Decision Making, Evidence, and Practice

Kevin W. Lobdell, MD, Geoffrey A. Rose, MD, Aneil K. Mishra, PhD, Juan A. Sanchez, MD, and James I. Fann, MD

Department of Cardiothoracic and Vascular Surgery and Department of Cardiology, Atrium Health, Charlotte, North Carolina; College of Business, East Carolina University, Greenville, North Carolina; Department of Surgery, Johns Hopkins University School of Medicine, Baltimore, Maryland; and Department of Cardiothoracic Surgery, Stanford University, Stanford, California

On April 19, 1995, a 45-year-old man, standing 5’ 7” and weighing 270 pounds, robbed 2 banks during daylight hours with no mask. Surveillance camera footage was shown on the local 11 p.m. news, and minutes later, a tip was received. Approximately 1 hour later, McArthur Wheeler was in police custody and passionately stated, “but I wore the lemon juice. I wore the lemon juice.” Apparently, Wheeler knew that lemon juice is often a key ingredient for invisible ink and deduced that his face would be invisible to surveillance cameras. In fact, Wheeler told police that he tested his scheme by experimenting with a Polaroid camera. Wheeler suffered from flawed judgment, decision making, and a poorly designed experiment [1].

Preventable medical errors are estimated to take as many as 200,000 lives and cost approximately $20 billion annually in the United States [2]. Errors in medical decision making have been highlighted by the Institute of Medicine [3, 4], and further, the Society to Improve Diagnosis in Medicine posits that 1 in 10 diagnoses are unnecessary variation and untoward outcomes may be reduced through routine use of evidence-based medicine (EBM) and evidence-based practice (EBP). EBM has been defined as “the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients,” and the randomized, controlled trial is the gold standard in evaluating therapy in EBM [6]. EBP includes information regarding diagnosis, prognosis, therapeutics, management strategies, and outcomes through quantified measurements and analytics [7].

To understand threats to decision making, quality, and patient safety, considering common cognitive phenomena and foibles with the individual (patient or practitioner), the team, and the institution is vital. Recognizing how decisions are made, information flows, innovation diffuses, and knowledge is managed is also vital. The following will briefly review commonly accepted theory and practice to assist the reader in understanding threats. Strategies to improve decision making, performance, and reliability, while closing the gap between evidence and practice, will also be discussed.

Address correspondence to Dr Lobdell, PO Box 32861, Charlotte, NC 28232; email: kevin.lobdell@carolinashealthcare.org.

Threats to Decision Making

Threats to individual decision making are manifold. Consider the following examples of flawed reasoning [8]:

1. 88% of drivers in the United States rate themselves as above average.
2. Software engineers from company A and company B were individually asked whether they were in the top 5% of software engineers: 32% of company A and 42% of company B software engineers rated themselves as being in the top 5%.

Both examples suggest illusory superiority. This phenomenon, known as the “Dunning-Kruger effect,” highlights a poor performer’s lack of skill and the necessary knowledge to identify his or her meager performance. Interestingly, amateurs have been found to rate themselves comparable to experts in various endeavors that include, but are not limited to, humor, grammar, and logical reasoning. Even college debaters—where the bottom 25% of performers lost 80% of their debates, but estimated their rate of winning at 60%—demonstrate illusory superiority [9, 10].

Inattentive blindness, where naïve observers may overlook important information, is another phenomenon that may threaten decision making. The classic “invisible gorilla experiment” (http://www.theinvisiblegorilla.com/videos.html) is a graphic example of how perception can mislead us. Drew and colleagues [11] demonstrated that experts are also prone to inattentional blindness, as captured in their experiment with lung nodule detection with computed tomography scans, where a gorilla, 48 times larger than the average lung nodule, was overlooked by 83% of the 24 radiologists tested (Fig 1).

The dual process theory of psychology suggests that we have fast-unconscious and slow-conscious modes of thinking. On one hand, type 1—fast thinking—is learned by experimenting, especially through trial and error, and includes rules of thumb, best practices, intuitive judgment, and common sense [12, 13]. Cognitive shortcuts, also known as heuristics, and biases are associated with this unconscious, quick thinking. Among common cognitive biases are anchoring, ascertainment, availability, confirmation, diagnostic momentum, framing effect, and desire for premature closure [14, 15]. Teleologically, human evolution and survival depended on quick thinking and action (without logical, conscious decisions) in threatening situations.
On the other hand, the archetype for the slow, type 2 process, is a probability computation, which requires time and mental energy. Numbers and probabilities are notoriously and adversely affected by use of heuristics. Cognitive load and imperfect memory, along with incorrect attribution of cause, are additional common threats to decision making. Furthermore, it is noteworthy that decision neuroscience suggests that judgment begins with rapid, unconscious weighting of emotional tags from memory [16] and that emotion is known to substantively affect judgment and decision making [17, 18].

