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Developing Clinical Reasoning in a Physician Assistant curriculum. The University of Sheffield approach.

Introduction

Clinical reasoning is the process by which clinicians collect and process information, understand the patient's physical and psychosocial problems, develop and implement a medical plan, evaluate outcomes and learn from them. It is recognised as a core skill to be developed by clinicians during training yet studies in the United States from autopsy data have demonstrated that clinical reasoning errors in diagnosis still represent 10-15% of all clinical errors with authors noting that despite this, relatively little curriculum time is dedicated to the subject[1]. Competence in clinical reasoning is described in the outcomes expected for medical graduates by the United Kingdom General Medical Council (GMC) [2] and some academics have called for it to be explicitly included as one of the core competencies described by the United States Accreditation Council for Graduate Medical Education (ACGME)[3]. As the GMC is soon to become the regulator for the Physician Assistant profession in the UK, providing effective learning in clinical reasoning skills now has increased relevance for current UK Physician Assistant educators.

Current curricula tend to prioritise the acquisition of biomedical knowledge over skills in gathering and processing information, however it is a combination of both that facilitates development in clinical reasoning to improve diagnostic accuracy[4]. Croskerry (2009) discussed the application of specific reasoning concepts, such as dual process theory to improve clinical reasoning[5]. Dual process theory is the concept that reasoning processes involve a combination of rapid system 1 processes and slower system 2 processes[6]. System 1 processes are rapid and intuitive, leaning heavily on experience and pattern recognition, whilst System 2 processes are slower, rule based and involve hypothetico-deductive reasoning. Review of the literature would suggest that where clinical reasoning has been developed in clinical curricula it is more often built upon hypothetico-deductive

reasoning (System 2) and marginalises learning about System 1 processes. Contrary to common thinking the evidence shows pattern recognition (utilising "system 1" processes) leads to an overall lower diagnostic error rate[7]. We propose that the development of sound clinical reasoning in students will be frustrating if it is built solely from a hypothetico-deductive approach.

Other authors have suggested supporting the development of clinical reasoning through a variety of pedagogical approaches, including problem solving clinical seminars[8], comparisons of the use of clinical vignettes vs chief complaint with necessary information gathering[9], test-enhanced learning[10], and the use of illness scripts[11]. With all these contrasting methods, it is unsurprising that there is still a lack of consensus about how we best teach and assess clinical reasoning[12].

Following the recent expansion of the Physician Assistant (PA) role in the UK (re-named Physician Associate) work has shown one of the biggest barriers perceived by doctors to the employment of newly qualified PAs is anxiety regarding their clinical reasoning abilities after a relatively shorter training period and particularly their ability to "*know what they don't know*". It is notable however that the work found the same anxieties around newly qualified medical graduates[13].

This paper sets out how we have sought to address these concerns in the Physician Associate course at the University of Sheffield (UoS) Medical School. Our curriculum seeks to develop students' clinical reasoning skills through an integration of a number of approaches to reasoning including contextual bounded rationality (the making of decisions based on limited information, our cognitive limits and time constraints)[14], dual process theory and illness scripts. We then provide some critical reflection upon this process and discuss the challenges we recognise in taking this work further.

The University of Sheffield approach

The UoS programme is split into two stages. The first is predominantly about knowledge acquisition with a focus on learning the biomedical sciences (including anatomy) and clinical skills in simulation. The second is almost exclusively based within clinical placements.

Clinical Reasoning development in stage one

In stage one we integrate the basics of consultation skills, including the psychosocial elements of information gathering with an introduction to approaches to clinical reasoning skills. Recognising our students do not initially have the experience to utilise 'system 1' thinking with appropriate acuity, we seek to ensure that they understand how to use the hypothetico-deductive method to allow them to practice 'system 2' thinking whilst actively using cognitive forcing strategies as a safeguard (ensuring this approach does not become their baseline for clinical reasoning too early in their development).

Theory sessions

Nine dedicated sessions are delivered to introduce the concepts and theories needed, as shown in Table 1, alongside standard lectures in the biomedical sciences. These are deliberately ordered to ensure students develop a good understanding of the psychosocial elements of patients' problems and how this is as vital to effective information gathering as the traditional medical history.

