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Reasoning for registrars

An overview for supervisors and medical educators

As supervisors and medical educators, one of the most difficult tasks we face is helping a general practice registrar who is struggling to adapt to the primary care environment. Of course, there are many features of the registrar that can make this process difficult: a need for certainty, a lack of flexibility, or personal or professional qualities. And sometimes we find it difficult to create an environment conducive to effective learning: interpersonal conflicts, lack of educational experience or resources, and the perennial lack of time may affect our capacity to support our registrars.

However, there are also cognitive elements. We see registrars who ask all the right questions, get all the right answers, and yet cannot draw the conclusion we feel is 'obvious'. Other registrars become prematurely committed to a diagnosis, searching for validating signs and ignoring another condition altogether. Many registrars become overwhelmed by the sheer volume of knowledge and skill required in general practice.

How do we help registrars to extract the useful information from a clinical presentation and draw the best conclusion? We can help them learn about diseases, but how can we help them apply this knowledge effectively when they are faced with clinical complexity? And how do we best teach general practice so that it encourages effective clinical reasoning?

In order to answer these questions, it helps to delve into the reasoning literature and examine some of the concepts.

The importance of content: data acquisition

There have been attempts in the past to teach generalisable problem solving strategies to assist diagnosis on the assumption that skills can be applied in any clinical context.[1] However, recent research does not support this view.[1,2] Expertise seems to be context specific.

To most clinical teachers, this makes sense. We have all seen a registrar perform a confident, well structured consultation with a familiar situation (eg. an emergency presentation such as a child with a minor head injury) and then seen the same registrar struggle with a similar patient with a less familiar diagnosis (eg. a red eye or shoulder injury). The literature identifies expert clinicians experience simila r difficulties when they try to reason in an unfamiliar clinical situation.[1]

Registrars cannot reason effectively without the knowledge base to do so, no matter how many strategies we teach. But the question is: 'What knowledge should be taught, how is the knowledge organised and how is it best retrieved?'

Recent evidence suggests that clinical reasoning is most accurate when doctors use a combination of nonanalytical reasoning, or pattern recognition, with analytical reasoning or key feature matching.[3,4] Therefore, knowledge needs to be laid down in memory both as a collection of illness scripts or patterns of illness, and a network of key features and explanatory frameworks.[5]

The richer the knowledge network, and the more connections made across the biomedical matrix, the more likely it is an accurate and useful diagnosis will be reached.[6] So a registrar who can think through patients with 'shortness of breath' or consider 'common illnesses in the paediatric population' will be better equipped to work with a wheezy toddler than a registrar who has learned about asthma and bronchiolitis in isolation. The choice of textbook is significant.[7] Murtagh's diagnostic framework for instance, brings rich opportunities to network key diagnostic concepts by using a symptom based structure.[8]

An example of the importance of these rich networks of knowledge may be a patient who presents with tremor. The registrar may consider the diagnosis of Parkinson disease quite quickly if they recognise a pattern in gait or the appearance of the patient. They will then cross check symptoms and signs against the key features of the disease, and, if there is sufficient evidence, make an appropriate diagnosis. A lack of patterns in the memory (due to lack of experience) and a lack of a diagnostic framework (due to lack of knowledge) will make the accurate diagnosis of this patient less likely.

Patterns and probabilities: hypothetico-deductive reasoning

Both novices and experts use hypothetico-deductive reasoning: the strategy of generating a hypothesis early in the reasoning process, and then seeking out information to prove or disprove their theory before moving on to a different hypothesis if necessary.[9] This method has been criticised for encouraging premature closure: a commitment to a diagnosis too early in the reasoning process that precludes careful consideration of other alternatives.[10] As Elstein writes: 'A clinician may quickly become psychologically committed to a particular hypothesis, making it more difficult to restructure the problem'.[4]

It is important to note here that accuracy and thoroughness are not the same: we all know of very thorough medical students who reach the wrong conclusions by ignoring or misinterpreting data. Equally, it is possible to reach the correct diagnostic conclusion without being thorough. And it is, of course, possible to lack both thoroughness and accuracy! The model of a combined nonanalytical strategy (pattern recognition) with a more analytical phase (checking key features of the proposed diagnosis) is therefore desirable.[11]

The difference between novices and experts lies in the speed and accuracy of the hypotheses made, and the method and efficiency of weighing up evidence for and against the hypothesis.[12] Some of this speed lies in the ability to recognise patterns.[9] We all know that some areas of medicine rely heavily on pattern recognition. Visual patterns are essential in dermatology, cardiologists recognise aural patterns in heart sounds, surgeons use kinaesthetic cues. However, how does pattern recognition work for the patient with complex diagnostic processes, such as depression?

