



Research Article

Is Clinical Reasoning Assessed in Examinations? A Qualitative Study on Student Perceptions

Khin-Htun S*, Kushairi A and Lwin N

School of Medicine, University of Nottingham, Nottingham, United Kingdom

Abstract

Background: Clinical reasoning (CR) is a core skill for all clinicians and Medical school serves as a starting point for CR development. Numerous tools for assessing CR skills are present in literature. However, no single, gold-standard, complete assessment method exists; a multisource and broad approach is recommended for assessing CR in medical students. **Objectives:** This study is to understand the service users' (medical students) perceptions on current assessment and this would inform the curriculum team to further development of CR assessment and have changed educational practice. **Methods:** Medical students and teaching fellows at the University of Nottingham (UoN) were interviewed regarding their views on whether CR is assessed in their summative knowledge papers and objective structured clinical examinations (OSCE). **Results:** Generally, opinions were divided whether CR was assessed in examinations or not. Students who agreed that CR was assessed had different opinions on the degree of CR involved in the examinations. Interviewees who did not think CR was assessed held their views due to their interpretation of CR assessment, the difficulty of measuring CR skills due to the complex nature of the CR process, and the limitations of the knowledge paper and OSCE examinations. However, when summative assessments were combined with formative assessments on wards throughout the course, a better impression of students' CR can be captured. **Conclusion:** Students' perceptions on the assessment of clinical reasoning in examinations were variable. Valuable feedback was gleaned from participants in order to further integrate CR assessment into the examination system.

Abbreviations:

CR: Clinical Reasoning; UoN: The University of Nottingham; OSCE: Objective Structured Clinical Examinations; PBL: Problem-Based Learning; CP1: Clinical Phase 1, the first clinical phase; CP3: Clinical Phase 3, the third and final clinical phase; GI: Gastrointestinal; FBC: Full Blood Count; U & E: Urea and Electrolyte; CRP: C Reactive Protein; LFTs: Liver Function Test; UG: Undergraduate; OSCE: Objective Structured Long Examination Record; TFs: Teaching Fellow

Introduction

Evidence of clinical reasoning (CR) assessment has existed since the 1960s and 1970s and traditionally focused on evaluating knowledge base information [1,2]. However, the complexity of the CR process requires concurrent assessment of knowledge application, data selection from available information, evaluating need for more data and communication skills [3]. Groves stated that there is no single best tool to measure the CR process or end product [4]. Hence, assessing CR should be multi-sourced to take into account the multiple traits forming CR, with each trait best assessed by a specific tool [5]. CR, as a higher order cognitive process, is not directly observable, and can only be indirectly assessed through its products or individual verbalization [6].

Student's CR ability is measured through CR outcomes such as their diagnostic accuracy and management plan, rather than the CR process itself [7]. Moreover, the multidisciplinary nature of medical education with researchers from different backgrounds accepts a range of possible solutions for one problem [8]. Another challenge in assessing CR is that all

Workplace-based assessments may take place in more authentic contexts, and the combination of standardized assessments with authentic workplace assessments are essential [9].

The types of CR assessments belong in three categories: experimental and research methods, standardized assessments and workplace-based assessments. The experimental and research methods of assessing CR are stimulated recall, thinking and talking aloud protocols or protocol analysis [10]. Such methods enable deep understanding of the CR process for research purposes and to compare novices and experts, but not intended to formally assess students' CR ability in medical or dental education [11].

Standardized assessment tools are divided into multipurpose assessment tools and tools with specific aims to assess CR. Multipurpose assessment tools include standardized examinations such as written papers or objective structured clinical examinations (OSCE). They enable assessment across a predetermined set of problems and can sample a broad set of content domains within limited testing time, but take place in an artificial environments and do not assess all aspects of CR. Purpose-designed CR assessment tools such as test of diagnostic skills (TDS), simulated patient-problem technique, case study or patient management problem, high-fidelity simulations and virtual learning patients. They have different advantages such as authenticity and assess multiple aspects of the CR processes. The third category of CR assessment tools are work place assessments that authentically assess what learners do in actual practice; such as global assessment, oral case presentation and direct observation of clinical and procedural skills [9].

Despite multiple attempts and tools to perfectly assess CR, there is no single gold standard instrument for CR assessment [5,12]. To measure CR; a variety of tools with broad content domains across different contexts is needed, which are horizontal (within rotation and through a year) and vertical (between years) [9]. Multisource assessments including formative and summative assessments were suggested to assess undergraduate medical students' critical thinking and problem solving skills. This study aims to obtain medical students' perspectives on the assessment of their CR skills in medical school.

