From Mindless to Mindful Practice — Cognitive Bias and Clinical Decision Making

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Audio Interview

Interview with Dr. Pat Croskerry on widespread cognitive biases and ways of counteracting them for accurate diagnosis. (17:18)

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The two major products of clinical decision making are diagnoses and treatment plans. If the first is correct, the second has a greater chance of being correct too. Surprisingly, we don't make correct diagnoses as often as we think: the diagnostic failure rate is estimated to be 10 to 15%. The rate is highest among specialties in which patients are diagnostically undifferentiated, such as emergency medicine, family medicine, and internal medicine. Error in the visual specialties,

such as radiology and pathology, is considerably lower, probably around 2%.[1]

Diagnostic error has multiple causes, but principal among them are cognitive errors. Usually, it's not a lack of knowledge that leads to failure, but problems with the clinician's thinking. Esoteric diagnoses are occasionally missed, but common illnesses are commonly misdiagnosed. For example, physicians know the pathophysiology of pulmonary embolus in excruciating detail, yet because its signs and symptoms are notoriously variable and overlap with those of numerous other diseases, this important diagnosis was missed a staggering 55% of the time in a series of fatal cases.[2]

Over the past 40 years, work by cognitive psychologists and others has pointed to the human mind's vulnerability to cognitive biases, logical fallacies, false assumptions, and other reasoning failures. It seems that much of our everyday thinking is flawed, and clinicians are not immune to the problem (see Clinical Examples of Cognitive Failure). More than 100 biases affecting clinical decision making have been described, and many medical disciplines now acknowledge their pervasive influence on our thinking.

Cognitive failures are best understood in the context of how our brains manage and process information. The two principal modes, automatic and controlled, are colloquially referred to as "intuitive" and "analytic"; psychologists know them as Type 1 and Type 2 processes. Various

conceptualizations of the reasoning process have been proposed, but most can be incorporated into this dual-process system. This system is more than a model: it is accepted that the two processes involve different cortical mechanisms with associated neurophysiologic and neuroanatomical substrates. Functional magnetic resonance imaging scans vividly reveal the changes in neuronal activity patterns as processes move from one system to the other during learning. Although the two processes are often construed as two different ways of reasoning, in fact very little (if any) reasoning occurs in Type 1 processing — it is largely reflexive and autonomous. The *Augenblick* diagnosis, made in the blink of an eye, is an impressive piece of medical showmanship and the stuff of television entertainment (and corridor consultations), but in real clinical life it is fraught with danger.

Descriptions of the operating characteristics of the dual processing system in clinical reasoning provide a useful starting point for learning about medical decision making.[3] Intuitive processes are generally either hard-wired or acquired through repeated experience. They are subconscious and fast and mostly serve us well, enabling us to conduct much of our daily business in all fields of human activity. We mostly get through life by moving from one of the intuitive mode's associations to the next in a succession of largely mindless, fixed-action patterns. These patterns are indispensable; however, they are also the primary source of cognitive failure. Most biases, fallacies, and thinking

failures arise from the intuitive mode (see box). When primary care physicians trust their intuition that a patient's chest pain does not have a cardiac origin, they will usually be correct — but not always. The clinical gamble of trusting one's intuitions generally carries good odds, but inevitably those intuitions will fail some patients. The issue is whether we can tolerate the current levels of failure — or is there room for improvement?

Analytic processes, by contrast, are conscious, deliberate, slower, and generally reliable. They follow the laws of science and logic and therefore are more likely to be rational. Despite the ubiquity and usefulness of intuitions, they are not reliable enough for us to use them to send a spaceship to Mars. By contrast, when a patient undergoes analytic assessment for chest pain in a cardiac clinic that culminates in angiography, the conclusion is invariably correct. Analytic failures can occur, but usually when the wrong rules are followed or other factors come into play, such as cognitive overload, fatigue, sleep deprivation, or emotional perturbations. The biggest downside of analytic reasoning is that it's resource-intensive. Although analytic reasoning can often be done quickly and effectively, in most fields of medicine, it would be impractical to deal with each clinical decision analytically.