Research on the categorisation process suggests that experts have built up a bank of prototypes.[9,13] These may be built on specific cases that they have met, or a representation of a number of cases,[14] or an abstract model built through theory and practice.[15] Experts have a rich understanding of the variations in the patterns and the ways in which patterns may overlap.[16] The combination of the patient, the symptoms, and the signs form a prototype that facilitates our diagnosis. We may remember a particular case vividly, or recognise a conglomeration of all our Parkinsonian patients, or perhaps we recall a pattern from a recent continuing professional development event.

However, we also need to ensure the registrar recognises the pattern and remembers the relevant key features, so an understanding of memory structure and retrieval is also vital to the understanding clinical reasoning.

Retrieving the content: problem representation

Memory can be an extraordinarily efficient tool for diagnosis, or frustratingly inaccessible when we most need it. What facilitates access to a crucial illness script or set of key features when we are presented with a diagnostic dilemma?

Elstein,[17] Bordage[18] and Schmidt,[19] have focused on the cognitive structures around which we lay down and retrieve our medical knowledge. A key concept is that data will be best retrieved when the stimulus best matches the pattern laid down in memory.

We all recognise the moment when a patient triggers a diagnosis: the 'worst headache I've ever had' immediately triggers the idea of an intracranial bleed, because we lay down that feature in our memory in association with that disease. When we describe 'acute, severe, crushing, central chest pain' to a colleague, it is highly likely that the diagnosis of ischaemic heart disease will spring to mind.

This is known as problem representation: the way we interpret or translate a presentation of symptoms and signs into a coherent clinical case. The more we match the current problem to the illness script in our memory, the more likely we are to make a match and proceed to a diagnosis.[6,19,20] Most illness scripts are laid down in predictable ways, and often involve semantic qualifiers.[21] Semantic qualifiers are paired opposing descriptors that are used to create an abstract description of the event. Examples of semantic qualifiers include: acute/chronic, single/multiple, mild/severe, constant/intermittent and unilateral/ bilateral.

Chang et al[22] describe the difference between a student presenting a case and an expert who uses these semantic qualifiers. While a student may describe a 'painful swollen right knee that began 2 nights ago with attacks 2 and 9 years ago' an expert will provide a more abstract problem representation: 'an acute, recurrent attack of abrupt, nocturnal and severe pain in a single, large joint'. The semantic qualifiers reflect the meaning attached to the clinical data and helps the doctor sort through differential diagnoses. They facilitate retrieval of relevant material from memory by closely matching the way diagnoses are encoded.[23,24]

Moving from novice to expert: pathways for developing expertise

When a doctor moves from novice to expert the way they lay down and retrieve their knowledge changes. Higgs and Jones[1] describe novice reasoning as a step-by-step process through long chains of detailed data. When we watch a medical student work through a case of abdominal pain, they will often work system by system, structure by structure, and generate a large amount of data before they are able to reason through the case.

As the novice matures, elements within their knowledge matrix that frequently activate together become 'encapsulated' into concepts.[18] A registrar will have a method for reasoning through a case of obstructive jaundice, or forward failure in heart disease. The expert fills out this knowledge with 'illness scripts'; which are recognisable patterns and prototypes that guide the reasoning process. An expert seeing an obese, middle aged woman with right upper quadrant abdominal pain will investigate cholelithiasis early and efficiently. Of course, complex cases will still need the detailed reasoning we learned as medical students, but on the whole, we make rapid diagnoses based on patterns.

So how do we facilitate this shift? As teachers, we need four processes.

