

Opinion Paper

Nicola Cunningham*, Helmy Cook, Deborah Leach, Jill Klein and Julia Harrison

Demystifying cognitive bias in the diagnostic process for frontline clinicians and educators; new words for old ideas

<https://doi.org/10.1515/dx-2025-0016>

Received January 31, 2025; accepted February 6, 2025;

published online March 7, 2025

Abstract: Diagnostic error is a pervasive problem in healthcare with approximately one-third of adverse events in hospitals attributed to a failure in the diagnostic process. Cognitive biases are systematic, often unconscious, automatic patterns of thought that sometimes skew thinking and are considered a major contributor to diagnostic error. More than 100 different biases have been described that affect clinical decision-making, and the challenge for educators and clinicians is bringing the conceptual knowledge of cognitive bias to the bedside in an applicable and useful way to mitigate the effects of cognitive bias in diagnosis. The language that is commonly used around cognitive bias is technical in nature, often with complicated and nuanced descriptions, so developing a clear understanding of cognitive bias is a task that needs sophisticated language and memory skills as well as clinical reasoning skills. A novel language approach to learning and talking about biases in medicine is to use idioms, short phrases with a particular meaning that differs from the meaning of each word on their own, to simplify the terminology and improve recognition of cognitive bias at the frontline. We present ‘The Idiom’s Guide to Cognitive Bias’, a Table that lists 21 common cognitive biases in the diagnostic process, and defines each, offering a healthcare example and possible explanation for why each occurs. The benefit of The Guide is its practical approach to reinforcing cognitive and medical concepts through the

synergy of language and imagery and to demystify cognitive bias in the diagnostic process.

Keywords: diagnostic error; cognitive bias; clinical reasoning; idioms; medical education

Introduction

In its landmark report on improving diagnosis in healthcare, the National Academies Press concluded that most people will experience at least one diagnostic error in their lifetime, sometimes with devastating consequences [1]. Almost 10 years later, remarkably little has changed - diagnostic error remains a pervasive problem in healthcare with approximately one third of adverse events in hospitals attributed to a failure in the diagnostic process [2]. While a variety of factors can lead to diagnostic error, cognitive biases have been found to be a major contributor [3]. These biases are inherent in clinical diagnosis due to the frequently uncertain and complex nature of the task [1].

Addressing the role of cognitive bias in medical education is a key component of improving clinical reasoning and the diagnostic process for clinicians. Yet the application of knowledge about cognitive bias to improve recognition of its influence in frontline practice, remains an elusive and evolving field. Put simply, there is still a gap between knowing that cognitive bias can lead to sub-optimal decisions and reducing the effects of cognitive bias at the bedside. The challenge for medical educators and clinicians is how best to translate abstract concepts about bias to frontline clinical practice in a way that improves diagnosis. Is there a way to build upon tried-and-true teaching methods designed to sharpen clinical reasoning?

We propose the use of idioms to teach clinicians about cognitive bias in diagnosis. An idiom - such as “up in the air” as an expression of being undecided - is a short phrase with a particular meaning that differs from the meanings of each word on their own [4]. Because of their simplicity and memorability, idioms can help bridge the gap between conceptual knowledge about bias and applying specific mitigation strategies during the diagnostic process. We

*Corresponding author: Nicola Cunningham, Faculty of Medicine, Nursing and Health Sciences, Monash University, Wellington Rd, 3800 Clayton, VIC, Australia, E-mail: Nicola.Cunningham@monash.edu. <https://orcid.org/0000-0001-6559-8750>

Helmy Cook, Deborah Leach and Julia Harrison, Faculty of Medicine, Nursing and Health Sciences, Monash University, Clayton, VIC, Australia. <https://orcid.org/0009-0004-4817-3530> (H. Cook). <https://orcid.org/0009-0005-5785-0617> (D. Leach). <https://orcid.org/0000-0002-6953-5180> (J. Harrison)

Jill Klein, Melbourne Business School, Melbourne Medical School, University of Melbourne, Carlton, VIC, Australia. <https://orcid.org/0000-0001-6297-5469>

provide idioms for 21 biases and include ways to counter the effects these biases have on diagnostic outcomes.

Cognitive biases in medicine are ‘a dime a dozen’

Cognitive biases are systematic, often unconscious, automatic patterns of thought that sometimes skew thinking. Many cognitive biases originate from the use of heuristics, or ‘rules of thumb’, which are unconscious mental short-cuts to problem-solving [5]. These heuristics may be useful in routine situations but can fall short in unrecognised, non-routine contexts where biases can lead to perceptual distortion, inaccurate judgment and illogical decisions [6].

The role of cognitive biases in clinical decision-making has received considerable attention in the medical literature, as well as in the source disciplines of social psychology and behavioural economics. There are exemplar resources that articulate the role of cognitive errors in diagnostic medicine with theoretical explanations and case examples [5, 7, 8]. Specific attention to cognitive bias is being drawn in various medical sub-specialty publications as well [6, 9–14].