Materials and Methods

Medical students at the University of Nottingham (UoN) consist of undergraduate students who have an integrated curriculum and graduate students who learn through problem-based learning (PBL). Both groups of students are combined in the clinical stage with the same curriculum. Students in their first year of clinical placement (CP1) and third year of clinical placement (CP3) were approached by the researchers face-to-face, who explained the aim of the study and distributed volunteer information sheets and an informed consent form. The same process was repeated for teaching fellows in the department.

Researchers use qualitative methodology when the purpose of the study requires investigation or deep exploration of people's perception and interpretation of a phenomenon [13]. For this qualitative study, the researchers explored the attitudes, views, behaviour, understandings, practices, and experiences of students and teachers through interviews to get an in-depth opinion from participants. It usually starts with questioning about the nature and characteristics of a phenomenon focusing on meaning and understanding. The end-product of qualitative studies includes detailed descriptions. The researchers served as the central instrument for data collection [14].

Those who consented to participating in the study were invited to be interviewed on their opinion on the assessment of clinical reasoning in the course. Semi-structured interviews were held where researchers asked follow-up questions to explore perceptions and experiences of participants regarding CR assessment. The interviews were recorded and data collected interactively. The 'human-as-instrument' concept was utilized where the researchers acted as data collector, selector of relevant data and caller of meaning emerging from data. Data was often described in the participant's own words, but data interpretation may reflect the stance and thoughts of the researchers. Member checking was applied to improve data credibility; where participants were given a password-protected transcription copy of their interview.

Thematic analysis is a highly qualitative, reflective, and highly inductive type of analysis, that is, the themes emerges from the data and then apply these codes to the entire data [15]. Inductive thematic analysis is data driven in which the researchers tries to extract themes from data without trying to fit data into a pre-existing framework or researcher's analytic theoretical conceptions [11]. In this study, the inductive thematic data analysis was conducted to the manifest, semantic or explicit level. Data was analysed recursively to

formulate different themes. This process was suggested as being common for qualitative research [16]. Themes were agreed upon with the researcher's mentor or supervisor. As suggested by Green and Thorogood [17], it is always advisable to agree upon coding themes and their meanings with supervisor if the researchers is not working in a team.

The 'immersion and crystallization' pattern of data analysis according to Miller and Crabtree [18] was applied: data was examined in detail, followed by reflection of the analysis process to identify articulate patterns or themes during immersion. In reporting of results, each participant was identified by code and a number. The code represented what phase they were in and whether they were in the PBL or integrated group. The number referred to the order in which the student was interviewed. For example, "CP3 I 1" represents the first interviewee from the integrated curriculum from CP3 and so on.

With regards to validity and reliability of the study; credibility was optimized by the member checking process, and having the study reviewed by an expert. Quotations of participants' speech were provided as examples of emergent codes and themes. Transferability was improved by providing a detailed discussion of procedures during recruitment, data collection and analysis. Dependability was maximized by presenting findings in detail. To improve confirmability; objectivity of the data collection and analysis process was maintained by having a member check and transcribe interviews verbatim to avoid any change to actual data obtained from participants. Moreover, codes have been checked by a third-party colleague and studied for consistency.

Ethical considerations were addressed by providing each participant with accurate, relevant information on the study and asking participants to sign written, informed consent. Participation in the study was completely voluntary, and any termination of participation during the study was allowed. No incentives were offered for study participation. Participant identity and data were kept confidential, codes were used for research identification. All data files were kept in a locked cabinet with access only by the researchers. The files will remain in the cabinet for five years after study completion, then files burned and destroyed.

Results

The basis for identifying the minimum sample requirement is the point when data saturation has been reached [19,20]. To do this, the researcher analysed data in increments. The researcher started with analysing data from five interviews and with each addition of interview data in the analysis phase, the researcher identifies the change in number of unique codes and themes. After identifying the point of data saturation, the total number of participants was 28 students and 11 teaching fellows at the point of data saturation. From the integrated group, there were eleven CP3 and ten CP1 students. From the PBL group, there were seven CP3 students. Students' perspective on CR assessment in medical school is categorized into themes on CR assessment in knowledge papers and CR assessment in OSCEs. The

feedback from teaching fellows on CR assessment was elicited as well.

Is CR assessed in knowledge papers?