Given the substantial impact of our evolving understanding of cognition over the past few decades, it is somewhat surprising that these major social science findings have not readily made their way into medicine. Although

our awareness of research biases led to the development of the randomized, prospective, double-blind clinical trial, we remain unrealistic about the scale of everyday cognitive and affective biases and their effect on clinical reasoning. Cognitive psychology has not historically been considered within the remit of medicine, but I believe that we should embrace any work that helps us think about our thinking (metacognition) and that it would be beneficial both to include basic psychology courses in the medical school curriculum and to expand medicine's lexicon to incorporate terms from cognitive psychology.

If cognitive biases are so abundant and troublesome in clinical decision making, why not simply identify them and use a "debiasing" strategy to avoid them? Unfortunately, that's not as easy as it sounds. First, many decision makers are unaware of their biases, in part because our psychological defense mechanisms prevent us from examining our thinking, motivation, and desires too closely. Second, many clinicians are unaware of, or simply don't appreciate the effect of, such influences on their decision making.

Becoming alert to the influence of bias requires maintaining keen vigilance and mindfulness of one's own thinking. When a bias is identified by a decision maker, a deliberate decoupling from the intuitive mode is required so that corrective "mindware" can be engaged from the analytic mode. "Mindware" is defined as the "rules, knowledge, procedures, and strategies that a person can retrieve from memory in order to

aid decision making and problem solving."[4] It includes knowledge about the properties of the particular bias and what strategies might eliminate or reduce it. This process appears to be uncommonly difficult, although there have been some successes. A variety of debiasing strategies have been proposed, and they lead to a few important conclusions: debiasing is not easy, no one strategy will work for all biases, some customization of strategies will be necessary, and debiasing will probably require multiple interventions and lifelong maintenance.

Cognitive failures like those described in the box can be addressed by educational strategies that embrace critical thinking — the "ability to engage in purposeful, self-regulatory judgement."[5]Regulating judgment requires training that can permit judicious interventions by the analytic mode when needed — specifically, in its capacity to override the intuitive mode. This critical step has been referred to as decoupling, metacognition, mindfulness, and self-reflection. Most of us never reach our ceilings for critical thinking, and many people go through life unaware of their thinking limitations. We are not born critical thinkers. Like any other skill, however, critical thinking can be taught and cultivated, but even accomplished critical thinkers remain vulnerable to occasional undisciplined and irrational thought.

I believe that medical educators should promote critical thinking throughout undergraduate, postgraduate, and continuing medical education. One key

element of training in critical thinking should be a review of the major cognitive and affective biases and the ways they affect thinking. Greater effort is needed to develop effective cognitive debiasing strategies in medicine. All clinicians should develop the habit of conducting regular and frequent surveillance of their intuitive behavior. To paraphrase Socrates, the unexamined thought is not worth thinking.

CLINICAL EXAMPLES OF COGNITIVE FAILURE

Case 1

A 21-year-old man is brought to a trauma center by ambulance. He has been stabbed multiple times in the arms, chest, and head. He is in no significant distress. He is inebriated but cooperative. He has no dyspnea or shortness of breath; air entry is equal in both lungs; oxygen saturation, blood pressure, and pulse are all within normal limits.

The chest laceration over his left scapula is deep but on exploration does not appear to penetrate the chest cavity. Nevertheless, there is concern that the chest cavity and major vessels may have been penetrated. Ultrasonography shows no free fluid in the chest; a chest film appears normal, with no pneumothorax; and an abdominal series is normal, with no free air. There is considerable discussion

between the resident and the attending physician regarding the management of posterior chest stab wounds, but eventually agreement is reached that computed tomography (CT) of the chest is not indicated. The remaining lacerations are cleaned and sutured, and the patient is discharged home in the company of his friend.

Five days later, he presents to a different hospital reporting vomiting, blurred vision, and difficulty concentrating. A CT of his head reveals the track of a knife wound penetrating the skull and several inches into the brain.