More than 100 different biases have been described that affect clinical decision-making [15], however many biases overlap or are subsets of others. One example is confirmation bias, where we are led to look for and believe information, as well as interpret ambiguous information, in a way that fits with our initial expectations and/or preferences. We see what we want or expect to see. Several different biases result from the psychological processes underlying confirmation bias and so can be seen as subsets or specific instances of confirmation bias. These include anchoring, which is the tendency to stick with our initial thoughts or impressions, and diagnostic momentum, where a prior diagnosis is held and passed on without critical analysis. Further examples of bias groups include gender bias, racial bias, and stereotyping, that all exist as subsets of ascertainment bias wherein stereotypes produce the expectations that we then tend to see as confirmed by ‘evidence’. In contrast to overlapping biases, two biases can represent opposite ends of a spectrum, such as commission bias and omission bias, where both can result in error. Commission bias is the tendency to err on the side of intervening more, whereas omission bias is the tendency to err on the side of intervening less. Both inclinations being motivated by good intentions towards the patient.

In diagnostic medicine, many biases are prospective, that is, they occur at the time a diagnosis is being made, however, some are retrospective, such as hindsight bias (the tendency for people with knowledge of an actual outcome to believe falsely that they would have predicted the outcome), which

affects how a prior diagnosis is judged. Outcome bias has two distinct definitions depending on whether it relates to a prospective scenario (where a less severe diagnosis is formulated, based on what one hopes will happen rather than what one really believes might happen), or a retrospective evaluation of a diagnosis (where the quality of the decision is judged on the basis of the outcome, rather than how that decision was made with the available information at the time). Hindsight bias and retrospective outcome bias are important biases to understand when undertaking clinical case reviews, as they impact on the reviewers’ assessment of the diagnostic process and quality of care delivered and therefore the potential learnings from the case.

Mental shortcuts, pattern recognition and subconscious automaticity, from where biases spring, are essential to efficient human functioning, whether it be getting dressed, driving a car, conversing, or forming judgements and making decisions [16]. Cognitive biases are not necessarily bad in and of themselves, but in situations where there is little time for deliberate thought, combined with an atypical situation that superficially appears typical, they have the potential to lead to errors. Many cognitive biases are pervasive and persistent, and in a wide range of conditions, different clinicians tend to use similar heuristics and show the same cognitive biases [17]. As stated by Atul Gawande “not only do all human beings err, but they err frequently and in predictable, patterned ways.” [18] An example of this is an observed gender bias in the diagnosis and treatment of cardiovascular disease in women where symptoms are more likely to be misdiagnosed as gastrointestinal or anxiety-related presentations [19]. The ramification of biases that influence the diagnostic process are significant (e.g. misdiagnosis of an infarct) and can lead to serious patient harm.

Mitigating bias by ‘making a long story short’

Much of the focus on cognitive bias in medicine has been about its existence and ill effects in clinical decision-making. Increasingly, consideration is being given to how students and clinicians should best be taught about cognitive bias [20–22], recognizing that biases are challenging to mitigate [23]. Tried and true, traditional teaching of diagnostic reasoning has evolved in such a way as to mitigate errors from cognitive bias with an emphasis on careful observation, thoroughness, consideration of differential diagnoses and the encouragement of second opinions. Furthermore, it is commonplace for more experienced doctors to hand down cautionary tales (e.g. “Not all that wheezes is asthma”, “ectopic pregnancy is a black cat on a dark night”), known

Table 1: Generic countermeasures for cognitive bias.

Slow down. Stop and think
Learn about and recognise cognitive bias
Consider all the available evidence and relevant information
Identify alternative diagnoses; what ELSE could this be?
Seek diverse perspectives. Get second opinions
Use decision support tools and AI
Promote humility and openness; acknowledge uncertainty
Engage in reflective practice. Get feedback whenever you can

clinical traps (e.g. “Sepsis in the elderly may not present with fever”), and maxims to help avoidance of such traps (e.g. “The older, the colder!”) [24, 25].

More recently, generic countermeasures have been articulated to explicitly help clinicians guard against cognitive bias [3, 26–28]. Cognitive bias awareness and instruction in metacognitive skills and reflective practice, may help clinicians move toward adaptive expertise and improve diagnostic accuracy [29]. The countermeasures listed in Table 1 represent sound approaches to reducing bias traps in diagnosis in a broad sense [3, 26–28].

Some of the barriers to recognising and reducing cognitive bias can be understood in the context of how clinicians communicate, think, and learn. The language that is commonly used around cognitive bias is technical in nature, often with complicated and nuanced descriptions of the similarities and differences between individual biases. The fundamental attribution error (the tendency to over-emphasise personal characteristics and ignore situational factors in judging others’ behaviours) is an example of this, where the nature of the bias, its definition, and real-world application is not readily understood from its literal name. Frontline clinicians tend to think and learn on a more practical level. In the fast-paced, high-workload setting of delivering frontline care, clinicians prefer simple concepts and rules that are easy to recall and apply as they rapidly retrieve and evaluate clinical information. Therefore, a point of commonality is needed to connect technical theories with practical applications and make the concept of cognitive bias more accessible to frontline clinicians.

