Mapping the delivery of ‘Clinical Reasoning’ in UK undergraduate medical curricula

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BACKGROUND

Clinical reasoning (CR) is a key skill of the proficient clinician and is the process by which clinicians collect cues from patient presentations, process information, come to an understanding of a patient’s problem or situation, plan and implement interventions, evaluate outcomes, and reflect on and learn from the process. Despite the importance of CR in patient care, the published literature suggests that the skill is rarely formally taught and assessed in medical schools, and qualified doctors often remain unsure how they perform the skill (Linn et al, 2012). The literature also suggests that adopting a formal educational approach to this skill may be beneficial for medical students (Eva, 2005; Kassirer, 2010; Linn et al, 2012; Audétat et al, 2012), yet most medical schools do not specify where this is covered in their curricula.

The General Medical Council (GMC) publication Outcomes for Graduates (GMC, 2015a), originally published as part of Tomorrow’s Doctors (GMC, 2009), specifies three outcomes that are aligned to the definition of CR as given above:

8(c) Justify the selection of appropriate investigations for common clinical cases;

8(g) Make accurate observations of clinical phenomena and appropriate critical analysis of clinical data; and

14(f) Make clinical judgements and decisions, based on the available evidence, in conjunction with colleagues and as appropriate for the graduate’s level of training and experience. This may include situations of uncertainty.
The current study has ‘mapped’ where these CR-related outcomes are covered and assessed in a representative sample of UK undergraduate medical curricula. This 'map' may be beneficial in improving graduates’ awareness of CR in general, in helping medical schools to identify where CR exists as a ‘strand’ (or not) in various curricula and, hence, help medical schools learn from best practice in the sector.

THE STUDY
AIMS
Currently, CR is an ill-defined element of undergraduate medical curricula in the UK, despite the fact that CR is seen as an essential skill for the practising clinician. The overarching aim of this study is to map the delivery of CR within UK undergraduate medical curricula, by asking all UK medical schools to identify where and how they deliver and assess three CR-related ‘Outcomes for Graduates’ as specified by the GMC (GMC, 2009; 2015a).

The main aim of this study can be broken down as follows:

1. To identify where and how CR is being delivered and assessed in UK undergraduate medical curricula.

2. To identify if differences exist in the delivery and assessment of CR across UK undergraduate medical curricula.

3. To identify which assessment methods are considered to be most appropriate for the delivery and assessment of CR in UK undergraduate medical curricula.

4. To make recommendations to UK medical schools regarding the development of best practice in the teaching and assessment of CR in undergraduate medical curricula.

As all UK medical schools must show that their graduates meet these outcomes as specified by the GMC (GMC, 2009; 2015a), they were asked to identify where and how they deliver and assess these outcomes within the broad spectrum of UK medical curricula.
DESIGN

The overall study design included both quantitative and qualitative aspects, as it featured the use of an online questionnaire that yielded quantitative data as well as free text comments, with follow-up interviews. The data were analysed using a mixture of methods, including thematic analysis. Ethical approval for the study was granted by the Ethics Sub-Committee of the School of Medicine, Pharmacy & Health at Durham University in June 2015.

The study followed a step-wise approach. Firstly, ‘Directors of Teaching’ at all of the UK medical schools were identified and sent an email asking them (or their nominee) to complete an online survey centred around the delivery and assessment of GMC outcomes 8c, 8g and 14f in their various undergraduate medical curricula. It was clearly articulated that, by participating in the survey, the participants were giving their informed consent for the information provided to be utilised in a report and publication in peer-reviewed journals. The estimated completion time for the survey was approximately 45 minutes.

The first section of the online survey gathered generic information on the medical school in question and allowed the potential participants to give their consent and continue with the survey, or to withdraw at that point. All data has been anonymised. Participants were asked if they were willing to be contacted to explore some issues in more detail with them via telephone interviews. The confidentiality of participants and their affiliation was preserved at all times.

In the main section of the online survey, the medical schools were asked to indicate where they believed their students achieved each of the three outcomes in their programmes and what methods were used to ensure that the outcomes were achieved, including delivery and assessment. Participants were also asked to identify and comment on methods they felt were particularly advantageous in the delivery and/or assessment of these outcomes, based on their experience and evaluation.

