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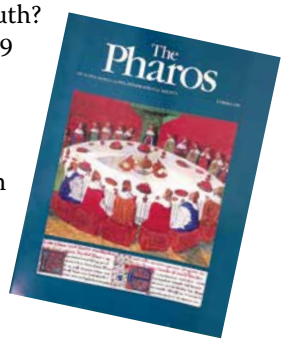
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Editor's note: Dealing with evidence in the information age is such a big topic, so I invited a group that has written several editorials to contemplate together. This group includes deep thinkers with backgrounds that include medical humanities, communication, education, and trauma surgery. I am grateful for their authorship, and hope our thoughts are useful for your own reflection about this important topic.

"Seeing is believing." It's an aphorism that is both useful and problematic for clinicians. On the one hand, it is a reminder to verify or ground one's thoughts and decision making in direct and primary observation of a phenomenon rather than rely on second-hand data, such as incorrect physical exam findings carried forth in the medical record. On the other, as even amateur magicians will tell you, primary data, such as one's visual focus and the thoughts that follow, can be manipulated like smoke and mirrors, creating beliefs that can cause us to ignore what is in plain sight. Either way, the adage requires us to bring thoughtful attention to how we deal with evidence.

Is evidence all we need to discern Truth? In a fascinating article in the Spring 1999 issue of *The Pharos,* James Gamble, MD (AΩA, University of Maryland, 1974) discusses the topic of spontaneous human combustion and popular opinion about it through the ages. Spontaneous combustion was felt to be a rare, but real cause of human demise until the



mid-nineteenth century, when the scientific community began to systematically prove that it was an impossibility of physics and chemistry for human tissue to achieve ignition energy and thus spontaneously burst into flames. During this period, there were passionate debates about the reality of spontaneous combustion, and no less than Charles Dickens weighed in on the side of believing in its possibility, carrying the weight that his fame brought to his voice. Gamble writes:

> Why did Dickens take such a strong public stance on the reality of death by spontaneous combustion? I think it was because he honestly believed [it] could happen. Dickens wrote: '[the scientist] Liebig is a great man, deserving of all possible respect, and receiving no greater deference from any one than me. But I cannot set his opinion – his mere opinion and argument – against full scientific evidence of a fact. That evidence appears to me to exist … If I take anything on evidence, I must take that.' Dickens was ready to hold forth on spontaneous combustion against the best scientific minds of his day. He thought his belief was based on scientific evidence and saw disagreement as one man's opinion against another's. He did not appreciate the difference between the quality of his evidence and that of Liebig's. His evidence was from historical testimony. Liebig's was from modern experimentation.[1]

It seems that everyone has evidence these days. A brief perusal of YouTube, Reddit, or any social media platform will lead to a bombardment of arguments, advertisements, articles, videos and more, explaining nearly anything, and quoting myriad sources of information. All will claim a lock on Truth, and many will systematically debunk any argument to the contrary, citing evidence along the way. While it feels like things might be worse these days, perhaps they are not, given that the above-mentioned article was published in 1999, and it is about events that took place in the 1850s.

Dickens' stance is a classic example of myside bias, a form of confirmation bias that occurs when people evaluate evidence, generate data, and test hypotheses in a manner predisposed toward their own prior opinions and attitudes. Not only has myside bias been widely demonstrated, it also has been shown to operate independently of intelligence.[2] So, no matter how smart one may be, they still are at risk for being led astray by myside bias. While the Dickensian scenario might not be a new one, what is novel in today's world is the seemingly infinite amount of information available to the average person with a phone and enough time to engage the world through it. Add to this the availability of increasingly sophisticated artificially intelligent chatbots and agents that will go out and scour the web for exactly the kinds of information we seek, regardless of quality, and the tendency we humans have toward myside bias has just been supercharged. In today's world, we are supported by powerful tools that can access infinite troves of information and present it to us in an authoritative voice that is clear, concise, and convincing. What is missing, however, is an accurate and reproducible assessment of the quality of that evidence.

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Instantaneous access to infinite information might just be changing our brains, and those of the students we serve. In the past, when something was unknown, students needed to brainstorm, to make hypotheses, to imagine what might be true, and then go out and find information and struggle to evaluate it, incorporate it, and make sense of it based on what they already knew, or thought they knew. There was cognitive dissonance in this process, and it required reconciliation and evolution of one's knowledge base to make sense of things. For those students willing to do this seemingly inefficient and frustrating work, the reward was a more robust, sophisticated, and nuanced understanding of medicine and the world. For those who were miserly with their cognitive energy, the rewards were less and their progress was ultimately slower.

Numerous changes in medical education over the past two decades including, but not limited to increasing "white space" for study and reflection during the day, requiring active learning during large group lecture time, and providing early patient exposure during medical school represent efforts to get students to think, to see how the facts play out in the real world, to grapple with complex concepts, and to seek the truths underneath

the facts. Unfortunately, we are swimming upstream. Efficiency in learning has become big business, as multiple test prep companies market themselves to students with the promise that their products can help students learn and assimilate information faster and with less effort than sitting with, discussing, and struggling with complex concepts either in class or on their own time. The white space today is mostly filled with multiple choice questions and videos full of sound bites, watched at 2x speed. Add to this the availability of AI tools that can listen to a lecture, take notes, make a podcast out of an uploaded file, and organize information for easy digestion, and most of the actual thinking part is gone. This is not just an artificial intelligence phenomenon, either. For example, if writing notes in the medical chart used to be an activity where a physician replayed an encounter or procedure in their head, ordered and organized the information, and then processed it into an assessment and plan for moving forward, the loss of that thinking activity didn't just recently begin with ambient AI scribes. Rather, it has been declining for a decade or more, enabled by the ability to copy and paste yesterday's note in the electronic medical record and the availability and usage of human scribes, both strategies intended to increase the "efficiency" of note writing.

