and contribution of experience and experiential learning as both are essential components of advanced clinician practise (O’Neill and Dluhy, 1997) and are a recognised stimulus to clinical reasoning (Fowler, 1997).

This feature is consistent with medical colleagues who use cumulative experience, in conjunction with script analysis (networks of prior knowledge) to augment the development of elaborate cognitive prototypes when managing patients (Schmidt et al., 1990; Charlin et al., 2000). Scripts are equivalent to schema; goal directed knowledge structures which are adapted to efficiently perform tasks (Johnson and Haser, 1987). Scripts are activated in order to enhance reasoning built on the process of deduction (Charlin et al., 2000; Grant and Marsden, 1987). Nurses also use schema theory to construct mental models for problem solving (Offredy and Meerabeau, 2005; Greenwood et al., 2000). Experienced nurses working in a speciality use schema and cognitive prototypes to manage care (Ferrario, 2004). Prototype formation will enhance the development of a sense of saliency in experienced nurses; a hallmark of clinical reasoning and expert practise (Jacavone and Dostal, 1992). Prototypes reduce cognitive processing time and result in cognitive shortcuts which allow nurses to progress from rule-based thinking and a step-by-step analysis to more focused reasoning style which alleviates cognitive strain (Benner et al., 1996; Ferrario, 2004). Cognitive shortcuts are induced by the automatic cognitive processes and higher order thinking of experienced nurses (Tabek et al., 1996) which are built on clinical knowledge and experiential learning (Ferrario, 2003).

Evidence to support the use of cognitive operators and cognitive strategies to underpin clinical reasoning is limited. In order to inform nurse education and training more research is needed to explore the characteristics, use and application of clinical reasoning processes and strategies used during the planning and implementation of nursing care. Ribbons (1998) and Thompson et al. (2005) have shown how nurses can benefit from the use of computers as cognitive tools to aid clinical reasoning skills. However, for this educational approach to be of benefit, students need time to sufficiently assimilate taught knowledge before they can apply it to clinical exemplars.

The think aloud approach is an underused teaching and learning method which can create the environment for developing clinical reasoning skills in nursing students (Lee and Ryan-Wenger, 1997). A criticism of the approach is that the cues that may actually influence the respondent’s ability to verbalise their thoughts may not be the cues that are reported, as cues are often difficult to verbalise (Thompson et al., 2005). Given the importance of clinical reasoning in nursing, it is necessary for nurse educators to develop alternative teaching and learning approaches that foster the development of this skill.

Conclusions

Clinical reasoning is a cognitive process that is underpinned by cognition and metacognition
(Kuiper and Pesut, 2004) In nursing, definitions of clinical reasoning appear to revolve around the processes involved in making professional judgments, evaluating the quality of evidence to solve problems and to make diagnostic and patient management decisions (Higgs et al., 2001). Although experienced and inexperienced nurses use clinical reasoning processes to make judgements and decisions about the nursing care that they provide to patients, the alacrity of the thinking process and the outcomes may differ. Experienced nurses use patient centred prototypes to undertake cognitive shortcuts during the thinking process but also rely on schema, experience and intuition.

Protocol analysis and the think aloud approach are common methods of assessing clinical reasoning. A drawback of using the think aloud approach is the accuracy of findings on thought processes and cognitive strategies are prohibited by the proposed difficulties that nurses can have verbalising their reasoning.

More research and educational development is needed to develop current understanding of cognitive operators and cognitive strategies that are used by nurses during the thinking process and to develop tools that can be used to accurately assess clinical reasoning strategies.

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