Questions asked in follow-up interviews were generated from preliminary analysis of the data from the survey. In all cases, some interview questions were generic and some specific to the interviewee’s institution. Interviewees were sent a topic guide detailing the interview process prior to interview. Interview data were
anonymised and interviewees were free to decline the opportunity for interview after having initially expressed an interest.

Interview transcripts were generated from audio recordings of the interviews by one of the research team, and transcripts were agreed with the interviewees. Qualitative data from interviews were then independently analysed by two of the authors, allowing the identification of thematic subheadings under which interview responses could be filed.
**PARTICIPANTS**

*Inclusion criteria*

The ‘Directors of Teaching’ at all 33 UK medical schools delivering undergraduate medical education that leads to a primary medical qualification or, in one case (asterisked below), a BSc degree as a pre-requisite to complete a primary medical qualification at another UK medical school, were invited to respond to the online survey. These individuals could elect to forward the initial email invitation to a colleague within their institution. The following medical schools were invited to participate:

- University of Aberdeen
- Barts and the London School of Medicine & Dentistry
- University of Birmingham
- Brighton and Sussex Medical School
- University of Bristol
- University of Cambridge
- Cardiff University
- University of East Anglia
- University of Exeter
- University of Dundee
- University of Edinburgh
- University of Glasgow
- Hull York Medical School
- Imperial College School of Medicine
- Keele University
- King’s College London School of Medicine
- Lancaster University
- University of Leeds
- University of Leicester
- University of Liverpool
- University of Manchester
- Newcastle University
- University of Nottingham
- University of Oxford
- Plymouth University
- Queen’s University, Belfast
- University of Sheffield
- University of Southampton
- University of St Andrews*
- St George’s, University of London
- Swansea University
- University College London
- University of Warwick

*Exclusion criteria*

Participation was by invitation only, but no UK medical schools were excluded.
DATA COLLECTION
The 33 undergraduate medical schools in the UK, many of which run several different programmes, were invited to participate in the questionnaire survey in June 2015, as described above. A reminder email was sent out in early July 2015 and the online survey closed at the beginning of August 2015.

The initial data obtained from this survey were collated and analysed during August 2015. ‘Themes’ were identified and further questions generated for telephone interviews. Telephone interviews were conducted in the first three months of 2016.

DATA ANALYSIS
The data on where and how the CR outcomes are being delivered in the various curricula was analysed using a multi-step approach; firstly by checking if all of the responding medical schools were covering each of the three CR outcomes (since these are GMC ‘Outcomes for Graduates’, we expected that all responding medical schools would confirm that this was the case), secondly by determining ‘where’ in the curriculum these CR outcomes are being covered (e.g. in the early stage of the programmes, in the later stage, or in specific clinical rotations), and thirdly by identifying where responding medical schools indicated that they adopted a specific approach to the delivery and/or assessment of the CR outcomes.

It should be noted that the data presented in this report reflect a composite or ‘average’ view of the pattern of delivery and assessment of CR outcomes.

RESULTS
a.) Consent:

14 of the 33 UK undergraduate medical schools consented to participate in the research and responded to the online questionnaire. However, despite attachment of the ‘Participant information’ sheet to the original email invitation (with contact details for the research team), and the inclusion of a link to this document on the first page of the survey, only 79% (11/14) of respondents indicated that had been given the opportunity to ask questions or to get a response to their questions prior to starting the survey (Figures 1 and 2). Respondents from two medical schools answered ‘No’ to both questions and respondents from two other medical schools answered ‘No’ to only one of the questions.
Figure 1. Pattern of participants’ dichotomous responses to the statement “I have been given the opportunity to ask questions, and these initial questions have been answered acceptably”

Figure 2. Pattern of participants’ dichotomous responses to the statement “I have been provided with and have read the participant information sheet for this study”

b.) **Data on responding medical schools:**

14 of the 33 UK undergraduate medical schools participated in the survey. This represents UG programmes that have a total of intake of 3109 medical students per year. The average intake per university was therefore 222 students per year and the range was broad (ethical concerns prevent reporting of minimum and maximum numbers of students within the respondent sample). The profile of responding medical schools was broadly comparable to the national picture in terms of geographic location and the range of programmes being delivered. 11 of the 14 respondents run five-year degree programmes, five of the respondents run
a four-year degree programme, and three respondent universities run a six-year degree programme option. A greater proportion of respondent medical schools were what could be called ‘newer’ medical schools, established since the late 1990s.