These small group sessions utilise a blend of didactic learning, role play and group exercises to develop skills needed to better gather and deliver effective consultations to patients. The focus is continually brought back to the need to get the right information, both clinical and psychosocial, to utilise their biomedical knowledge emphasising that these are interdependent in effective diagnosing.

Session nine uses illness scripts on similar conditions to highlight the similarities and differences between the two from a diagnostic perspective. Illness scripts comprise structured information around a condition (pathophysiology, presentation etc) and allow a compare and contrast approach to learning, facilitating reasoning development [11]. This session explores how a differential diagnosis is not a static list of disorders that is produced after all of the information has been presented to us (as suggested by the classical hypothetico-deductive method) but rather an emergent and

developing process of forming and rejecting hypotheses based on relative risks and predictive values of different symptoms and signs against our internal knowledge scripts as information is presented. Evaluation of these sessions with respect to developing clinical reasoning is very positive but this is an area for continuing development.

Integrated learning activities

These small group sessions are focused on a particular condition (e.g. asthma or depression) and we add specific clinical reasoning objectives to address the common presentation (e.g. the differential diagnosis of breathlessness or low energy). These are designed to complement the main lectures (which are condition based) in order to emphasise the need to undertake a clinical reasoning process and highlight that patients present with symptoms not diseases.

Clinical Reasoning development in stage two

During the second stage of teaching students are predominantly on placement. Clinical supervisors are supported to adopt an interrogative approach to teaching utilising the one- minute preceptor approach, which has been shown to support reasoning development in a busy clinical environment[15]. In a situation where the student is adopting a more passive observer role this approach can be used to draw out the students understanding of the clinical reasoning behind what they have observed. For example, in a Gastroenterology clinic you might ask “why do you think I thought this was inflammatory bowel disease?” The student must then reason the information they have gained from their observation to identify the salient points. The clinician can then provide a couple of key learning points linked to this, advise on things to consider in the reasoning process, and move on to the next case.

Other elements of our placement design have been adapted to support the development of clinical reasoning. We have moved away from a concept of placements in speciality areas to one where they are all presented as generalist clinical learning environments. We recognised that in hospital

placements students are often likely to have a greater degree of information about a patient prior to seeing them whereas in family medicine this is often minimal (with emergency medicine being somewhere in the middle). We therefore deliberately order our placements in the following manner: hospital medicine, then emergency medicine, and finally family medicine to allow a gradual increase in the frequency and degree of clinical reasoning available to and required by students. During the family medicine placements students meet as a group with a tutor once per week to discuss their diagnostic clinical reasoning (by student-led case based discussions in smaller groups followed by an interactive review of key conditions) that focus on a different clinical area each week e.g. respiratory medicine.

Assessment

Recognising that assessment drives learning we had to consider how we could deliver summative assessment of clinical reasoning to avoid the risk of students failing to engage with these curricular elements designed for reasoning development. One review has considered multiple assessment methodologies including tried and tested Single Best Answer (SBA) and Objective Structured Clinical Examination (OSCE) approaches[16] whilst others have looked at the options to assess reasoning across Miller's pyramid of clinical competency, particularly the higher levels[17]. This suggests that there is not necessarily a need for a totally new assessment method to assess reasoning but that we need to ensure the purpose of learning in clinical reasoning is clear and firmly integrated to the biomedical learning running alongside. We continue to utilise SBA and OSCE as our primary summative assessments but ensure our quality assurance processes have a focus on clinical reasoning by ensuring higher order questions are set, with the greater need for reasoning, and eliminating low order questions, which are simply seeking knowledge recall. This approach facilitates the assessment of critical thinking and deeper knowledge retention[18]. On clinical placements we utilise mini clinical evaluation exercise (Mini-CEX) assessments throughout stage 2 in which student competence in interpretation of findings is explicitly sought. These evaluations have been shown to

have good criterion-rated validity when compared to other assessment methodologies and thus provide us with an additional assessment tool for clinical reasoning[19]. We deliberately ask that these are done across the whole placements time rather than in a cluster to allow an appreciation of the development of reasoning rather than a single "snapshot in time". Progress to date suggests this approach has demonstrated improvement in student reasoning however more formal work remains to be done to provide clear demonstration of this.