‘Honing in’ on language and learning

An increased recognition in the literature of the role of cognitive bias in clinical decision-making over the last decade has not yet resulted in a corresponding decrease in clinician error [30]. There are multiple possible explanations for this. Although cognitive bias is innate and ubiquitous, a lack of insight into one’s own biases is common. Many clinicians are

either unaware of the existence of bias in their decision-making or dismiss its effects [9]. Furthermore, it is unclear how significantly an awareness and generic understanding of cognitive bias impacts decision-making at the bedside, yet it is self-evident that understanding cognitive bias aids reflective practice, and learning lessons for the next time for self and others in a given clinical scenario [24]. Another explanation may be that the academic knowledge has not yet reached enough frontline clinicians. The aforementioned report by the National Academies Press highlighted that education of diagnosticians on clinical reasoning and the cognitive contributions to decision-making was a major gap and should be a key priority in efforts to minimise error and improve patient outcomes [1]. Many clinical training programs do not have designated modules dealing with clinical reasoning, or judgement, decision-making, and preventing diagnostic error [31, 32]. Developing a clear understanding of cognitive bias and how to reduce the risk of it in clinical practice requires an ability to recall the many types of biases that exist and then determine their relevance to a particular scenario. It is a cognitive task that needs sophisticated language and memory skills as well as clinical reasoning skills. The use of a language tool such as idioms, may be effective in simplifying the complex nature of cognitive bias terminology to improve the recognition of cognitive bias at the frontline.

Idioms have been used in day-to-day life for countless generations, replacing literal words with figurative expressions to effectively paint word pictures and create vivid mental images. Idioms are designed to resonate with their audience and create a shared understanding. They aid in communicating an idea through intrigue, humour, and colour, so that the concept is easier to grasp.

There are thousands of idiomatic expressions whose meanings differ from their literal interpretations, and many oft-used idioms have an opposite idiomatic expression. For example, “opposites attract” and “birds of a feather flock together” describe two opposing beliefs suggesting that differences are attractive, or alternatively, similarities are attractive. In truth, neither idiom is necessarily always correct. Each are relevant or irrelevant depending upon the context in which they are examined. Importantly though, they both act as word images to help prompt thinking along a particular line when engaged in decision-making.

Neuroscientific research has shown that idiomatic expressions increase activation of the inferior frontal gyrus and amygdala, evoking stronger cognitive engagement coupled with stronger emotional responses in the brain than literal sentences [33]. Idiomatic expressions therefore better illustrate the full nuance of meaning and are more informative than the literal words, often using fewer words to say more. Through the use of familiar concepts and accessible

Table 2: The Idiom's guide to cognitive bias in diagnosis.

Bias	Definition	Why it happens	Example	The related idiom	What can help	The counter idiom
1 	Affective bias When emotions influence thinking, including positive or negative feelings towards a patient based on prior experiences	Affective bias is influenced by psychological, social, cognitive, cultural, and biological factors. These factors drive our emotional responses to internal and external stimuli that in turn can skew our perception, attention, memory, decision-making and behaviour	Finding a patient disagreeable and dismissing their shortness of breath as anxiety before considering a chest X-ray which would have revealed pleural effusions	Leading with your heart and not your head	Be aware of your unhelpful emotional reaction, and put it to the side Identify the emotions you are prone to experiencing in particular scenarios Channel an alternative emotion (e.g. compassion), to counteract your emotional response	Think before you act
2 	Anchoring bias Relying heavily on the first few features noted to support an initial diagnostic hypothesis and sticking with it despite new information that refutes this hypothesis	Our brains commonly preference the first piece of information as a reference point for subsequent decisions and judgements, because it is perceived to be more salient, and this simplifies a complex process	Attributing a patient's weight loss to the new diet and exercise routine they describe, without giving due consideration to their other recent symptoms of tremors, frequent bowel motions, and heat intolerance (that would suggest hyperthyroidism)	Digging your heels in	Be thorough Actively consider, rule in and rule out differentials Ask about relevant negatives	Keep an open mind
3 	Ascertainment bias When decision-making is based on prior expectations (stereotyping, racial bias and gender bias are subsets of ascertainment bias)	We tend to categorise people into groups, and our expectations and inferences of those groups come from our experiences and everyday observations of the kinds of social roles they play	Assuming that a patient found unconscious in the park next to an empty syringe has had an overdose, and missing the diagnosis of severe hypoglycaemia in a person with diabetes	Judging a book by its cover	Be mindful of stereotyping Adopt an empathetic approach Ask questions rather than make assumptions	Looks can be deceiving
4 	Authority bias The tendency to assume that a more senior colleague is correct despite evidence to suggest otherwise	Evolution and cultural norms program us to have respect for authority because strong hierarchical order can be beneficial to society. Trusting an expert generally saves us time and effort, however blind faith in an authoritative figure can impair the quality of a decision	Reviewing a patient after surgery for drainage of a neck abscess and being concerned about their level of pain and difficulty breathing. Then accepting the surgeon's telephone advice that the symptoms are to be expected and missing the complication of an expanding haematoma	Dancing to someone's else's tune	Recognise that people can make mistakes despite decades of experience Speak up if puzzled or concerned Remember that good teams pool their knowledge and ideas	We're all cut from the same cloth
5 	Availability bias The tendency to think of diagnoses that come most easily to mind, usually because of recent, frequent, or vivid experiences	The retrieval of facts or memories in our brain can occur spontaneously or through intentional effort. Events that occurred recently, or often, or that leave a lasting impression (perhaps because they are	Making a diagnosis of hay fever in a patient with cough and nasal congestion, on the basis that several patients have presented recently suffering hay fever with similar symptoms	Front of mind	Continue thinking beyond the initial diagnosis by generating alternatives Consider if a recent experience is affecting	Rack your brain