Comment: The cognitive failures identified here are “anchoring” and “search satisficing.” The resident and attending staff both anchored onto the chest wound as the most significant injury. When they satisfied themselves that the chest wound was stable, the resident failed to conduct a sufficient search to rule out other significant injuries.

Case 2

An 18-year-old woman is referred by her family doctor to a psychiatric service for symptoms of severe anxiety and depression. She has been having frequent episodic dyspnea, associated with hyperventilation, carpopedal spasm, and loss of consciousness. The

admitting psychiatrist wants to exclude the possibility of a respiratory problem and sends the patient to the emergency department (ED) with a request for a chest film to rule out pneumonia.

She is seen and assessed by an ED resident. The patient was not noted to be in any significant distress other than feeling breathless. She is obese, has a history of asthma, and smokes cigarettes. She is currently being treated with a benzodiazepine and anxiolytics and is taking a birth-control pill. Her chest and cardiovascular examination are normal. The resident orders routine blood work and a chest film. He reviews the film, reads it as normal, and believes the patient can be safely returned to the psychiatric facility. He attributes her respiratory problems to anxiety.

While she awaits transfer, she becomes very agitated and short of breath. Several nurses attempt to settle her, encouraging her to breathe into a paper bag. Shortly afterward, she loses consciousness. Her monitor shows pulseless electrical activity and then asystole. She cannot be resuscitated. At autopsy, she is found to have pelvic vein thrombosis extending from the femoral vein and saddle emboli in both lungs, as well as multiple clots of varying age.

Comment: Several cognitive

failures probably influenced the outcome in this case. The patient's diagnosis of anxiety established "momentum" from her family doctor through to the ED, and although she might well have had hyperventilation due to anxiety, other possibilities were not ruled out earlier on in her care. Furthermore, bias regarding her psychiatric diagnosis probably influenced her care providers; psychiatric patients are more vulnerable to adverse events. "Framing" may also have been a problem, since the psychiatrist had specifically asked the ED to rule out an infective process and had not raised the possibility of pulmonary embolus, despite the patient's multiple risk factors. "Search satisficing" is again a problem, in that the resident called off the search for a cause for the patient's dyspnea after ruling out pneumonia.

Disclosure forms provided by the author are available with the full text of this article at NEJM.org.

SOURCE INFORMATION

From the Division of Medical Education, Dalhousie University, Halifax, NS, Canada.

June 2010 | Interview

In Conversation with...Pat Croskerry, MD, PhD

Editor's note: *Pat Croskerry, MD, PhD, is a professor in emergency medicine at Dalhousie University in Halifax, Nova Scotia, Canada. Trained as an experimental psychologist, Dr. Croskerry went on to become an emergency medicine physician, and found himself surprised by the relatively scant amount of attention given to cognitive errors. He has gone on to become one of the world's foremost experts in safety in emergency medicine and in diagnostic errors. We spoke to him about both.*

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Interview

Dr. Robert Wachter, Editor, AHRQ WebM&M: What got you interested in patient safety?

Dr. Pat Croskerry: The simple answer is that I really wasn't aware of the issue until I became the head of an emergency department. It says something about the covert nature of error in medicine that I really wasn't aware of what was going on in the department until suddenly everything started coming across my desk. What struck me was that I never ran into a case where a mistake was malevolent or egregious in any way. The errors always involved well-intentioned efforts by hard-working people, but these people were working with imperfect systems and flawed cognition.

Thinking critically and clearly, especially in an environment like emergency medicine, is not an easy thing to do, even at the best of times. An emergency department—which some people have described as a natural laboratory for error—is a chaotic environment. Once I became aware of things that were going wrong, I began to look outside of medicine and to other industries, like the airline industry and to the people who had been talking about human error, for answers.

RW: You ended up focusing on cognitive errors and diagnostic errors. What about you and your background caused that to happen?