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Coupling the prioritization of efficiency with instantaneous access to information, there appears to be a new resistance to the idea of meandering around in a knowledge field to see what there is to see and try to make sense of it. What used to be a process characterized by deep thinking, reflection, and sense-making based on primary sources of evidence is now seen as busy work. The tendency is to say: "If I need that information, I'll get it when I need it," knowing that the technology will deliver it to us on demand. When such supply chain logic makes its way into education, the focus shifts toward the answer right here and now rather than storing anything up for the future. If all the world's information can be accessed immediately, what need is there for storing anything? The problem is that, with less robust personal stores of knowledge, we lose the ability to effectively compare incoming information with what we know to be true or false. In other words, without some cognitive processing, reflection upon our own knowledge and biases, and evaluation of what we're told in the context of these, we might be losing the ability to discern high- from low-quality evidence. And that makes errors, or, worse yet, false information, harder to spot and challenge.

Reflecting this concern, the Canadian government released a statement through its 2024 Policy Horizons Canada report, suggesting that the number one and most imminent future disruption to Canadian society is that "people cannot tell what is true and what is not."[3] The notion of best evidence is becoming replaced with just "evidence" or worse yet, "answers" with no critical evaluation of those answers. While each generation has had its go-to's, time-honored sources such as Harrison's, Sabiston, Robbins, UpToDate, Dynamed, and others are being used less often than new AI-powered engines, or they are building AI engines themselves. The AI sources have started to do more of our thinking for us, and some previously highly trusted US government sources have become less trustworthy. And yet, best evidence that seeks to illuminate Truth is still necessary both for clinical effectiveness and the promotion of public safety and health.

Consider the following story: Two physician colleagues were recently having a car conversation about vaccine challenges and realized they knew very little about the European vaccine guidelines that have been referred to in various discussion forums. As they were driving, the easiest way to address this was to ask one of the popular AI chatbots to summarize differences and rationale between the US and European approaches. The bot provided them with a nicely organized and bulleted summary and ended with a statement saying that "US vaccine policy is more influenced [than Europe] by litigation patterns." Our colleagues reacted immediately—this made no sense to them. Regardless of what one thinks about current activities in the Department of Health and Human Services, historically, when one considers the processes of the US Preventive Services

Task Force and the Centers for Disease Control, this statement about US vaccine guidelines being based on litigation is misleading at best and patently wrong at worst. So, they pushed back, asking for the source of this information on litigation-based decision making. The bot promptly apologized: "Fair to push on that—I don't have a specific source for it, and I shouldn't have stated it as settled fact. Let me search rather than rely on memory." After a brief pause: "You're right to ask, and I can't back that claim up…The honest version: I was drawing on a general 'defensive medicine' narrative sometimes invoked to explain US/Europe differences in medical practice broadly…"[4] It was only because our colleagues knew otherwise that they were able to challenge and expose the misinformation provided by the bot.

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Whereas structural changes to medical education over the past 40 years have been fostered by a drive to innovate, a renewed recognition of the value of critical thinking, a desire of some faculty to do better than what was done to them, and a variety of other reasons, the effect of today's technologies increases the urgency for us all to get this right. The threat of deskilling and never-skilling is not just a hypothetical; rather, it is a threat to the clinical effectiveness of a whole generation of physicians. In a recent editorial, Keren and colleagues provide some ideas for how we can promote thinking and reflection in an era of instant accessibility to infinite information.[5] We would propose that AI companies themselves provide not only access to the tools they are developing, but also financial support for independently-conducted medical education research as part of the cost of marketing those tools for use in healthcare. Such support, to be mandated by healthcare regulatory agencies, would help identify and develop approaches to training physicians to navigate the turbulent waters of practicing high-quality medicine in the information age. Assuming that human doctors will still be relevant in the next decade or two, we will all need those humans to think independently, reflect routinely, and be able to discern Truth from conjecture and opinion, and we need to figure out how to train those doctors in a world where the evidence game has changed so radically.

In summary, while the illusion of smoke and mirrors predates even Dickens, the magical metaphor seems to ideally represent the ways information permeates our present-day society. Like early magicians seeking to create a dramatic appearance of an altered reality, disseminators of information frequently use various media to entertain, illuminate, distort, deceive, or distract. Herein lies the challenge: As practitioners, educators, and those dedicated to serving the suffering, we must not only identify our own perspectives, biases, and assumptions, we must also question our sources, discern and seek Truth, and protect and promote best evidence in order to maintain our commitment to practicing the most effective medicine possible. Anything less is just smoke and mirrors.

> "To be a scientist is to be naïve. We are so focused on our search for the Truth, we fail to consider how few *actually* want us to find it. But it is always there, whether we see it or not, whether we choose to or not. The Truth doesn't care about our needs or wants, it doesn't care about our governments, our ideologies, our religions. It will lie in wait for all time."
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> —The Soviet physicist Valery Legasov as portrayed by Jared Harris in the 2019 film *Chernobyl*[6]

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