

# Cognitive Bias in Inpatient Pediatrics

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cognitive bias, diagnostic error, medical decision-making

## ABBREVIATION

ED: emergency department

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The contribution of cognitive bias toward diagnostic error has been well documented.<sup>1-7</sup> Previous research exploring the effects of these cognitive pitfalls centers on examples from internal and emergency medicine, but it is fair to presume that pediatric hospitalists remain equally vulnerable to such cognitive error.<sup>8</sup> To improve the overall awareness of cognitive bias within inpatient pediatrics, we present 2 cases that serve to illustrate some of the many cognitive biases a pediatrician may encounter in inpatient practice. We conclude with strategies to avoid the effects of cognitive bias on diagnostic accuracy.

## CASE 1

A 3-year-old male with no significant medical history presented to the emergency department (ED) with 11 days of a limp and 10 days of fever. His review of systems was otherwise positive for intermittent abdominal pain, increased loose stool, and a 3-pound weight loss. On examination, he had no point tenderness or swelling or erythema over either extremity; results of his neurologic examination were normal. The patient's laboratory work was significant for a white blood cell count of  $18.9 \times 10^3/\mu\text{L}$ , hemoglobin of 10.8 g/dL, erythrocyte sedimentation rate of 65 mm/h, and C-reactive protein of 51.5 mg/L. Given the patient's fever, limp, and elevated inflammatory markers, the inpatient team began an evaluation for osteomyelitis. A bone scan was positive in the area of the left lateral femoral condyle, and a follow-up MRI revealed inflammatory changes in the medial femoral metaphysis and epiphysis. He was diagnosed with osteomyelitis and was discharged from the hospital on intravenous antibiotics. Two weeks later, the patient presented with worsening abdominal pain, loose stool, and continued elevation in his inflammatory markers. A colonoscopy was performed and revealed evidence of Crohn's disease. On review, the inflammatory changes seen previously on the MRI were consistent with chronic recurrent multifocal osteomyelitis, a noninfectious inflammatory disorder related to his Crohn's disease.

## DISCUSSION

This case illustrates some of the cognitive biases a pediatric hospitalist may encounter on a day-to-day basis, including: anchoring, confirmation, search satisfying, and availability (Table 1). Each of these biases contributes to acceptance of a diagnosis before it has been fully confirmed through active consideration of all clinical information and potential alternative diagnoses.<sup>9</sup> Anchoring bias is defined as latching on to certain features of a diagnosis early in the course of a patient's presentation, and the inability to consider alternative diagnoses even in the face of contradictory information.<sup>5-7,10-12</sup> In case 1, the physicians anchored on

to the diagnosis of osteomyelitis and the presenting symptoms of fever and limp. This anchoring bias prevented them from considering alternative diagnoses and subsequently contributed to diagnostic error.

The clinicians' anchoring bias was likely compounded by confirmation bias, which is defined as the inclination to seek information that substantiates a diagnosis while disregarding pertinent information that is not consistent with that diagnosis.<sup>5-7</sup> As stated, the physicians honed in on the patient's fever, limp, and elevated inflammatory markers that confirmed their anchored diagnosis of osteomyelitis. In doing so, they downplayed the patient's weight loss, abdominal pain, and loose stool, all of which pointed to the true underlying disease process. Furthermore, the MRI results revealed inflammation in both the metaphysis and epiphysis, which is an atypical finding in acute bacterial osteomyelitis due to the growth plate acting as a barrier to the spread of infection. This information was likely subconsciously de-emphasized by the clinical team because it did not confirm the presumed diagnosis.