Figure 3 shows the relative frequency of descriptors used by respondent medical schools when asked to describe their curriculum type. Allowing respondents to choose multiple descriptors and/or to add their own descriptor led to a very mixed picture, as respondents would use several, sometimes contradictory, descriptors (for example, traditional and also problem-based). Approximately one third of respondent medical schools described their curriculum as being ‘case-based / case integrated’. Approximately one quarter of respondents described their curriculum as either ‘PBL’ (problem-based learning) or ‘integrated system based’. A minority of respondents described their curriculum as purely ‘systems based’, ‘TBL’ (team-based learning) or ‘traditional’, but together these accounted for nearly a quarter of responses.

\[\text{Figure 3 Pie chart showing the pattern of course descriptors used across the 14 respondent UK medical schools}\]
c. Data relating to outcome 8c. Justify the selection of appropriate investigations for common clinical cases:

For outcome 8c, there is a roughly even distribution of the type of taught session in which this is delivered (Figure 4). The most commonly-occurring type of taught session was ‘Small group/tutorial/PBL’ (20% of all sessions), followed closely by ‘Clinical/communication skills sessions’ and ‘Primary care placements’ (each 17% of all sessions mentioned).

![Pie chart showing the pattern of sessions of various types for outcome 8c over all years within UK undergraduate medical programs](image)

Figure 4 Pie chart showing the pattern of sessions of various types for outcome 8c over all years within UK undergraduate medical programs

When viewed as whole, outcome 8c is delivered relatively infrequently in years 1 and 2 and most frequently in year 3 (Figure 5). There is a slight reduction in the number of sessions for outcome 8c in year 4, but a further increase in year 5.

Figure 6 shows that the most common modes of assessment listed by respondents for outcome 8c were multiple choice exams and objective structured clinical examinations (OSCEs). A significant proportion of respondents indicated that ‘long cases’ and ‘short answer questions’ were used to assess outcome 8c, with only a small proportion of respondents indicating the use of other modes of assessment.
**Figure 5** Combined number of sessions attributed to delivery of outcome 8c across respondent medical schools, by year

**Figure 6** Pie chart showing most common means of assessment of outcome 8c for all years
d.) Data relating to outcome 8g. Make accurate observations of clinical phenomena and appropriate critical analysis of clinical data:

For outcome 8g, the distribution of the type of taught session in which this is delivered (Figure 7) is similar to that for outcome 8c (Figure 4). Again, the most commonly-occurring type of taught sessions were ‘small group/tutorial/PBL’, ‘clinical/communication skills sessions’, and ‘primary care placements’.

![Pie chart showing the pattern of sessions of various types for outcome 8g over all years within UK undergraduate medical programs](image)

Figure 7 Pie chart showing the pattern of sessions of various types for outcome 8g over all years within UK undergraduate medical programs

Figure 8 shows that outcome 8g is delivered fairly frequently in years 1 and 2, and that it is delivered most in years 3-5. The pattern of delivery for this outcome is similar to that for outcome 8c in years 2, 3, 4 and 5, but different in year 1, where outcome 8g has more comprehensive coverage.
The most common modes of assessment listed by respondents for outcome 8g were OSCEs and multiple choice exams (Figure 9). Again, a significant proportion of respondents indicated that ‘long cases’ and ‘short answer questions’ were used to assess outcome 8g, with only a small proportion of respondents indicating the use of other modes of assessment.
e.) Data relating to outcome 14f: Make clinical judgements and decisions, based on the available evidence, in conjunction with colleagues and as appropriate for the graduate’s level of training and experience. This may include situations of uncertainty.

The patterns of mode of delivery (Figure 10) and mode of assessment (Figure 11) for outcome 14f are very similar to those for outcomes 8c and 8g. The pattern of delivery of outcome 14f across the various stages of the curriculum is, however, different to that for outcomes 8c and 8g (Figure 12).

![Pie chart showing the pattern of sessions of various types for outcome 14f over all years within UK undergraduate medical programs](image)

*Figure 10 Pie chart showing the pattern of sessions of various types for outcome 14f over all years within UK undergraduate medical programs*
Figure 11 Pie chart showing most common means of assessment of outcome 14f for all years

Figure 12 Combined number of sessions attributed to delivery of outcome 14f across respondent medical schools, by year
The coverage of outcome 14f increases incrementally as students progress through the curriculum, and is predominantly taught in the final and penultimate years of study.