Discussion

It is recognised that university education should strengthen the development of critical thinking. If clinical teaching has been too heavily focused on knowledge transfer and assessment too heavily dependent on knowledge acquisition, then assumptions that students will be able to easily transition from education to future clinical roles are at best naïve and at worst negligent.

We aspire to provide learning that makes this transition feel as seamless as possible for our students. Our integration of the concepts of bounded rationality, dual process theory and illness scripts with experiential learning and a determined focus on developing clinical reasoning skills provides our students with skills that should make this transition less painful. We suggest the concepts of bounded rationality and dual process theory are particularly important in understanding clinical decision making[14] and, that in the development of clinical reasoning, illness scripts are most useful in explaining how experts formulate decisions using non-analytic intuitive reasoning. Though it has been proposed that introducing students to "system 1" processes early might lead to increased confirmation bias or early closure bias, evidence indicates that early hypothesis formation is associated with better diagnostic accuracy[20]. We also recognise work which demonstrates that when developing clinical reasoning, students' personal cognitive regulatory processes need to be actively practiced and developed and that didactic teaching about these processes on its own does not necessarily lead to students' developing higher cognitive processes[21].

We must also ensure that we present an honest picture of the world that awaits our students. Though most medical education is founded with a basis on disease processes, this does not reflect the way that patients present. Patients bring symptoms of illness influenced by their own ideas, concerns and expectations which present as a puzzle to be solved. They bring more than one problem and frequently their symptoms do not fit the classical patterns of diseases. We must bridge the educational divide between how our students learn and how they are required to interpret a patient's symptoms to make a diagnosis in the real world. At times, this still remains a challenge for the most experienced clinicians and students should be re-assured that their journey in developing clinical reasoning is only just beginning.

Through continued review of our assessment processes we can improve how we evaluate students' clinical reasoning. As a course we recognise that there is the need to reflect whether our current workplace-based assessments remain fit for purpose to develop reasoning knowledge when other tools, such as the Assessment of Reasoning tool[22], are available. Introduction of such tools will necessitate development of our clinical supervisors as well as students and is thus work for the future. In addition, more work is required in supporting our clinical supervisors in their own development as teachers with respect to this area.

In the introduction we highlighted the aspiration to see clinical reasoning as a core part of medical training in both the UK and US as well as the concerns of employing clinicians. We believe that all Physician Assistant courses should see this as a vital part of their curriculum development and that the ways described in this paper are simple enough to scale up to other programs. There are potential challenges with some of our concepts, such as the order in which students undertake placements, given the pressure on training places. We believe however that just redefining the concept of placements from learning a speciality to a more global educational opportunity can help mitigate this and support reasoning development, especially when supported with improved tutor and student education in the reasoning process.

Conclusion

In designing our curriculum in response to concerns raised by potential future employers, we suggest our course now provides learning in clinical reasoning at a deeper level than is often found in other courses in the UK, whether for medical students or physician associate students. The doctors in our faculty are primarily Family Practitioners and we strive to keep the patient narrative at the very centre of our learning and development of clinical reasoning skills. Starting from the concepts of patient ideas, concerns and expectations, we have sought to build students communication skills, and hypothetico-deductive reasoning whilst simultaneously integrating broader and deeper clinical reasoning theories and techniques. We present clinical reasoning as an iterative, dynamic process carried out with patients, not as some independent higher cognitive exercise.

We have not sought to reinvent the wheel and have utilised previous thinking in medical undergraduate education described at Keele University[23] and the University of Adelaide [24]. We have built on these through the introduction of illness scripts along with a robust exploration of dual process theory on reasoning and common cognitive biases including how these can be recognised and mitigated.

We hold the patient and the consultation process at the very centre of our curriculum, practicing scenarios where patients present with confusing stories or produce unwanted emotional reactions that can frustrate clear clinical reasoning processes. This understanding of the consultation as a dynamic two-way process in which the clinicians own emotional state is as important for sound clinical reasoning as that of their patients will hopefully also help them to develop resilience in their future careers.

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