It is important to note that multiple biases are frequently involved in the path toward diagnostic error, and this case also demonstrates search satisficing and availability bias. Search satisficing refers to the inclination to discontinue an evaluation once any diagnosis is found, even if that diagnosis does not completely explain the clinical presentation.<sup>5-7</sup> The positive MRI findings likely contributed to clinical inactivity, as the clinicians were satisfied with their diagnosis even though the patient's clinical presentation was not entirely consistent with osteomyelitis. Another common example of

**TABLE 1** Summary of Cognitive Biases Used in Case 1

Actions of Clinicians	Cognitive Bias
Focused on fever, limp, and well-known diagnosis of osteomyelitis	Anchoring and availability
Sought information that supported the diagnosis, while downplaying other pertinent information	Confirmation
Stopped further evaluation once an answer was found on MRI	Search satisficing

search satisficing occurs during respiratory season with testing for viral pathogens. It is clear to see how a positive respiratory syncytial virus result may sway cognitive processing and affect clinicians' ability to maintain broad differential diagnoses for respiratory distress.

Finally, availability bias is defined as the tendency to either inflate or deflate the incidence of a particular illness based on the diagnoses that are readily accessible to a clinician's recall.<sup>5-7</sup> The pediatricians in case 1 were more likely to have recently seen numerous cases of bacterial osteomyelitis versus a rare extraintestinal manifestation of inflammatory bowel disease, making the diagnosis of osteomyelitis more available and thus more likely.

## CASE 2

A 4-year-old female with a history of short bowel syndrome presented to the ED with 4 days of vomiting and diarrhea. The patient's weight had increased only 2 ounces since her last pediatrician visit 5 months earlier, and the mother had not been administering supplementary gastrostomy tube feedings as had been prescribed. The family was homeless and had been sleeping at a friend's apartment for the past several months. Upon presentation to the ED, a nurse attempted intravenous access but stopped after 1 failed attempt. On the admission sign-out to the floor, the ED physicians emphasized that the patient was not dehydrated and that admission

was strictly warranted for further evaluation of her poor weight gain and development of a safe discharge plan given social concerns. While on the wards, the patient was allowed to eat, and gastrostomy tube feedings were restarted slowly. Throughout that time, the patient continued to have voluminous, watery stool output similar to her presentation in the ED. On her second day of admission, the patient's heart rate increased steadily from 110 to 140 beats per minute, and her urine output decreased significantly. She was diagnosed with hypovolemic shock and was emergently transferred to the ICU where she required aggressive fluid resuscitation for severe dehydration.

## DISCUSSION

This case represents examples of both context and diagnosis momentum biases (Table 2). Hospitalists remain highly vulnerable to context errors in which a verbal sign-out or framing of the clinical scenario can affect how a provider objectively views a patient's clinical presentation.<sup>6</sup> Preconceived notions of a diagnosis from an initial provider have the ability to influence evaluation by subsequent providers. In case 2, the ED physicians were adamant that the patient was not dehydrated and was mainly being admitted for social concerns. This framing of the clinical context clouded the inpatient physicians' judgment, significantly impairing their ability to promptly identify a routine case of dehydration.

**TABLE 2** Summary of Cognitive Biases Used in Case 2

Actions of Clinicians	Cognitive Bias
Allowed ED framing of the patient as a “social admission” to affect judgment	Context error
Diagnostic labeling gained acceptance among physicians	Diagnosis momentum

Diagnosis momentum pertains to the difficulty in removing diagnostic labels once they are applied to a patient, and can be likened to a train full of presumed diagnoses departing from the ED that gains steam with every clinician that gets on board.<sup>5-7</sup> As the train picks up speed, it becomes increasingly difficult for a hospitalist to pull the brakes and review the pertinent information that supports or contradicts the given diagnostic label. The “social admission” diagnosis gained acceptance among the inpatient team, and this diagnostic labeling was maintained up until the patient developed hypovolemic shock requiring significant intervention.

Both of these cognitive errors are also particularly common among ICU transfers, where a significant amount of diagnostic evaluation creates a clinical context and presumed diagnosis. This framing of the clinical presentation has the potential to greatly affect how the inpatient team cognitively processes a transfer patient’s presentation, and how much thought they put into confirming a patient’s diagnostic label.