Themes
1. CR was absolutely tested in knowledge papers
2. CR was tested in knowledge papers, but only up to a basic level:
3. CR was not assessed in knowledge papers

Table 1: Themes for the Thematic Category Assessment of CR.

Theme 1: CR was absolutely tested in knowledge papers

There were students who thought CR was definitely tested in the knowledge papers:

“When we did the obs and gynae exam, there were --- things like, ‘You come across a lady --- having a postpartum haemorrhage. Rank the options in order of what you would do first to last in terms of priority, --- we’d never done reasoning through scenarios in a formally examined setting.” (CP3 I 9)

“I think it is actually--- Certainly more and more! --- Now I feel my exam is going to be very heavily focused on that and that’s the main thing to focus on this year” (CP3 I 3)

Theme 2: CR was tested in knowledge papers, but only up to a basic level:

Some students believed that CR is tested in the knowledge papers as they involve data interpretation, working out diagnosis and management from given symptoms. However, not the whole process of CR was assessed:

“There’s no questions --- like, ‘what would you do if this patient comes in with this? What are the differentials?’ It’s more, ‘Look at this x-ray. What’s the problem?’ which I suppose is kind of like CR but it’s not like taking you through the whole process” (CP1 I 7)

“It’s a lot about results and examination and investigations and ---, but it’s usually quite sort of small steps that are assessed rather than sort of whole global picture. --- decision-making assessment which would go through numerous different steps which is not how the current knowledge paper works, but the individual steps are sort of CR but just a little bit.” (CP3 P 4)

Theme 3: CR was not assessed in knowledge papers

Some participants did not think CR is assessed in knowledge papers.

“No. I don’t think they really are assessing our CR. They’re more assessing knowledge.” (CP1 I 2)

“It’s just sort of random questions about different things. I don’t think they’re necessarily- That’s more of a sort of knowledge and revising-based.” (CP1 I 6)

“I think knowledge papers are just who can absorb paragraphs of text --- it’s like remembering sometimes pointless pieces of information. --- it’s a lot of memory tests” (CP3 I 6)

Some teaching fellows were not sure whether CR can be assessed in examination settings at the undergraduate level:

“Can you assess CR? I mean I’m sure you can assess CR in clinical practice by looking at specific situations and incidents and events and people and families, to look at how the student makes their decision. I mean you could assess on a paper exercise by having lots of bits of information and ask the students to pull them together and make sense of them?” (TF 8)

Is CR assessed in the OSCE examinations?

Participants’ responses for whether CR was assessed in the OSCE examinations were also variable.

Theme 1: CR was absolutely assessed in OSCE examinations

There were students who believed that CR is assessed in the OSLER-style OSCE exam:

“A lot is all about your history-taking skill and how you use your CR to sort of focus in on the things you need to focus, otherwise you will run out of time. So yes. I would say the OSLER is mostly CR.” (CP1 I 10)

“From my understanding, taking a history, that’s CR in itself. Then trying to choose your questions to fit into what you think is going to be a differential diagnosis. Then picking what examination you’re going to do as well. Then I’m not sure whether we have to give management or not, but if we were, then that’s CR as well. So --- it is assessed.” (CP1 I 8)

Some CP3 integrated students thought that CR was the main aspect measured in the OSCE:

“There’s a much greater emphasis on CR and the fact that you’re expected to interpret findings from your examinations, have a better grip on a focused history, --- everything’s more focused and targeted.” (CP3 I 10).

Theme 2: CR was assessed in OSCE examinations, but only to a basic level

However, some students commented that CR is still tested, however only the basics and not at the highest level:

“Not a lot. As long as you know the basics and you want to make sure that the patient’s going to be stable for then senior review to come and do the more advanced management. Obviously as F1s (Foundation year 1 doctor), we’re under supervision, but as long as we can give our basic CR to basic management, and I think that’s tested in the OSCEs.” (CP3 P 7).