Table 2: (continued)

Bias	Definition	Why it happens	Example	The related idiom	What can help	The counter idiom
6	Base rate neglect 	The tendency to ignore statistical information about the base rate or true prevalence of a disease and give more weight to case-specific information (e.g. symptoms or test results)	emotionally vivid) are more likely to be automatically recalled, so come to mind more easily We favour information that is specific to a person or event over objective, statistical data (the base rates) because our brains correlate specificity with relevance and consider statistical information as being more general and abstract, and therefore less relevant	Overestimating the pre-test probability of pulmonary embolism in a very low-risk patient and ordering a complete work-up because of the seriousness of the condition, despite how statistically unlikely it is to be the diagnosis	your thinking Recall the not-to-be missed diagnoses Familiarise yourself with the prevalence rate of the disease Use clinical decision support tools Determine the likelihood ratios	Common things are common
7	Commission bias 	Results from a beneficent view that harm to the patient can only be prevented by active investigation or intervention. It is the tendency towards action rather than inaction; and believing that more is better	We have a natural aversion to ambiguity or uncertainty and a desire for control, so taking action is a way of combatting those aversions and creating a sense of control. Doing something feels like we are being helpful. Doing nothing feels unhelpful	Diagnosing bacterial tonsillitis and prescribing antibiotics in a patient with a sore throat 'just in case', even though the history and examination findings suggest viral pharyngitis	Don't just stand there, do something Conduct a risk-benefit analysis of taking action - Follow protocols that outline criteria for action Consider pros and cons of 'nil or minimal action' as a treatment option	Tincture of time
8	Confirmation bias 	Assigning weight to information that supports your diagnosis and discounting information that does not (diagnostic momentum and anchoring bias are subsets of confirmation bias)	This is one way in which our brains sort through large amounts of information more efficiently. The self-selecting positive reinforcement reduces cognitive dissonance and builds a sense of confidence. It is common for people to form a quick opinion, and then find a way to justify it. This is called motivated reasoning	Attributing a patient's back pain to a muscular sprain because the first thing you hear from the patient is that the pain occurred after lifting something awkwardly and eased with rest and simple analgesia (ignoring the history of severe osteoporosis and previous atraumatic fractures)	Use open questions and avoid leading questions Ask yourself "what doesn't fit?" Identify disconfirming evidence by asking "what evidence would show me I'm wrong?"	Take the blinkers* off * 'blinkers' (American English)
9	Diagnostic momentum 	The tendency for a diagnosis to be accepted and passed on without consideration or critical analysis of the available information (where the diagnostic label becomes attached to the patient) The initial label can come from the patient, their carers or healthcare staff.	This occurs more commonly when there are pressures to make a quick diagnosis, and an early hypothesis is transformed into an accepted truth. Confirmation bias, anchoring bias, and authority bias can all reinforce diagnostic momentum	A patient arrives in the ED with a handover from ambulance officers that the patient has abdominal pain and is constipated. Their abdominal pain continues to be treated as constipation to the exclusion of investigations and other possible differential diagnoses	Be vigilant at handovers of care Have a low threshold to verify information when you are the clinician responsible for care Reassess the diagnosis when new information comes to light	Take it with a grain of salt

Table 2: (continued)