**DISCUSSION OF QUANTITATIVE DATA**

**Participant information sheet**

14 of the 33 UK undergraduate medical schools participated in the survey. Of these, four respondents indicated that they had either not had the opportunity to ask questions about the study or that they had not been provided with a participant information sheet. This finding is surprising because a copy of the participant information sheet was attached to the original email inviting medical schools to participate in the survey, and a link to the information sheet appeared on the first screen of the online survey, with an instruction to take time to read it before giving consent. It is possible that the four respondents who answered ‘No’ to one or more of these questions were not the initial recipients of the email (i.e. they were nominated to provide responses by the ‘Director of Teaching’ at their medical school, who did not pass on the information sheet), or that they missed the link to the information sheet on the first screen of the survey.

**Descriptive data on participating medical schools**

Although considered unlikely, it was possible that one or more of the respondent medical schools would indicate that their curricular coverage of one of the GMC outcomes was relatively scant. Ethical considerations, therefore, mean that it is not possible to provide a list of UK medical schools that elected to participate in this study. This feature of the survey and report therefore makes it difficult to draw generalisations from the sample that may not be comprehensively representative of UK medical schools. However, the data presented above (including Figure 3) should provide some reassurance that the sample was broadly representative of UK medical schools and their various curricula, without giving details that may allow the reader to identify a specific respondent (or non-respondent) medical school because of the reader’s knowledge of that medical school’s curricular structure.
Teaching and assessment of outcomes 8c (Justify the selection of appropriate investigations for common clinical cases) and 8g (Make accurate observations of clinical phenomena and appropriate critical analysis of clinical data)

The quantitative data suggest that the predominant mode of delivery for these two GMC outcomes is ‘Small group/tutorials/PBL’, followed by ‘Clinical/communication skills sessions’ and ‘Primary care placements’ (Figures 4 and 7). This is perhaps not surprising given that (a) PBL was listed as a mode of delivery in a large proportion of the medical schools and (b) the outcomes refer to ‘clinical cases’ and ‘clinical data’. One subtle difference between the mode of delivery for these two outcomes is that 8g was described as being delivered by ‘Other’ forms of taught session. In this case, reference was made to ‘Student Selected Components’ and a ‘Public health attachment’, which might reflect closer mapping of the ‘critical analysis of clinical data’ aspects of outcome 8g to these activities.

There would also seem to be a subtle difference in the timing of the delivery of these two outcomes, with more emphasis on 8g in year 1 (Figures 5 and 8). Whilst there are several alternative explanations for this, it is likely to be a reflection of the continuum of learning, with students in year 1 being expected to focus on the skill of observation and critical analysis of data, rather than on the selection of investigations for clinical cases, which is a higher level skill that is best practised once the student has gained sufficient fundamental knowledge and experience.

The pattern of delivery of outcomes 8c and 8g in the final three years of study also indicates that students are expected to focus more on these outcomes in years 3 and final year, with less emphasis on these outcomes in the penultimate year of study (Figures 5 and 8). The sharp increase in coverage in year 3 is to be expected, as this is the first year in which students undertake most of their learning on clinical placements, and the outcomes use the terms ‘clinical cases’, ‘clinical phenomena’ and ‘clinical data’. The dip in coverage of these outcomes in the penultimate year of study may be explained by the pattern of activities that is undertaken in many UK medical curricula in this year of study, often ‘specialist’ rotations in child health, mental health, women’s health, ophthalmology, orthopaedics, etc. Here, the students may be expected to attend more core teaching, learn the specifics of each specialty, and see more patients who have received a diagnosis and whose condition is being managed, and so such rotations may not lend themselves quite so well to the exploration of general CR. Please see pages 21-22 for an exploration of the opinions of interviewees on this point.
In relation to assessment of outcomes 8c and 8g, medical schools report using a wide range of assessment modalities. However, the most common modes of assessment for 8c and 8g are reported as being multiple choice exams and OSCEs, followed by open questions/short answers and ‘Long Case’ (Figures 4 and 7). This is not surprising, given that multiple choice exams are the predominant assessment modality used for the ‘Knowledge’ element of medical curricula, and outcomes 8c and 8g are listed in Outcomes for Graduates domain of ‘Doctor as Scholar and Scientist’ (GMC, 2009; 2015a). However, it would appear that, in several medical schools, assessment models recognise the need to test these outcomes at higher levels within the revised Bloom taxonomy (Anderson & Krathwohl, 2001). In order to meet this outcome, students need to be able to analyse data and justify decisions, which would correlate with Analyse and Evaluate within the taxonomy. This therefore justifies the need to use short answer-type questions, OSCE stations and ‘Long Cases’, to assess attainment of these outcomes.