## SUMMARY

To date, there is no clear consensus on the most effective cognitive debiasing strategy, and many leaders in the field provide differing recommendations on how to best overcome cognitive error. Croskerry promotes didactics on metacognition, stating that clinicians must force themselves to “think about how they think” and

focus on increasing their own awareness of the many biases that can affect objective clinical reasoning.<sup>13-15</sup> Others recommend teaching clinicians to actively participate in slowing down thought processes through the use of cognitive checklists that promote deliberate, analytical cognitive processing.<sup>3,15,16</sup> We have incorporated these recommendations to designate 3 major areas of focus for combating cognitive error: achieving a cognitive balance, improving awareness of the effect of cognitive bias on diagnostic error, and bolstering resident and medical student education.<sup>17</sup>

### Achieving Cognitive Balance

Applying dual process theory to medical reasoning, clinicians should aim to foster a balance between 2 cognitive systems at work: system 1, nonanalytical, subconscious, and heuristic; and system 2, analytical, deliberate, and Bayesian.<sup>18-20</sup> Heuristics are defined as mental shortcuts, pattern recognitions, or instinctive thought processes that help physicians make rapid and generally accurate diagnoses in hectic medical settings.<sup>5,13,14,18</sup> They are acquired and strengthened through experience and serve as essential cognitive tools for physician survival in fast-paced medical environments in which deliberate Bayesian applications are not always feasible and/or necessary.

Although often helpful by simplifying clinical reasoning, overreliance on system 1 processing and medical heuristics creates the opportunity for

cognitive biases to cloud objective clinical judgment.<sup>5,13-16</sup> Case 1 demonstrates the dangers in relying too heavily on heuristics, as the clinicians instinctively connected fever and limp with osteomyelitis. Once this diagnosis was entertained, the clinicians’ anchoring and confirmation biases led them to seek information that substantiated that diagnosis and prevented them from exploring all possible etiologies.

To effectively promote a cognitive balance, hospitalists must force themselves to generate thoroughly analyzed differential diagnoses, rather than simply creating a list of possible diagnoses (or in certain cases, providing no differential diagnoses at all). To help analyze a differential diagnosis, hospitalists must ask themselves: “What diagnosis is most likely? What historical, physical, and laboratory information supports or contradicts this presumed diagnosis? What other diagnoses have we considered? What information makes them likely and/or unlikely?” These types of questions encourage system 2 processing by forcing clinicians to slow down and provide evidence and analysis for their thought processes. Performing this mental exercise for all cases, even those that seem straightforward, helps to minimize the effects of the aforementioned common cognitive biases and avoid overconfidence in a single diagnosis.

### Improving Awareness

It is also imperative that clinicians improve their own awareness of the discussed cognitive pitfalls so that they may best monitor themselves and others for biases that may affect diagnostic accuracy. Clinicians must feel comfortable exploring their own

thought processes and be aware of certain situations in which cognitive bias may be contributing to diagnostic error, such as in times of high fatigue, stress, and a large patient census.<sup>20</sup> In case 2, an increased awareness of contextual errors may have helped the clinical team avoid the observed delay in diagnosis. They could have asked themselves, “have we effectively analyzed this patient’s presentation, or are we being led astray by how the ED has framed the admission?” Clinicians can perform these types of exercises if they are well versed in the interplay of cognitive bias and diagnostic failure.

### Bolstering Educational Opportunities

With their daily presence on morning rounds at many academic centers, hospitalists serve a key role in challenging resident physicians and medical students to balance their use of heuristic thinking with more analytical processing. In our experience, performing the same lines of questioning (as recommended earlier) with trainees can serve as an effective tool for helping them analyze their differential diagnoses and consider the potential impact of cognitive bias on diagnostic error. Furthermore, because the described biases occur subconsciously, residents and medical students are likely to be unaware of the effects that cognitive biases may have on their clinical reasoning, and they can benefit from questioning that helps them directly consider their influence.<sup>3</sup>

Moving forward, our medical education system must begin to take seriously the importance of cognitive bias

in diagnostic error. A curriculum that teaches the basic techniques of a lumbar puncture would be incomplete if it did not include a discussion of the possible pitfalls that may be encountered. We should accept nothing less from our educational approach to diagnostic reasoning. This concept is starting to gain steam, as evidenced by recent work evaluating how a curriculum on cognitive and diagnostic error affects resident education.<sup>21</sup> We also believe that future research opportunities exist in the evaluation of other innovative de-biasing strategies, and that the use of medical simulation may be a successful educational tool in improving both medical student and resident education.