Bias	Definition	Why it happens	Example	The related idiom	What can help	The counter idiom
10 Framing effect 	Favouring certain diagnoses according to how the problem is described	We focus on certain aspects of a problem, leaving others in the shadows, because of the way information is represented. Our prior knowledge and training also influence which aspects of a problem we attend to	An older patient experiencing shortness of breath is worked up for cardiac failure because the medical handover emphasises a history of aortic stenosis. However, the handover did not relay the history of a recent fall onto their upper back with bruising over their scapula, so a traumatic cause for the patient's breathlessness is overlooked	Missing the elephant while studying its tail	Purposefully reframe the information Ask "what information is missing?" Consult with clinicians/others who might have a different perspective	Step back to see the big picture
11 Fundamental attribution error 	The tendency to attribute a patient's behaviour to their personality, rather than their circumstances when formulating a diagnosis	We are hard-wired to make quick judgements about people and over-attribute behaviour to personality. We readily see a person's behaviour but may be blind to the situational constraints or conditions that are driving that behaviour	A patient behaving aggressively with slurred speech, difficulty walking, and a known history of schizophrenia and alcohol use disorder requires sedation for his behaviour. He is diagnosed with intoxication, but it is later discovered that his blood alcohol reading is zero and he has a small cerebrovascular haemorrhage	Seeing the actor without the stage	Be curious and ask questions about their behaviour Recognise that our attributions are usually guesses, and we can easily be wrong Imagine the situation from their perspective Remember the principles of probability and randomness Evaluate the problem as an independent event and actively exclude consideration of past occurrence Test the logic of the diagnosis	Walk a mile in their shoes
12 Gambler's fallacy 	A belief that if a particular event occurred more frequently than average in the past it is less likely to happen in the future – even though the probability of the event occurring in the future is independent of what happened in the past	This stems from our tendency to want to make sense of random events, and an attempt to rationalise those events to make them seem more predictable. We also see patterns in randomness	A clinician sees a number of patients in clinic with inflamed joints that prove to be septic arthritis. The clinician presumes that the sequence of the diagnosis in question would not continue in the next patient and starts thinking of alternative diagnoses even if the presentation is highly suggestive of septic arthritis	Playing the odds		Clear the ledger
13 Hindsight bias 	The tendency to over-estimate the prior predictability of a diagnosis after it is known. This can manifest in the belief that a correct diagnosis or treatment path should have been apparent to the clinicians at the time, without realizing that it only seems obvious in retrospect	How we interpret past events is affected by how we reconstruct memories and make sense of the world around us. We tend to exaggerate our ability to predict events and revise the probability or knowledge of a diagnosis after the fact. Events make more sense in retrospect, when all of the relevant information is in	Reviewing a case of a missed presentation of sepsis and assuming that the correct diagnosis should have been easy to make (thereby failing to appreciate the systemic or complex patient factors that led to the missed diagnosis, and limiting the ability to learn from the case)	Hindsight is 20/20	Consider the time course of the events Evaluate the constraints, uncertainties, data and assumptions that were present when the diagnosis was made Think about why incorrect diagnoses might have appeared to be correct	You can't see around corners

Table 2: (continued)

Bias	Definition	Why it happens	Example	The related idiom	What can help	The counter idiom
14 Group think 	Accepting the consensus of a group and individuals and failing to undertake or voice clinical reasoning of their own; a type of premature closure on a group level	This is more likely to occur when the dynamics of the group are influenced by hierarchical powers, decision-making stress, pressure for conformity, and homogeneity amongst the group members. People can also assume others know better than them, or they may assume that because no one is voicing a counter opinion, this means everyone else agrees. However, it could be that everyone has the same concerns that a diagnosis is incorrect, and no one is speaking up.	A patient with confusion and leg ulcers is admitted to hospital with a diagnosis of delirium. They are treated with antibiotics and fentanyl patches, but their confusion worsens over a number of weeks. Several members of the medical team discuss the patient, with the lead clinician attributing the symptoms to the ulcers. Others on the team are concerned about opiate toxicity but each assumes that because no one mentions this, they must be wrong. The team increases the medication dose, and the patient becomes unconscious as a result of missed opiate toxicity.	Running with the pack	Create an environment of psychological safety so that people feel comfortable to share a range of viewpoints. Include raising alternative hypotheses and questioning assumptions as part of the group discussion. Admit uncertainty.	Go against the tide
15 Omission bias 	The tendency towards inaction stemming from a non-maleficence view and making a diagnosis that does not require an action or requires a simpler action. Avoiding something that is more difficult to do and believing that less is better	This arises from a desire to simplify decision-making and alleviate feelings of guilt through the notion that actions that lead to negative consequences create more guilt than inaction that results in a negative outcome.	Diagnosing a patient complaining of a headache with a tension headache and failing to consider meningitis as a differential diagnosis because it would be difficult and painful to perform a lumbar puncture on the patient.	Letting sleeping dogs lie	Reflect on the immediate consequences of both action and inaction. Reflect on the more distant consequences of action and inaction. Consider moral obligations, ethical principles, and duty of care.	Nothing ventured, nothing gained
16 Outcome bias (in the prospective sense) 	The tendency to favour a less severe diagnosis in decision-making for what one hopes will happen rather than what one really believes might happen. This may result in serious diagnoses being minimised	This occurs when we de-emphasise the events that precede the outcome and over-emphasize the outcome (or weight the outcome more heavily than other pieces of information).	Diagnosing a young woman with lethargy, heavy menstruation, and easy bruising as being iron deficient and missing the diagnosis of a haematological malignancy.	Wishful thinking	Focus on the quality of the process in making the diagnosis. Promote an evidence-based approach using empirical evidence and clinical guidelines. Seek a second opinion.	Get to the heart of the matter
Outcome bias (in the retrospective sense) 	The tendency to judge the quality of a decision on the basis of the outcome, rather than how that decision was made with the available information at the time. This is similar but distinguishable from hindsight bias, which is the tendency looking at the factors that impacted	We tend to attribute blame more readily in scenarios where the outcome is poor and serious. This stems from a belief that the quality of a decision is the sole determinant of a good or bad result, rather than looking at the factors that impacted	Reviewing a case where a child presented with a fever and mild cough but appeared well with normal vital signs and no respiratory distress. The clinician considers the need for a chest X-ray and antibiotics but based on their clinical examination and guidelines for	No harm no foul	Review the quality of the diagnostic process independent of the outcome. Learn from near misses. Consider the context within which the decision was made.	It's not whether you win or lose, but how you play the game