Teaching and assessment of outcome 14f (Make clinical judgements and decisions, based on the available evidence, in conjunction with colleagues and as appropriate for the graduate’s level of training and experience. This may include situations of uncertainty)

Outcome 14f appears in Outcomes for Graduates (GMC, 2009; 2015a) in the ‘Doctor as a Practitioner’ domain and can be considered a high level outcome within the revised Bloom taxonomy (Anderson & Krathwohl, 2001), which may explain why, in contrast to outcomes 8c and 8g, the coverage of outcome 14f increases steadily over the course of UK medical undergraduate curricula (Figure 12). The modes of delivery for this outcome are very similar to those for 8g (Figure 10), although in this case the one description for ‘Other’ forms of teaching mentioned interprofessional learning sessions. This, therefore, probably relates to the ‘in conjunction with colleagues’ aspect of outcome 14f.

As with outcomes 8c and 8g, outcome 14f is assessed via a range of modalities, with OSCEs the most common (Figure 11). This finding is not surprising given the nature of OSCEs, in which students are asked to perform a range of tasks, all with a clinical focus, often with a significant element of clinical judgement involved. OSCEs are also closely matched to the candidates’ expected level of competence, so it is relatively easy to see how these might be the mode of assessment of choice for outcome 14f, given the qualifying statement ‘as appropriate for the graduate’s level of training and experience’.
THEMATIC ANALYSIS

In addition to the quantitative data from the online survey, free text comments were analysed, in order to decide on questions to be asked in follow-up telephone interviews with three participants who had consented to this. Thus, it was possible to carry out thematic analysis of the ‘Survey Data’ and the ‘Interview Data’.

As can be seen from the quantitative data, there is substantial variability in the approach to teaching and assessment of CR within UK undergraduate medical curricula, but there are some clear unified themes that emerge from the data, which will be discussed here.

Themes from Survey Data

Theme 1 – Suitability of assessment types for CR outcomes

Although a range of assessment types are used, it is apparent from free text responses to the survey questions that the OSCE format (and its variations) is considered to suit assessment of CR outcomes more than other formats. However, this may simply reflect that OSCE is the best mode of assessment available, rather than OSCE being the de facto best means of testing these particular outcomes. This may also reflect the flexibility of OSCE and the capacity of OSCE to assess at multiple levels within the revised Bloom taxonomy, especially as the GMC outcomes are relatively broad.

An extension of this theme is that, although the OSCE may be the best means of formal assessment of the outcomes, the best means of informal assessment is reported to be through 'work based' assessments in their various forms. These range from ward-based mini clinical examinations (mini-CEXs) to the apprenticeship-style roles that students have while studying medicine, particularly when attending clinical placements.

This theme suggests that UK medical schools should consider developing one or more robust assessments to test CR outcomes. This could be done through the work of the Medical Schools Council Assessment Alliance.
Theme 2 – Role-modelling as a method of teaching CR

A second theme emerging from the free text responses to the survey is that of ‘role modelling’, where it is anticipated that, although students or doctors in training may not be able to define CR, they know it when they see it, and are encouraged to mimic more experienced practitioners when facing a similar situation. However, this is a rather tenuous model on which to rely for the teaching of CR as, although it would be ideal if all students were regularly exposed to role model figures who were CR experts, it seems unlikely that such individuals would cross the path of students frequently enough to ensure that the CR outcomes were being met in all cases.

This theme suggests that UK medical schools should identify clinical teachers who can act as CR role models to students; this could improve teaching of CR on clinical placements (see also Theme 6 below).