There is significant promise for wisdom in groups, provided the groups (or group members) address potential problems of cognition, coordination, and cooperation as well as conditions of diversity and independence, recognizing the real-world clinical threats of eminence, vehemence, eloquence, providence, diffidence, and confidence, among others [19, 20]. The heart team, multidisciplinary care, and teaming are common examples of the use of groups to provide diversity in expertise and decision making [21, 22]. Conversely, the management classic, “The Abilene Paradox” suggests that group dynamics may also challenge group decisions [23]. This illustrative phenomenon, where a group agrees to do something even though privately and individually most, or all, members of the group disagree with the group’s decision (a violation of the condition of independence). As this implied, a group can end up in “Abilene,” where nobody really wanted to go.

Institutions, with their structure, processes, and history of favorable outcomes, may also fail, not just simply but spectacularly, in their decision making. For example, during the many years that Kodak dominated the film-based photographic process market, Kodak also had Steve Sasson on its payroll, who in 1975 created the digital camera. Because it did not disrupt itself (or jeopardize its market and, hence, revenue), Kodak did not embrace digital photography in a timely fashion [24, 25]. As a result, Kodak filed for bankruptcy in 2012. Jim Collins’ research suggests that there is a reproducible pattern of institutional failure described in 5 stages [26]:

1. Hubris born of success
2. Undisciplined pursuit of more
3. Denial of risk and peril
4. Grasping for salvation
5. Capitulation to irrelevance or death

Stage 2 suggests that institutions commonly make decisions based on marginal costs and marginal revenues (the things that historically generated profit), which also makes these same institutions fodder for disruptive innovators [27]. Analogously, Nelson and Winter suggest that, “much of firm behavior is best understood as a reflection of general habits and strategic orientation from the firm’s past rather than the result of detailed survey of the remote twigs of the decision tree” [28]. These examples are emblematic of the contemporary bewilderment witnessed in health care institutions during the transformation from “volume to value.”

More generally, high-performance organizations intentionally and intensely focus on achievement and are marked by common aspirational goals, adaptability, alignment, and accountability [29–32]. Axiomatically, any deviation from these characteristics poses a threat to performance. Steven Covey [33] relates the following illustrative examples of threats to fundamental components of high-performance organizations (based on a Harris Poll of 23,000 United States employees):

- 37% of employees have a clear understanding of what their organization is trying to achieve and why
- 20% were enthusiastic about their organization’s goals
- 15% felt their organization fully enabled them to execute on key goals
- 10% felt their organization held employees accountable for results

**Idea Flow**

Adam Smith’s “Invisible Hand” [34] suggests that it is inherent to human nature to exchange ideas, assistance, and favors out of sympathy. Alex Pentland’s [35] ongoing research points to exposure, exploration, and engagement as fundamental to this idea flow. Importantly, Pentland finds that the rate of idea flow predicts half of the variation in the productivity of organizations. Many diverse ideas and “dense interaction” are also characteristic of high-performance groups. Furthermore, decisions are found to be a combination of personal and social
information. For instance, when personal knowledge is low, one places increased weight on social information. This “testimonial” approach is thus often used by patients seeking qualified medical and surgical care.

**Diffusion of Innovation**

In the classic *Diffusion of Innovation*, published in 1962, Everett Rogers [36] categorized adopters as innovators, early adopters, early majority, late majority, and laggards. The process of dispersion and adoption of innovation are overwhelmingly reliant on human capital, and the rate varies with many factors. In medicine, research evidence is commonly estimated to require 17 years to become accepted practice [37]. Profound threats to quality, safety, and timely returns on investment can result from medicine’s reluctance to change and the sluggish pace of adoption.

**Knowledge Management**

To assist providers in reviewing and interpreting available medical evidence in patient management, organizations, such as The Society of Thoracic Surgeons (STS) and the American Association for Thoracic Surgery, have developed consensus guidelines based on comprehensive review of clinical and scientific data [38, 39]. The STS Workforce on Evidence Based Surgery is tasked with defining and addressing controversial clinical topics by providing guidance, thereby ensuring thoughtful patient evaluation and mitigating cognitive biases. The STS and American Association for Thoracic Surgery have also collaborated with general and interventional cardiology organizations to define diagnostic and management guidelines for the multidisciplinary management of ischemic heart disease, aortic and mitral valve disease, cardiac arrhythmias, thoracic aortic disorders, and general thoracic malignancies [38, 39]. Appropriate guideline use requires monitoring and commitment to learning and improvement, as evidenced by the observation that of patients with indications for coronary artery bypass grafting (CABG), 53% were recommended for CABG and 34% for percutaneous coronary intervention (PCI); in contrast, of patients who had indication for PCI, 94% were recommended for PCI [40]. Furthermore, of patients with an indication for CABG or PCI, 93% had recommendation for PCI and only 5% for CABG [40].

All guidelines will have strengths and limitations. Bias may be introduced into these efforts through study design (eg, criteria for inclusion and exclusion, statistical methods and analysis, and timeline for follow-up) and expert opinion. The rate at which information accrues and analyzed is also increasing and creates challenges to the painstaking process of guideline creation and knowledge transfer.