Table 2: (continued)

Bias	Definition	Why it happens	Example	The related idiom	What can help	The counter idiom
17 Premature closure 	for people with knowledge of the actual outcome of an event to believe falsely that they would have predicted the outcome	on the decision-making process. Sometimes a good outcome can happen despite a poor clinical decision, and vice versa.	managing febrile children, diagnoses a viral infection and recommends antipyrexial medication and early review. The child deteriorates the next day and requires an intensive care unit admission for a week. The case is later reviewed by two paediatricians. The first is not aware of the outcome and supports the clinical decision-making. The second is aware of the outcome and criticises the decision not to obtain imaging or commence antibiotics in the first instance.			
	Failing to seek additional information or consider reasonable alternatives after an initial diagnosis is made	We are hard wired to spot patterns to make sense of things, which is usually very helpful. Once we think we understand something, we are not inclined to look for an alternate pattern or explanation as we are used to our initial impressions being correct	Diagnosing an open ankle fracture in a man who has fallen off a ladder but failing to check for other injuries and missing a subdural bleed	Jumping to conclusions	Be thorough with the history and examination Use a systematic approach for patient assessment Consider a differential diagnosis	Look before you leap
18 Representativeness bias 	The tendency to judge the likelihood of a diagnosis based on a typical prototype of the diagnosis, regardless of the actual probability of the diagnosis (while atypical presentations are more likely to be missed)	We often determine the likelihood of a diagnosis by assessing how similar it is to known or past experiences that we think should be representative of an outcome	Missing the diagnosis of a thoracic aortic dissection because the presentation did not include a description of searing chest pain radiating through to the back	Sticking to the script	Incorporate a consideration of prevalence into your thinking Seek collateral information Understand the range of presentations for any given condition	Not everything is textbook
19 Status quo bias 	The tendency to prefer the current state of affairs, with a preference for familiarity in diagnosis. It is more likely to occur when there is choice overload or high uncertainty	We prefer to stick to the norm because we are risk averse, and change can invoke a sense of uncertainty and loss, and choice can create a feeling of being overwhelmed	Attributing pain and numbness in the foot to peripheral neuropathy and referring the patient to a podiatrist. When the patient re-presents several times with similar symptoms, they are re-referred to the podiatrist without examination, until they eventually return with a pulseless leg. The possible diagnoses were broad and included vascular, neurological, and musculoskeletal, which may have paradoxically increased the preference for the initial diagnosis of peripheral neuropathy	If it ain't broke, don't fix it	Ask yourself why the current diagnosis is preferred Assess the risks and limitations of the current diagnosis Deliberately analyse the likelihood of an alternate diagnosis	Out with the old and in with the new

Table 2: (continued)

Bias	Definition	Why it happens	Example	The related idiom	What can help	The counter idiom
20 Sunk cost fallacy 	When a diagnosis is held even when it is not supported by the findings, because of the time, mental energy and resources that have already been put into it (an unwillingness to let go of a failing diagnosis)	We are sensitive to losses and avoid the perceived loss with abandoning a diagnosis that we have invested so much into already (cognitively, financially, emotionally, temporally). It is always difficult to admit failure or that an initial decision/investment was wrong	A patient has an abnormal brain MRI showing multiple lesions and is diagnosed with multiple sclerosis and treated with immunotherapy. This management is continued at subsequent reviews even though the treatment has had little effect. Years later the patient is re-evaluated by a different team and determined to have cerebral small vessel disease and not multiple sclerosis	Throwing good money after bad	Set the pre-existing investments aside and focus on the future costs and benefits of an alternative diagnosis Establish clear criteria to guide decision-making about a diagnosis Seek input from impartial peers	Cut your losses
21 Triage cueing 	When a specific discipline tends to look at the patient only through their perspective, and the disposition of a patient cues their diagnosis	We have a natural inclination to utilise information that is most familiar to us when we are evaluating potential diagnoses and outcomes. This is closely related to framing bias and availability bias and arises from our own contextual experiences and the patient's location	A patient with peptic ulcer disease admitted under the gastroenterology team for investigation of anaemia develops chest pain and is treated with antacids and a proton pump inhibitor. The patient deteriorates several hours later, and an electrocardiograph reveals an acute myocardial infarction	Geography is destiny	Focus on symptoms and signs rather than labels Independently obtain information from the patient Think beyond the patient's location and ask yourself whether they are in the right place	Look through a different lens

language, idioms are a good scaffold to support the understanding and integration of learning about cognitive bias into clinical practice. Idioms offer a shortcut to meaning and create connections between words and context that are insightful and memorable. This suits the context of frontline healthcare.

The use of idiomatic expressions is not new in clinical practice. Traditional medical teaching has long since incorporated idioms, such as the phrase “hear hooves think horses, not zebras”, coined by Dr Theodore Woodward in the 1940s, as a reminder that clinicians should consider the most common possibility first when thinking of a diagnosis [34]. As Friedberg noted, “Finding ways to make abstract and often obtuse concepts understandable to students, interns, residents, and fellows is a crucial pedagogical task” [23].