Theme 3 – Links between CR and reflective practice

Another practice in the teaching of CR that emerges as a theme from the survey data is the use of reflective practice. Reflective practice is a general feature of the education of medical students and part of clinical practice in its wider context. This theme, although it is mentioned reasonably frequently, does not reveal in what way it can be best used to teach CR. The reflective cycle could be used by students to reflect on errors in thinking and judgment but it is not clear to what extent this can be done in real time, so perhaps a portfolio-based assessment of this is required, which is linked to Theme 1.

Theme 4 – Case-based discussions as a mode of delivery and assessment of CR outcomes

The final emerging theme was on case-based discussions in CR. Some consensus was noted regarding the value of case-based discussions in the teaching and assessment of CR. Although in most instances these discussions are not formulised, there are examples of formulised case-based discussions in various curricula, which may constitute best practice.
Themes from Interview Data

A different set of themes emerged from the telephone interviews, which complemented and enhanced the themes from the survey data.

Theme 5 – Definitions of CR

The first theme to emerge was that the three interviewees gave different definitions of CR, or what constitutes CR. The definition of CR that we provided in our online survey was: “a doctor’s ability to make clinical decisions based on both experience and available clinical information, which includes patient history, physical examination and results of tests/investigations, against a backdrop of doubt and clinical uncertainty”

The interviewees gave the following explanations of what CR was:

‘...decision making processes that a physician goes through when they are assessing and deciding how to manage a patient’.

‘Well certainly from an educational perspective, it is teaching students about how to make decisions, talking to them about things like pattern recognition, things like how bias can affect decisions and can result in errors’.

‘...for me there are two aspects to clinical reasoning, though there are probably more, so from the point of view of clinical skills there is diagnostic reasoning, which is how your findings, or history, or special investigations influence you making a diagnosis and the process that people go through to make that diagnosis and also I think that part of CR is knowing when which bits of the test, in the most liberal use of the word, are useful or not’.

Given the significant variation seen in these responses, it may be helpful for UK medical schools, through the work of the Medical Schools Council and the UK Clinical Reasoning in Medical Education group (CReME, www.creme.org.uk), to adopt a consensus definition of CR, to provide clarity in this area.
Theme 6 – CR and the patient safety agenda

All three interviewees agreed that CR had a strong link to patient safety. One interviewee stated:

‘And progressing into final year they are being prepared for the workplace, that places a greater emphasis on practical knowledge and skills. With the current emphasis on patient safety that's probably informing a lot of this as well as with patient safety and learning from mistakes you are looking at the sequence of events in things going wrong, and that maybe contributing to it’

Hence, it seems likely that CR may need to become a more important feature of UK medical curricula, given the emphasis on patient safety in Outcomes for Graduates (GMC, 2009; 2015a) and Promoting excellence: standards for medical education and training (GMC, 2015b).

Theme 7 – Delivery of CR teaching on clinical placements

One theme emerging from the free text comments in response to the online survey was whether CR is explicitly taught in some situations, or whether this is simply assumed. Interviewees also picked up on this point and there was consensus among them that it is more difficult to be certain about teaching of CR outcomes in the later years of medical curricula, as these years of most programmes are more difficult to manage. One interviewee stated that they would assume that CR was being taught, as this would be inherent to the clinical placement activities that students would be undertaking:

‘I would assume that students are doing both of those things <Outcomes 8c and 8g> in the <deleted> block, as how can they do the block without doing it?’

A second interviewee referred to the later years as a black box:

‘Yes except, as you know, years 3, 4 and 5. <Name deleted> calls it a black box, we are just trying to have a look in at the moment’,

which is perhaps a natural consequence of the number of individuals involved in the delivery of the curriculum to a large number of students spread across different specialities, and often at many different sites at any given time. This is an issue that UK medical schools will need to consider when mapping their curricula against Outcomes for Graduates (GMC, 2009; 2015a).
Theme 8 – Inter-specialty differences in CR and implications for teaching

Interviewees provided varied responses when asked which arena was best suited to the teaching of CR. There was consensus that CR is best taught in medical specialties (examples given included general medicine, acute medicine, care of the elderly and cardiology) and also in general practice/primary care, which was stated as an often-forgotten fact. Two interviewees stated that the nature of general practice, in which the doctor often has little or no information on the patient’s problem until they start to speak, means that this specialty lent itself well to the teaching of CR:

’Sof I am not sure that secondary care is best, I think there is just as much -- depending upon your definition of CR -- if not more in primary care and I think often the students miss that; I think a lot of the what the primary care physician does is actually working out which bits factor into a working diagnosis and then testing that with a limited exam and limited investigations which I think is often a little bit more pure clinical reasoning’

‘General Practice is an area where Clinical Reasoning is taught. At the end of the day the students are seeing patients and they haven't even got a referral letter to begin with’.