In addition, a less rigorous but highly practical aid in decision making is represented by the STS Expert Consensus Documents, which reflect the collective opinions of experts in the field [41]. The opinions expressed using this approach do not necessarily reflect a formal evidence review based on the process outlined for evidence-based guidelines. Nonetheless, the clinician is provided with treatment strategies based on the collective knowledge and experience of a committee of experts. For instance, in the expert consensus for resuscitation of patients who sustained cardiac arrest after cardiac surgery, a task force was convened to review all relevant medical literature, with the development of consensus using a modified Delphi method with two rounds of voting [42]. Importantly, the task force proposed a protocol that takes into account a number of variables, such as defining six key roles that should be allocated and rehearsed as a team, the procedural rationale and sequence for pacing and defibrillation, and the indications for repeat sternotomy (Fig 2) [42].

The conclusions and recommendations generated by professional organizations may minimize the potential for individual biases in patient care. Notwithstanding the many topics addressed and consensus documents developed by the STS and the American Association for Thoracic Surgery, many clinical situations have yet to have such robust guidance and thus require continued awareness of potential biases and the many pitfalls in clinical decision making.

**Pragmatic Tactics**

Inexperience with complex medical issues and emotional overlay may affect a patient’s ability to make an informed and thoughtful health care decision. The shared decision making process, therefore, is designed to engage, educate, and assist patients in understanding risks, benefits, and alternatives to their therapeutic options and appears to improve “value-congruent choices” [43]. The practitioner is encouraged to develop a framework to categorize problems in the clinical environment. Based on methods of complexity theory, the Cynefin [44–46] framework, is a pragmatic paradigm that we use (independent of the temporal dimension or time constraints for decision making). Such a framework can mitigate the potential risk of emotions on decision making by operational routine and elimination of variation, which in turn degrades performance (Table 1).

In addition, clinicians should aspire to personal mastery in thought and action. As a part of their study on executive decision making, McKinsey and Company offer an assessment that evaluates the pattern recognition, action orientation, stability, social harmony, and self-interest [47]. Clinicians can avoid cognitive missteps, such as the “Dunning-Kruger Effect,” by creating an environment that nurtures thoughtful decision making. For example, a safe environment promotes questioning of judgment and decisions, solicitation of feedback, and emphasizes continuous learning and improvement. Other common, cognitive biases that can affect clinical decision making, patient safety, and outcomes include the availability heuristic, confirmatory bias, and egocentric bias [48–51]. For example, the availability heuristic, or an individual’s tendency to assign greater value to recent events and a
higher probability that such events will occur, is evident when a recent blood transfusion reaction results in the provider’s perception of a higher likelihood of a reaction in the next patient who requires a transfusion. Moreover, when one makes a diagnosis in the setting of limited information, it is important that one does not succumb to confirmatory bias by only acknowledging data supportive of one’s assessment or management strategy. Finally,
egocentric bias occurs when the clinician is overconfident in his or her diagnosis in the setting of missing data points, thereby resulting in inaccurate probability assessment. Notably, use of Kahneman’s 12-point checklist in important decisions is a useful example of process to avoid biases in decision making (Table 2) [52].

Teams should routinely assess and quantify risk and institutionalize risk mitigation strategies [53]. This approach may affect the diagnostic process and promote institutional learning, where data are converted to tacit knowledge and operational routine. As Thaler and Sunstein relate in their review of Moneyball: The Art of Winning an Unfair Game, “We suspect that countless areas of enterprise, both private and governmental, would benefit from their own Billy Beanes and Paul DePodestas, challenging widespread intuitions, or what ‘everyone knows,’ with statistical information about what works and what does not, and with performance measures that more accurately reflect the true contribution to organizational success. Baseball is not the only realm for which The Book is in need of revision” [54].

Pentland’s [55] research on idea flow suggests we must experiment and focus on teammates with strong social ties. Furthermore, because new ideas become habit through the process of social learning, we need to evolve our educational methods and focus on communication. Clinical medicine and research demands reliable execution, which is fostered by inquisitiveness, sharing of information, empowerment, teamwork, and learning quickly [55]. Reliability may be augmented with tools such as goal sheets, checklists, and hand-off tools [52].

From a practical perspective, Brent James [56] suggests that clinical processes of high impact be identified and EBP built around such an approach. James emphasizes that the process “blend into clinical workflow so that it doesn’t rely on human memory” [56]. The EBP must also be integrated with a learning system that combines data, computerized analysis, and an expert at the interface of the system and clinical environment. Similarly, Joint Commission recommendations [57] consist of enhancing knowledge and awareness of cognitive bias, professional reasoning, critical thinking, and decision-making skills. The Joint Commission also suggests enhancement of work system conditions and workflow design that affect cognition.

### Summary

Quality and safety, and the deviation from EBM and EBP, may be threatened by individuals, teams, and institutions. Knowledge of principles related to decision making and biases, idea flow, and knowledge management is vital. A disciplined focus on structure, process, institutional learning, and the development of a culture of continuous improvement will mitigate risk of threats to performance and reliability and thereby improve patient safety.

### References