“I think even OSCE I I’ve seen CR used. I was part of a station last year for OSCE 1, ---They had to take a history and then do a urine dip-stick and then explain to the patient what the test showed and what would happen now. So that’s a fair amount of CR. --- even if they’ve got to do a cardiovascular exam and they hear a murmur, they’ve then got to suggest what they think the murmur means, whether they think it’s a valve defect or congenital heart disease. There’s still quite a lot of CR in that” (T 5)

“I think there is a degree of CR --- at a fairly basic level, but that might be appropriate.” (T 4)

Theme 3: CR was not assessed in OSCE examinations

In pre-clinical examinations, CR were not addressed:

“The first and the second year OSCEs were just like these six station-based things and as soon as you’d done that one, you were done with it.” (CP1 I 2)

Clinical students also did not think that CR was measured much in CP1:

“CP1 is very much kind of actual diagnosis might not count. So it’s being able to perform the skills, ---, pick up all the signs, but without that CR.” (CP3 I 8)

Some CP3 students from the integrated curriculum thought that CR was not tested in the OSCE exams:

“There’s no CR there whatsoever. Anyone could have passed that as long as you followed the correct steps and you could have trained a geography student to pass that exam.” (CP3 I 7)

“No because the OSCEs, you can just do the motions, not a clue what you’re talking about but you’ve ticked the boxes. “ (CP3 I 4)

Factors affecting participants’ opinions

Participants who did not believe CR was tested in the knowledge papers or OSCE may hold these beliefs due to several factors:

1. Their interpretation of the assessment of CR

Students remarked that the whole process of CR could not be assessed using knowledge papers:

“With CR, the questions are like, ‘A patient comes in. You see this. What would you do? I think that would assess your CR” (CP 1 I 6)

2. Not having separate CR examinations

Clinical students who came from a PBL background used to have separate CR papers in the pre-clinical stages. There were no separate CR papers in the clinical phase:

“We had CR paper. I haven’t had a CR exam like that since and it’s been three years.” (CP3 P 7)

3. Difficulty in distinguishing one person with good CR skills from another

The students thought that CR skills between students were not easily distinguishable using results from the knowledge paper:

“It’s far too easy just to do all the knowledge and still actually come out, --- no patient skills. --- how much effort some people put in and it’s not necessarily distinguishable one person from another based on what’s actually a very important medical skill and they’re just not tested.” (CP3 I 4)

It was also difficult to distinguish a student with good CR skills over another based on OSCE results:

“I’m not sure how much of their assessment is about just getting a diagnosis and how much of it is about giving the logic behind the decisions that they make. So for example if I’m doing a case on GI bleeding, someone might say, ‘Oh I’m going to ask for bloods, FBC, U & E, CRP, LFTs, group and save’. That’s fine. You’re not wrong, but if you probe them and say, ‘Why do you want a U & E?’, for example, ‘They just have an Upper-GI bleed. Why is it important?’ Then some students may not be able to tell you that because they’ve just learnt a list of things to say in an OSCE situation, but then on probing, you can then differentiate the better students who would say, ‘Actually I need to know what the urea is because that might be a sign of Upper-GI bleeding’.” (TF 7)

4. Limitations of knowledge papers and OSCE examinations in assessing CR

Knowledge papers also came with limitations in assessing CR skills:

“In the knowledge paper will have one problem at a time. It’s rare that you get people --- who come in because they’ve fallen over, --- breathless, --- tummy pains, --- constipated, and how do you deal with all of that together, and I think that’s where CR is far more relevant and I think that’s probably too complex to be assessing in a knowledge paper.” (T 4)

The limitations of OSCE examinations in assessing CR were brought up:

“No. (it is not assessed) I think it’s very structured --- It’s more about kind of, ‘Are you able to perform these tasks which they’ve done a few days before?’”. (TF 3)

“We do assess people taking a history but we’re more focused on --- how they interact with a patient. Are they nice to a patient? --- Do they find out what the patient’s worried about? They’re all very important but we don’t essentially assess their ability to differentiate between pathology which in my mind is what CR’s all about. --- Ultimately that’s the most important part of your job”. (TF 3)

5. General challenges of assessing CR

The complexity of the CR process also was a factor influencing the participants’ opinions, and may not be measurable at an undergraduate level:

“So I wonder whether assessment of CR is difficult given their level of knowledge at UG level and be better done at postgraduate level.” (T 4)

“It’s a different CR to real life because I mean it’s a completely preposterous situation isn’t it to have to examine a patient firstly within a time limit, secondly without having already taken a history, but neither of those things ever happen in clinical practice, but that’s not to say there’s not value in them “ (T 5)

Despite the limitations of examinations in assessing CR, participants commented that their CR skills were assessed informally in the clinical areas all the time and formally in the knowledge papers and OSCEs:

“It is assessed in a way that for example if I’m on the wards and I’m taking some histories from some patients, and --- I’ve presented --- summarised and ---proposed an immediate management plan. Hundred per cent of the medical staff have quizzed me, ---, ‘Why are you ordering that?’” (CP3 PBL 7)

