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Diagnostic Error

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Introduction

Getting the right diagnosis is a key aspect in health care as diagnostic errors can lead to negative health outcomes, psychological distress and financial costs. The Institute of Medicine (IOM) defined error in medicine to be a "Failure of a planned action to be completed as intended and the use of a wrong plan to achieve an aim". Their report "To err is human: building a safer healthcare system" distinguished four types of error in which diagnostic error was one.[1]

Diagnostic error is not uncommon, a conservative estimate found that 5% of US adults attending an out-patient department experienced a diagnostic error, post mortem studies have shown that diagnostic errors may contribute to 10% of patient deaths and medical chart review suggests 6 – 17% of hospital adverse events are due to diagnostic error.[2]

Many different definitions of diagnostic error have been proposed and there has been disagreement about what constitutes diagnostic error. Does diagnostic error refer to the process of arriving at a diagnosis or the final multifactorial outcome of which the diagnostic process is only one factor.

Therefore, the Committee on Diagnostic Error, which was set up to look at this issue, defined diagnostic error as: *The failure to (a) establish an accurate and timely explanation of the patient's health problem(s) or (b) communicate that explanation to the patient.*

The definition has been framed from the patient's perspective as the patient is ultimately at risk of harm. It also conveys that each arm may be evaluated separately. Therefore, focusing on two characteristics of diagnosis, accuracy and timeliness. The committee did not specify a time period that would reflect "timely". Therefore, this term needs to be operationalised for different health care problems.[2]

Clinical World

The fundamental aspect of making a diagnosis is based upon our history and examination of the patient. There is an iterative process of information gathering, information integration and interpretation to determine a working diagnosis. Clinicians will generate a differential diagnosis and will refine this list as further information is obtained. As the list narrows to one or two possibilities, diagnostic refinement becomes diagnostic verification in which the lead diagnosis is checked for its adequacy in explaining the patient's symptoms. It is important to note that clinicians do not need to obtain diagnostic certainty prior to initiating treatment.

Medical schools teach us how to acquire knowledge and use the traditional "bedside evaluation" (history and examination). However, the recent explosion of imaging and laboratory testing has inverted the diagnostic paradigm and junior clinicians often bypass the bedside evaluation for immediate testing. There has been an exponential rise in the volume of imaging done. For example, the fraction of ED patients with dizziness undergoing CT scans has risen steadily from 9% in 1995 to over 40% in 2013 with no increase in the number of stroke diagnoses.[3] This has allowed such investigations to move tentatively from symptom driven to non-symptom driven, leading to a flood of information which leads clinicians to accept a world in which we accept VOMIT (victim of modern imaging technology) as a reasonable price of technology but in which the diagnostic process has failed.[4]

Clinical Reasoning

Accurate, timely and patient centred diagnosis relies on proficiency in clinical reasoning, this is regarded as the clinician's quintessential competency. Understanding, the clinical reasoning process and the factors that can impact it are important to improving diagnosis.[5]

The current understanding of clinical reasoning is based upon the dual process theory (DPT) that integrates analytical and non-analytical models of decision making. The DPT was originally developed in the cognitive sciences and has been adapted for medicine.[6] It provides a scaffold for describing two pathways for decision making. System 1 is subconscious, fast and dependent upon pattern recognition, for example the recognition of the typical skin rash of herpes zoster. System 2 is conscious, slow deliberate and analytical. System 2 processing requires individuals to generate mental models of what should or not happen in a particular circumstance, in order to test possible actions or explore alternative explanations. System 1 is less demanding on cognition but there is a tendency to over-trust it and thereby leading to diagnostic failure.

Expert clinicians develop better mental models of disease which support more reliable pattern matching (System 1 processing). As clinicians accumulate experience, the repetition of Type 2 system processing can improve pattern matching and storing in the memory. This ability to create and develop mental models through repetition explains why expert clinicians are more likely to rely on pattern recognition compared with novices.