- We need to fill in the gaps in the registrar's knowledge matrix: you can't encapsulate knowledge and concepts that aren't there
- We need to encourage links between concepts to encourage encapsulation, and this means moving across the registrar's matrix. Medical students lay down their knowledge matrix on biomedical lines, the 'vertical' elements of their matrix. If we want to tie those concepts together, we use symptoms that cross systems (eg. chest pain, shortness of breath), patient groups (eg. aged care, Aboriginal health) or processes (eg. prescribing, consultation structure)
- We need to encourage registrars to use semantic qualifiers to facilitate abstract case representations that will trigger illness scripts
- We need to present and discuss patterns, prototypes and probabilities. Case based learning is a common and effective method to cement key concepts. In the language of clinical reasoning, we need to present 'illness scripts' to enable registrars to recognise patterns. We also need to discuss the changing probabilities of different diseases as you move from the tertiary to the primary setting.

Metaphors, vocabulary and concept formation

It is difficult to form a concept without the words to describe it. As general practitioners our primary tool is our language, and we cannot recognise, understand or explain patterns without words. We have a number of concepts that are new or less familiar to hospital registrars, and these change over time. If I discuss a patient with multiple medically unexplained symptoms, most GPs will recognise a pattern. When a registrar flounders with a patient, these concepts can lend structure to an otherwise random series of issues. As teachers, we often find ourselves commenting: 'this is a new mother seeking reassurance and education' or 'this is a doctor shopper' or 'this man is grieving'. These conceptual frameworks make sense of the consultation, and of the care of the patient as a whole. When we address the question: 'What is going on with this patient?' it is important to share these frameworks – they often have as much bearing on the patient as the diagnosis.

The role of the 'noncase'

Finally, we should mention the endpoint of diagnosis. In a secondary or tertiary setting there is always the 'noncase', the patient who does not acquire a diagnosis and whose complaint is not addressed by your particular specialty. In general practice, the paradigm shifts. The GP is regularly confronted with problems that defy classification and is frequently unable to 'convert evidence into the names of diseases'.[25] General practitioners are very familiar with these grey areas of medicine where there is symptomatic discomfort but no obvious diagnosis. The lack of diagnostic frameworks for these conditions makes management difficult – 'the absence of words, ie. disease categories, to cover large areas of symptomatology presenting at these boundaries, imposes severe strains of the clinician's ability to think'.[26]

Table 1. Strategies for improving clinical reasoning skills in registrars

- Fill the knowledge gaps, or preferably get the registrar to identify them and seek out the answers via a learning plan
- Teach by symptom to embed concepts of primary care probability and improve memory and retrieval in the clinical situation
- Introduce prototypes – typical cases in interesting, memorable ways to help lay down illness scripts. Use typical cases before moving on to atypical or subtle presentations
- Share classifications – the diagnostic 'shorthand' we use to encapsulate our understanding of a patient's illness
- Be clear about where responsibilities begin and end, and resist the 'noncase' diagnostic label
- Recognise that working 'across the matrix' is harder cognitive work for the registrar. This may need to be explicit otherwise your educational sessions may be poorly received as they are harder to understand
- Reassure the registrar that cognitive work diminishes as expertise increases, and investment now will pay dividends sooner
- Encourage registrars to use semantic qualifiers in their case presentations
- Provide cognitive feedback – encourage registrars to articulate illness scripts and problem representations and compare similarities and differences

For the registrar, this discussion is important. How do you explain musculoskeletal chest pain without simply reassuring the patient that it is 'nothing serious'? What do you do with a patient who has persistent abdominal pain despite a lack of evidence for any particular pathology? And what happens when none of your diagnoses help explain a person's experience?

As educators, we need to open up a discussion about the noncase or it is likely to be treated with frustration by the registrar and result in an unsatisfactory encounter for the patient. As Dixon writes, we: 'Must often diagnose what things are not, rather than what they are; must sometimes make management decisions before, or instead of, disease decisions and must frequently ignore the temptation to be thorough'.[26]

Strategies for improving clinical reasoning skills in registrars are outlined in *Table 1*.

Conclusion

As teachers, we recognise and empathise with a registrar's struggle to master the vast landscape of general practice care. By identifying methods of acquiring expertise we can improve the efficiency and effectiveness of our educational interventions.

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