PC: Before I went into medicine, I trained as a psychologist. Not a cognitive psychologist, but an experimental psychologist. I started seeing these repeated thinking errors that very hard-working people were making. With the help of the cognitive psychology literature, I was able to put together various explanations for how people actually got into trouble with their thinking. I want to emphasize that I don't think anybody was being casual or sloppy in their thinking. It's just that they were vulnerable to biases and distortions of their reasoning, especially in emergency medicine, which is a fertile ground for things going wrong. In the end, I decided to spend my time thinking about how doctors think.

RW: You mentioned the complexity and pace of the emergency department. Are there other attributes of emergency departments or the practice of emergency medicine that make thinking about patient safety different?

PC: I think so. The primary problem is the level of uncertainty. If you look at diagnostic error for example, it's highest in the disciplines with the most uncertainty, which are emergency medicine, family practice, and internal medicine. By the time you get to an orthopedics clinic or a plastics clinic, a lot of the uncertainty has been removed. In the emergency department, you usually don't know the patient, you don't necessarily have access to their whole history, and for all intents and purposes, the patients are strangers—it's quite a challenge. And on top of that, we're interrupted and distracted on a regular basis. We often cannot predict what the flow will be like; there are lots of surges—suddenly you have six ambulances at the door—and, I'm afraid, very few ebbs. I think about when I go into a bank and stand in an orderly line and each teller has one person to deal with. Bank tellers wouldn't dream of trying to deal with about eight or ten customers at one time. But that is what we do in the emergency department. It's like spinning plates:

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You juggle up to about a dozen patients at one time.

Psychologists tell us that when your attention is distracted by interruptions, you have to refocus on something else and then you have to get back to where you were before, and that's very costly in terms of cognitive effort. Add to that the problem that most emergency departments operate around the clock, adding the complications of fatigue and sleep deprivation. And it's now fairly clear that in the last 3 or 4 hours of the night shift, the emergency physician is probably functioning at about 70% of his or her capability. So when you add all those things up, you realize that to expect high-quality decision-making is somewhat unrealistic.

RW: One of the attributes of emergency medicine is how complex and undifferentiated patients are. So take me through the brain of Pat Croskerry when a patient with chest pain comes to see you, versus a physician who hasn't thought about the cognitive aspects of decision-making and diagnostic errors. What's going through your brain that's not going through that person's brain?

PC: I have the benefit of having analyzed a number of cases that went wrong and so I'm aware of the cognitive biases. They're not just thinking errors, they're also affective errors—errors that arise when physicians' feelings or nurses' feelings get involved in the decision-making process. And you can watch them happen: You can just stand back sometimes and admire the cognitive choreography in the emergency department.

RW: I love that.

PC: Just the way that people get set up for errors. For example, if a nurse or a colleague comes to you and says, "Oh, so and so is here. She's always here. It never amounts to anything; she's just a frequent flyer." For me, those are red flags. If anybody is offering me a diagnostic opinion without a thorough history and examination of the patient, then I immediately discount that in my thinking. I try to follow some of the recommendations in the psychology literature about how to avoid these cognitive traps. Most of us were trained on prototypes, for example, *this is what chest pain looks like*. But in fact, typical presentations of chest pain are in the minority. The majority of patients who come in with an acute coronary syndrome won't be typical. If you start from the position that you're looking for aberrant presentations, or if you're aware of patients labeling themselves, or of colleagues, triage nurses, and even paramedics labeling patients, then I think you've got your guard up. That's the difference. I make mistakes just like the next guy, but hopefully I'm making fewer because I see them coming. But I don't want to sound superior. I'm very humble about the whole setting and one's vulnerability in it.

RW: I was interested in the notion of affective errors. So when you're having a bad day or you're angry with a patient or you're overwhelmed, how do you defend against that? Does it help that you're aware of the possible holes that you may fall into, or are there more specific strategies that you undertake to prevent errors from flowing from those different affects?