### REFERENCES

1. Graber ML, Franklin N, Gordon R. Diagnostic error in internal medicine. *Arch Intern Med.* 2005;165(13):1493–1499.
2. Brennan TA, Leape LL, Laird NM, et al. Incidence of adverse events and negligence in hospitalized patients. Results of the Harvard Medical Practice Study I. *N Engl J Med.* 1991;324(6):370–376.
3. Norman GR, Eva KW. Diagnostic error and clinical reasoning. *Med Educ.* 2010;44(1):94–100.
4. Graber M, Gordon R, Franklin N. Reducing diagnostic errors in medicine: what’s the goal? *Acad Med.* 2002;77(10):981–992.
5. Groopman J. *How Doctors Think.* New York, NY: Houghton Mifflin Company; 2007.
6. Croskerry P. The importance of cognitive errors in diagnosis and strategies to minimize them. *Acad Med.* 2003;78(8):775–780.
7. Croskerry P. Achieving quality in clinical decision making: cognitive strategies and detection of bias. *Acad Emerg Med.* 2002;9(11):1184–1204.
8. Singh H, Thomas EJ, Wilson L, et al. Errors of diagnosis in pediatric practice: a multisite survey. *Pediatrics.* 2010;126(1):70–79.
9. Kumar B, Kanna B, Kumar S. The pitfalls of premature closure: clinical decision-making in a case of aortic dissection. *BMJ Case Rep.* 2011;2011. pii: bcr0820114594.
10. Bornstein BH, Emler AC. Rationality in medical decision making: a review of the literature on doctors’ decision-making biases. *J Eval Clin Pract.* 2001;7(2):97–107.
11. Eva KW, Norman GR. Heuristics and biases—a biased perspective on clinical reasoning. *Med Educ.* 2005;39(9):870–872.
12. Kuhn GJ. Diagnostic errors. *Acad Emerg Med.* 2002;9(7):740–750.
13. Croskerry P. The cognitive imperative: thinking about how we think. *Acad Emerg Med.* 2000;7(11):1223–1231.
14. Croskerry P. Cognitive forcing strategies in clinical decisionmaking. *Ann Emerg Med.* 2003;41(1):110–120.
15. Graber M. Metacognitive training to reduce diagnostic errors: ready for prime time? *Acad Med.* 2003;78(8):781.
16. Ely JW, Graber ML, Croskerry P. Checklists to reduce diagnostic errors. *Acad Med.* 2011;86(3):307–313.
17. Croskerry P, Singhal G, Mamede S. Cognitive debiasing 2: impediments to and strategies for change. *BMJ Qual Saf.* 2013;22(suppl 2):ii65–ii72.
18. Arkes HR. Impediments to accurate clinical judgment and possible ways to minimize their impact. In: Arkes HR, Hammond KR, eds. *Judgment and Decision Making: An Interdisciplinary Reader.* New York, NY: Cambridge University Press; 1986:589–560.
19. Kahneman D. *Thinking Fast and Slow: Part I.* New York, NY: Farrar, Straus and Giroux; 2011.
20. Croskerry P, Singhal G, Mamede S. Cognitive debiasing 1: origins of bias and theory of debiasing. *BMJ Qual Saf.* 2013;22(suppl 2):ii58–ii64.
21. Reilly JB, Ogdie AR, Von Feldt JM, Myers JS. Teaching about how doctors think: a longitudinal curriculum in cognitive bias and diagnostic error for residents. *BMJ Qual Saf.* 2013;22(12):1044–1050.

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