Making cognitive bias as ‘clear as day’

Although some publications might use an idiom to describe a specific cognitive bias [35, 36], until now there has not been a discussion of the potential role of idioms and figurative language to teach clinicians about cognitive bias, or the creation of a comprehensive list of cognitive biases with their associated idioms. Our Idiom’s Guide to Cognitive Bias (‘The Guide’) is a Table that lists 21 common cognitive biases in the diagnostic process. The Guide defines each bias, offers a possible explanation for why it occurs and provides a healthcare example of each (Table 2, see Supplementary Material for colour version).

Using language tools, The Guide also assigns an idiom to each bias and suggests three specific countermeasures that can be utilised (in addition to generic countermeasures), to guard against error. The Guide also presents a counter idiom, to reinforce the definition of each bias and highlight the countermeasures in a succinct and novel way to promote understanding and recall of the important concepts. The existence of the counter idiom also illustrates that idioms are just a thinking prompt, very context dependant and not generic truisms.

The aim of The Guide is to help clinicians learn about cognitive bias and more readily draw on this understanding at the bedside or when reflecting on cases. This understanding will, in turn, help clinicians develop better insight into the diagnostic process, its hazards and errors, and how to mitigate them through reflective practice. The Guide is designed to make learning about cognitive bias in the diagnostic process more purposeful for clinicians, and to assist clinicians in remembering the key aspects of each bias.

There are a few potential limitations to the use of idioms in understanding cognitive bias. An idiom may be

misunderstood or perceived as unclear language. Some idioms may be culturally specific and difficult to appreciate by clinicians less familiar with certain expressions. However, assigning an idiom to each bias is intended to enhance relatability and familiarity with the concept. It aids in differentiating between biases that are particularly nuanced or that exist as subsets of others, where their formal definitions may be hard to comprehend. The mental imagery of an idiom used to highlight a bias, and its countermeasure, may guide thinking and behaviour more intuitively and effectively than relying on the more traditional approach of learning the formal name and factual definition of each bias. The Guide may also encourage both novices and experienced clinicians to be more open to the idea of cognitive bias in diagnosis and promote more discussion of bias in the clinical workplace.

Conclusions

While the concept of cognitive bias features in some medical schools and training programs, for many clinicians, it is still a relatively new topic. Cognitive biases are relevant to diagnosis in healthcare. A clear understanding of why and when they occur and how to mitigate them may increase diagnostic accuracy. The challenge remains of bringing the conceptual knowledge of cognitive bias to the bedside in an applicable and useful way. Barriers for clinicians include difficulty assimilating the social sciences terminology used to describe cognitive biases with the practicalities of bedside diagnosis and the challenges of integrating a theoretical knowledge of cognitive bias into clinical practice more generally.

A novel language approach to learning and talking about biases through the use of idioms has the potential to improve understanding and communication about the relevance of biases for frontline clinicians. Idioms can help to bridge the gap between an abstract concept and clinical realisation of the cognitive factors affecting diagnostic accuracy. The benefit of The Guide is its practical approach to reinforcing cognitive and medical concepts through the synergy of language and imagery and to demystify cognitive bias in the diagnostic process. In an effort to create significant and sustained improvement in clinical reasoning and diagnostic accuracy, The Guide should be implemented with other debiasing and educational strategies such as cognitive aids, cased based discussions and reflective practice.

Research ethics: Not applicable.

Informed consent: Not applicable.

Author contributions: All authors have accepted responsibility for the entire content of this manuscript and approved its submission.

Use of Large Language Models, AI and Machine Learning Tools: None declared.

Conflict of interest: The authors state no conflict of interest.

Research funding: None declared.

Data availability: Not applicable.