Including summative and formative examinations from the knowledge paper and OSCEs, CR assessment was present throughout the medical course:

“It’s a quite good balance. It can’t assess you --- within a written or non-practical assessment (but) --- in conjunction with our OSLER, they cover everything. It ---assesses adequate competency hopefully.” (CP19)

Discussion

Based on interviewing medical students at the UoN in their clinical years and teaching fellows, there was a wide range of opinion as to whether the knowledge paper or OSCE examination assessed students’ CR skills. Participants who

think that the knowledge paper or OSCE exams do assess CR think that there is either a small part of CR involved in exams or a large component of CR in the exams. Participants who do not think CR is assessed hold their beliefs due to their interpretation of CR assessment, the difficulty in measuring the quality of CR due to the complexity of the CR process and limitations of the knowledge paper and OSCE exams in measuring CR separately. However, students and TFs also noted that when results from the summative knowledge paper and OSCE exams are combined with formative assessment throughout the course; there is good assessment of students’ CR skills.

The literature supports the difficulty in assessing CR among students. CR has been rarely taught in medical schools in formal teaching formats [21,22]. Additionally, there is no clear consensus on how CR might best be taught or how it should be assessed [23]. CR, as with any other type of high order cognitive process, is not available to direct observation, so it can only be assessed indirectly through the assessment of its products or via individual verbalisation as inference [6]. All of these research studies highlight the difficulty in assessing CR levels among students.

Feedback from medical students and TFs in this study was considered in efforts to improve their assessment formats. CR questions in the summative knowledge and OSCE examinations are now specifically tailored so that they can be learnt from cases, not lectures. The format of the knowledge paper is shifting from examining simple recall of knowledge to integration, interpretation and application of knowledge. Knowledge papers are reviewed and categorized at standard setting meetings in some cohorts as CR questions of non-CR questions prior to the exam. CR questions require students to mobilise and apply their knowledge to clinical contexts while non-CR questions can be answered using knowledge alone. The questions were reviewed based on the General Medical Council guidance and Bloom’s taxonomy of learning domains. The Bloom cognitive domain includes the recall or recognition of specific facts, procedural patterns, and concepts that serve in the development of intellectual abilities and skills. There are six major categories of cognitive processes: remember, understand, apply, analyse, evaluate and create [24]. Only questions that assess the third to the sixth category of Bloom’s cognitive processes are accepted as CR questions. CR questions can cover: (i) given a history, formulate a diagnosis, (ii) given physical findings, choose the most likely diagnosis, (iii) given investigation results, give a diagnosis or matching history, (iv) given a history, match investigation findings to interpretation of the findings.

OSCE examinations moved away from the traditional checklist marking to a hybrid domain marking scheme or domain-based model. Almost every OSCE station now contains a CR domain.

Limitations of this study include the timing of the interviews: some students have not sat the examinations that are being studied and could not explain in depth their opinions on the examination. Other factors that may influence the participants’ views on CR assessment such as complexity of the CR process and limitations of the examinations methods have been discussed above.

Conclusion

Many methods of assessing CR exist in literature except for a gold-standard, self-sufficient tool. Medical students and teaching fellows at the UoN have varying opinions on whether the knowledge paper and OSCE examinations assess students' CR skills. Those who agree that CR is assessed in the examinations have different views regarding the degree of CR involved in the examinations. Participants who do not think CR is being assessed hold this view due to their perception of CR assessment, difficulty in measuring CR due to the complex nature of CR and limitations of the knowledge paper and OSCE examinations. Combining formative and summative assessment results, there is better assessment of students' CR skills. Feedback from the participants in this study were highlighted to the examination board and helped in improving the assessment of clinical reasoning.

The recommendation for future research is to determine the important components of an assessment model that intends to evaluate the CR level of students. This research can be framed by exploring the different outcomes that can signal that a student is demonstrating CR. Future researcher can conduct an exploratory study that focuses on developing an appropriate rubric that taps into the different components or aspects of effective CR.

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***Corresponding author:** Dr Swe Khin-Htun, M.B.,B.S, MRCS (Edin), MMedSci (Medical Education), MFST (Edin), FHEA (UK), MAcadMed, FICS, Honorary Assistant Professor, School of Medicine, University of Nottingham (UoN), UK, Tel: 07800669015; Email: swe.khin-htun@nottingham.ac.uk

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