Rationality and Bias

Rationality is the foremost characteristic of the accomplished decision maker. Rationality can be defined as making the best possible decision given the available evidence and the prevailing conditions. This definition assumes that we are well rested, fed and have undivided attention. In addition, we are aware of our biases and know how to deal with them.

We need to be aware of the factors that compromise rationality. There is a tendency for the brain to lessen cognitive work, a cognitive miserliness. Kahneman coined the term WYSIATI ("What you see is all there is").[7] Rationality failures can also arise from the mindware (software) problems in that individual's brain.[8] Mindware can suffer from gaps were essential knowledge has not been acquired or is forgotten. This appears to be a particular problem for biostatistical knowledge than clinical knowledge.[9,10] Or where contamination has occurred, and the software is corrupted by bias and fallacious thinking.[11]

Heuristics are mental short cuts or cognitive strategies that are automatically and unconsciously employed in decision making. Heuristics can facilitate decision making but can lead to errors especially with atypical presentations. When a heuristic fails it is referred to as a cognitive bias.

There are over two hundred cognitive biases described in the literature and bias is so widespread that we need to consider it as a normal operating characteristic of the brain. Examples of such cognitive biases are listed in table 1. Some clinicians will persist in the notion that they are not vulnerable to cognitive bias, however, evidence exists in the literature that they suffer with a cognitive blind spot. [12,13]

Table 1: Examples of Cognitive Bias

Heuristic / Bias	Medical Example
Anchoring: Is the tendency to lock onto salient features in the patient's initial presentation and failing to adjust following further information being obtained	A patient is admitted with a TIA. During the course of the admission, the clinicians do not pay attention to new findings that suggest an alternative diagnosis.
Affective bias: Refers to the various ways that our emotions, feelings and biases affect judgement.	New complaints from recurrent ED attenders are not taken seriously.
Availability bias: Refers to our tendency to more easily recall things that we have seen recently.	A clinician who has read or seen a patient with an aortic dissection, assumes that the next patient has a dissection even though aortic dissections are rare.
Context errors: Reflect instances where we misinterpret the situation, leading to an erroneous conclusion.	The patient who presents with abdominal pain, we think of a GI problem. However, the pain may arise from another cause.
Premature closure: is the tendency to accept the first answer that comes along that explains the facts	ED hands over a patient to medical team as a haemorrhagic stroke. Later investigations determine that it is a bleed into a tumour.

Hot Zones

The counting of diagnostic error has not been easy. The complexity of the diagnostic process, inherent uncertainty underlying clinical decision making makes measurement a challenging task. In addition, many patients recover from their illness regardless of their diagnosis. Therefore, measurement of diagnostic error is not easy.

Using analysis of medico-legal claims in the United States as a surrogate marker of diagnostic error suggests that 12 million Americans each year in primary care suffer a diagnostic error of which 33% resulted in "serious permanent damage" or "immediate or inevitable death". Across practice settings missed vascular events, infections and cancers (sometimes collectively referred to as "The big three") account for most of the morbidity and mortality attributable to diagnostic errors. [14]

We regularly hear stories of over-crowding in our EDs and they have become the petri dish for diagnostic error. It is not a great place for diagnostic accuracy. You do not know the patient; the patient does not know you and we have incomplete medical records. The atmosphere is dynamic, there are distractions and sometimes chaotic scenes. All impairing our cognitive processing and increasing the likelihood of error.

Conclusion

Our medical schools teach us to take a history and exam our patients, leading to creating a differential diagnosis. There is, still a lack of formal teaching on diagnostic reasoning and students are not explicitly exposed to cognitive training in decision making. While recognising that the accurate measurement of a trainee's diagnostic reasoning is a challenging undertaking, there is a moral imperative to think about diagnostic pathway and how biases affect our thinking.

Therefore, it has been recommended that there is a need to optimise clinical reasoning to reduce cognitive errors. Secondly, to understand system related aspects of the diagnostic process. Thirdly, to effectively engage patients and the diagnostic team. Fourthly to promote appropriate values and attitudes and finally to improve education and the base of knowledge.[15]

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