All three interviewees did, however, make the point that all clinical specialties can be used for CR teaching but they had a mixed opinion of the extent to which surgical placements are suited to the teaching of CR to undergraduate medical students. For example one interviewee said:

‘I think the surgery which our students are exposed to is mostly routine surgery, routine procedures. The surgeon will look at the X-ray and will know immediately what it is that they need to do. Whereas a very complicated patient can present on a medical ward and quite a lot of decision making processes are algorithmically used’,

whereas another said:

‘I've seen surgeons do very nice detailed Bayesian reasoning without knowing that is what it was, trying to work out a diagnosis of a puzzling acute abdomen that looks like appendicitis with a normal ultrasound. I think in general surgeons try and make quicker diagnoses, but I don't think the process is any different.’

Therefore, it may be beneficial for medical schools to consider having CR as an explicit theme within general practice/primary care placements that are
undertaken by all UK medical students, which may additionally solve the issue of uncertainty about where CR teaching is delivered, as highlighted by Theme 3 above.

**Theme 9 – Training teachers and medical students about CR**

A final theme emerging was how clinical teachers could demonstrate their CR processes to students more effectively. The interviewees indicated that it was important for doctors who teach to be provided with training/tools to better understand their own thought processes, thereby enhancing their ability to explain CR to their students:

‘...so I have, as yet, don’t have much influence over what happens in the clinical setting – though in a few weeks I’ll be speaking to GPs about teaching CR’.

‘...and the doctors are trained to question them <the medical students> when they are doing their presentation, to determine what is the reasoning behind the diagnosis they have arrived at’.

One of the interviewees also highlighted the importance of actively engaging students in CR-related discussions:

‘...for example, the patient with what classically looks like a UTI who may have an ectopic pregnancy. We train them <the medical students> to say the most common things are common. We don’t train them to think, have I checked for an ectopic, have I checked for appendicitis? Have I checked for this... I must make sure that I do not miss diagnoses. It’s changing.’

This could be done through formal classroom teaching and/or workshops or through e-learning. This could prove useful for students as it could provide them with the ability to help their own teachers, who may have no formalised teaching in CR, to make the invisible visible, or at least more visible.
RECOMMENDATIONS

The results of this study suggest that the following actions should be considered by UK medical schools to support the enhancement of teaching, learning and assessment of CR outcomes in undergraduate medical programmes:

1. UK medical schools, through the work of the Medical Schools Council and the UK Clinical Reasoning in Medical Education group (CReME, www.creme.org.uk), should develop a consensus definition of what constitutes clinical reasoning in undergraduate medical curricula (Theme 5).

2. UK medical schools should recognise the challenges inherent in mapping and ensuring the delivery and assessment of clinical reasoning-related outcomes in the more clinically-oriented placements that occur in the last 2-3 years of UK undergraduate medical curricula (Theme 7).

3. UK medical schools should recognise that delivery and assessment of clinical reasoning provides an opportunity to improve the coverage of patient safety-related teaching and assessment in UK undergraduate medical curricula (Theme 6).

4. UK medical schools should consider identifying clinical reasoning as an explicit theme within their curricula. This may most easily be integrated into general practice/primary care placements that are undertaken by all UK medical students, although all clinical specialties could be utilised (Theme 8). This also links to 2. above.

5. UK medical schools should consider developing more explicit teaching for their students on cognitive and other processes involved in clinical reasoning (Theme 9).

6. UK medical schools should identify clinical teachers to be trained as clinical reasoning teachers, and to act as role models to students (Themes 9 and 2, respectively).

7. UK medical schools should consider developing one or more robust assessments (which may include written and practical exams, assignments, and/or portfolios) to test clinical reasoning outcomes. This could be done through the work of the Medical Schools Council Assessment Alliance (Theme 1).
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REFERENCES