PC: I think awareness is number one. Physicians tend to think of themselves as cold, objective decision-makers and we know that isn't so. If you take, for example, a borderline patient or a patient who's being obstructive, they create a negative atmosphere. The psychology literature tells us that hot emotions—emotions made when you're in a state of visceral arousal—are dangerous. If I find myself becoming emotionally polarized toward the patient, there are certain strategies that I follow to try to defuse that situation. One thing you can do is just take a time out and excuse yourself and say "I just have to attend to something else and I'll be right back." Then take a moment of reflection and identify your emotional arousal and try to get past it. The critical thing for me is to provide the best care here and not to allow my emotions to intrude. Now again, the psychology literature says that, not just in medicine but throughout your life, no decision is made that doesn't have some emotional polarization in it. If the patient is arousing negative emotions in you, then your decisions won't be as good as they would be otherwise.

By the same token, but to a lesser extent, you can get into similar trouble when your emotions are positively aroused. Some work has been done on this, but if you feel very positively toward the patient, sometimes there is a covert avoidance of finding the stuff that you don't want to know about. What I'm suggesting is that physicians would do well to develop skills in emotional intelligence.

RW: You've talked mostly about things that are going on between your ears that might help prevent certain errors in charged situations with a lot of uncertainty. Systematic solutions have also been proposed, such as computerized decision support or others. What's your sense of the utility of those kinds of approaches?

PC: Well, my starting point is that we will take whatever help we can get. A number of initiatives have been proposed that help us in our decision-making. Decision-making, which arguably is the most important skill that a physician has, breaks down into two types of reasoning. We reason intuitively—the fast, reflective shoot-from-the-hip stuff that all of us do, and as you get older, you do it more. That's in contrast to a slower analytical, deductive method that's much more precise and often yields fewer errors. Given that we spend most of our time in that fast intuitive mode, in emergency medicine at least, then the answer to the problem would be how do you make people function better in the intuitive mode? I was delighted to see a paper by Gordon Schiff and David Bates published in the *New England Journal of*

Medicine about improving electronic documentation to avoid diagnostic error. They listed a dozen or so features that might help people improve their performance; interestingly, they match up very well with what the literature says. There is an excellent book by [Robin M.] Hogarth called *Educating Intuition*, and he makes exactly these points. It's been shown very clearly that better environments make for better decisions. If you improve the feedback that people receive and if you have systems that prompt and remind you along with checklists and so on, there's a variety of strategies aimed at improving one's performance in that intuitive mode. So for my money, I think that approach needs encouraging.

RW: What will the practice of emergency medicine look like in 5 or 10 years, particularly vis-à-vis computer systems and decision support?

PC: Well, it's very clear that computerized decision support is a good idea, but it hasn't had a very good track record. Work on this started about 40 years ago. To some extent, the problem is partly the overconfidence of physicians, who think that they can outperform computers, and a lot of the time, they probably cannot. People are really challenged when they have to make more and more decisions. But if a computer interface that—let's say you were distracted or didn't have time to take everything into consideration—notices something that you didn't take into consideration, then it says, "You are about to discharge a patient with an elevated heart rate." Those little prompts are often enough to jolt you out of that intuitive mode, take a moment of reflection, and perhaps make a better decision. The medication information in computerized order entry systems is excellent. If you plug in the wrong dose or the dose is too high for somebody in renal failure, it lets you know right away, and that's the cognitive support we need. The more you can provide software that functions more reliably than your own brain, then the better the position you're in.

And it's not cheating. Some physicians think that algorithms and clinical decision rules decrease their autonomy, and it's a way of escaping some of your responsibility. It isn't. The literature shows very clearly that those decision rules and algorithms will outperform or match the performance of the physician about 90% of the time. Yet the uptake of clinical decision rules is abysmally low. People don't like the interference with their autonomy, and the patient in front of them is always special, and so on. But at the end of the day, the clinical decision rule will outperform you, so why not use it? Why not relieve some of the cognitive load? Say I've got a patient with a suspected TIA [transient ischemic attack]—if I can default into an algorithm that says the best management of TIA is this, this, and this, then that's where I go, because I know that those clinical decision rules have been developed by well-rested, well-fed people in the cold light of day who've looked at huge populations of patients. And they will outperform my decision-making, especially in the environment in which I'm working.