References

- Balogh EP, Miller BT, Ball JR. Committee on diagnostic error in health care, board on health care services, institute of medicine, the National Academies of Sciences, Engineering, and Medicine. In: *Improving diagnosis in health care* [Internet]. Washington, D.C.: National Academies Press; 2015. Available from: <http://www.nap.edu/catalog/21794>.
- Ladell MM, Yale S, Bordini BJ, Scanlon MC, Jacobson N, Papautsky EL. Why a sociotechnical framework is necessary to address diagnostic error. *BMJ Qual Saf* 2024;33:823–8.
- O'Sullivan E, Schofield S. Cognitive bias in clinical medicine. *J R Coll Physicians Edinb* 2018;48:225–32.
- The Cambridge Dictionary: idiom [Internet]. Cambridge University Press and Assessment. 2024. Available from: <https://dictionary.cambridge.org/dictionary/english/idiom>
- Howard J. Cognitive errors and diagnostic mistakes: a case-based guide to critical thinking in medicine. Switzerland: Springer International; 2019.
- Landucci F, Lamperti M. A pandemic of cognitive bias. *Intensive Care Med* 2021;47:636–7.
- Kahneman D. *Thinking, fast and slow*. New York: Farrar, Straus and Giroux; 2011.
- Croskerry P, Cosby KS, Graber ML, Singh H. *Diagnosis: interpreting the shadows*. Boca Raton: CRC Press/Taylor & Francis Group; 2017.
- Hansen K. Cognitive bias in emergency medicine. *Emerg Med Australas* 2020;32:852–5.
- Gottschalk CH. Cognitive biases & errors in headache medicine. *Headache* 2019;59:1863–70.
- Chen J, Gandomkar Z, Reed WM. Investigating the impact of cognitive biases in radiologists' image interpretation: a scoping review. *Eur J Radiol* 2023;166:111013.
- Atallah F, Hamm RF, Davidson CM, Combs CA. Society for maternal-fetal medicine special statement: cognitive bias and medical error in obstetrics—challenges and opportunities. *Am J Obstet Gynecol* 2022; 227:B2–10.
- Sahu D. What's important: as surgeons, we need to confront our cognitive biases. *J Bone Jt Surg* 2023;105:1822–4.
- Webster CS, Taylor S, Weller JM. Cognitive biases in diagnosis and decision making during anaesthesia and intensive care. *BJA Educ* 2021; 21:420–5.
- Croskerry P. From mindless to mindful practice — cognitive bias and clinical decision making. *N Engl J Med* 2013;368:2445–8.
- Bloom BS. Automaticity: “the hands and feet of genius.”. *Educ Leader* 1986;43:70–7.
- Korteling JE, Brouwer AM, Toet A. A neural network framework for cognitive bias. *Front Psychol* 2018;9:1561.
- Gawande A. *Complications: a surgeon's notes on an imperfect science*. New York: Picador; 2002.
- Al Hamid A, Beckett R, Wilson M, Jalal Z, Cheema E, Al-Jumeily Obe D, et al. Gender bias in diagnosis, prevention, and treatment of cardiovascular diseases: a systematic review. *Cureus* 2024. <https://doi.org/10.7759/cureus.54264>.
- Ruedinger E, Olson M, Yee J, Borman-Shoap E, Olson APJ. Education for the next frontier in patient safety: a longitudinal resident curriculum on diagnostic error. *Am J Med Qual* 2017;32:625–31.
- Trowbridge RJ, Rencic J, Durning SJ. *Teaching clinical reasoning*. Philadelphia, PA: American College of Physicians; 2015.
- Kassirer J, Wong J, Kopelman R. *Learning clinical reasoning*, 2nd ed. Baltimore, MD: Lippincott Williams & Wilkins Health; 2009.
- Friedberg RD. Teaching medical students, psychiatric residents, and fellows about cognitive biases: lunch a go-go. *Med Teach* 2022;44: 212–3.
- Sexton DJ, McDonald M, Spelman D, Stryjewski M, Yung A, Corey GR. Thirty operating rules for infectious diseases apprentices. *Infect Dis Clin Pract* 2007;15:100–3.
- Yung A, Spelman D, Street A, McCormack J, Sorrell T, Johnson P. *Infectious diseases: a clinical approach*, 3rd ed. Melbourne: IP Communications; 2010:698 p.
- Doherty TS, Carroll AE. Believing in overcoming cognitive biases. *AMA J Ethics* 2020;22:E773–778.
- Croskerry P, Singhal G, Mamede S. Cognitive debiasing 2: impediments to and strategies for change. *BMJ Qual Saf* 2013;22:ii65–72.
- Cunningham N, Cook H, Harrison J. Enabling diagnostic excellence in the real world: managing complexity, uncertainty and clinical responsibility. *Med Teach* 2024;16:1–3.
- Royce CS, Hayes MM, Schwartzstein RM. Teaching critical thinking: a case for instruction in cognitive biases to reduce diagnostic errors and improve patient safety. *Acad Med* 2019;94:187–94.
- Douros G. The cognitive biases of cognitive biases. *Emerg Med Australas* 2021;33:372–4.
- Vally ZI, Khammissa RAG, Feller G, Ballyram R, Beetge M, Feller L. Errors in clinical diagnosis: a narrative review. *J Int Med Res* 2023;51: 03000605231162798.
- Connor DM, Durning SJ, Rencic JJ. Clinical reasoning as a core competency. *Acad Med* 2020;95:1166–71.
- Citron FMM, Cacciari C, Funcke JM, Hsu CT, Jacobs AM. Idiomatic expressions evoke stronger emotional responses in the brain than literal sentences. *Neuropsychologia* 2019;131:233–48.
- Dickinson J. Lesser-spotted zebras; their care and feeding. *Can Fam Physician* 2016;62:620–1.
- Croskerry P. Croskerry's list of 50 common biases: 50 cognitive and affective biases in medicine (alphabetically). In: *Risk and reasoning in clinical diagnosis* [Internet]. New York: Oxford Academic; 2019. Available from: <http://sjrhem.ca/wp-content/uploads/2015/11/CriticalThinking-Listof50-biases.pdf>.
- Rotella J, Yeoh M. Taming the zebra: unravelling the barriers to diagnosing aortic dissection. *Emerg Med Australas* 2018;30:119–21.

Supplementary Material: This article contains supplementary material (<https://doi.org/10.1515/dx-2025-0016>).