RW: Can you give us a couple of examples of things that you built into your emergency departments that reflect your interest in safety and that you're particularly proud of?

PC: The major thing that we did was to change the nature of our M&M rounds. When I first inherited the department, we would have people presenting cases on their diagnostic triumphs or on some interesting esoteric case. But we weren't looking critically at what we were doing. So we turned our M&M rounds around, focusing on cognitive errors, affective errors, biases, distortions of reasoning, and so on. When I first came into my department, we were not doing that. It's been helped by the patient safety movement of course. But there is now an openness and an honesty in the way that people will review their cases. That was one of our major gains.

The other one was that we really put a concerted effort into improving feedback. To have a system operating without feedback, as we often do in emergency departments, complex patients just disappear in the ICU or disappear into the morgue and you haven't really learned anything. We implemented a number of strategies that have significantly improved our feedback.

RW: In both of those circumstances, part of the theme is getting your colleagues and yourself to be comfortable learning about and hearing about your failures unblinkingly. How did you get the culture to accept that?

PC: It wasn't easy. We were inheriting a very long tradition in medicine of secrecy. Diagnostic acumen, for example, is the one thing that physicians hold very dear. It's the most important thing to them. To actually stand up and say "I got this wrong" takes a bit of guts. The way that that works best is if you can get senior physician leaders to stand up and admit that they've made mistakes and show by example that it's okay to say you're not perfect. I certainly did that and I didn't suffer by it. The department generally became more honest and more willing to discuss our shortcomings. At the same time, remind people that we have to deal with a level of uncertainty that can never allow us to become perfect decision-makers. There's always a huge residue of uncertainty that we must learn to live with. When nurses ask me the discharge diagnosis on the patient and I say it's "chest pain not yet diagnosed" or "abdominal pain not yet diagnosed," I did not make the diagnosis; I didn't reach that final point. But I've left it open so that other people won't come in and possibly inherit the wrong diagnosis.

RW: That takes a lot of courage.

PC: You must have a bit of a thick skin to start that. But once you do it, then other people will follow, until

eventually, it becomes the departmental standard. I go to M&M rounds in other departments and see how they conduct them. Some of them are still suffering from that secrecy and covering things up. And especially with the younger people, you can work with them to bring it out. Say what you were thinking; say what you think you were doing wrong. If anything, physicians have a tendency to be overcritical of themselves. Then you can say, look, if you understand the error process and the biases and the obstacles put in your way, then you can feel better about some bad decisions that you did make.

RW: Any other recommendations you would make to emergency medicine physicians or people managing emergency departments?

PC: When I came into emergency medicine, nobody sat me down and said, this is what your life is going to be like. I think that's good in any area of medicine. To be frank with people and let them know what's coming and the sorts of failures that they're going to experience and so on, I think it just makes things more realistic. In my career, I've had a number of close colleagues who left emergency medicine because they couldn't live with the consequences of what they perceived to be a mistake on their part. So my advice to anybody coming in would be to talk to some of the older physicians and ask them what it's going to be like. Hopefully, they will get a realistic appraisal and they won't see it as a place where they must demonstrate perfection.

RW: Anything else that you want to talk about that we didn't cover?

PC: I do think that the whole business of shift work is devastating to people, and we have to find better ways of scheduling people in emergency departments. We've developed a system here called casino shifts, where we actually change over at 3:00 in the morning. That sounds counterintuitive, but if you set this up right, you will actually improve people's longevity in the discipline. The number one reason given by physicians for leaving emergency medicine is the shift work. It's extremely difficult to make good decisions in the last 3 or 4 hours of the night shift. We need to do more work on sorting that out. There are ways of identifying people who are different prototypes. You know, you have morning people and evening people, and as you get older you tend to become more of a morning person. So you can set up individual shift scheduling, which optimizes the physiological capabilities of age and physiological chronotype. I think that's extremely important. Shift work is a necessary evil, but it's an evil that we can dilute to some extent, and get more out of people and make them happier.

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