

To Do or Not to Do?—How People Make Decisions

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Abstract: Outcomes in healthcare depend a great deal on the quality of decisions made by the people who care for patients. In the early days of cardiac surgery decisions were often made on the basis of authority by surgeons with broadly based knowledge and skill, developed through extensive training and very long hours of work. The philosophy of the “captain of the ship” prevailed. The advent of much greater specialization and the emergence of evidence based medicine have led to a shift to a model of decision making in which expertise trumps authority. There has also been a reduction in the length of hours worked by many doctors, and greater emphasis on involving patients in decisions about their own healthcare. The framework for understanding human error has been refined on the basis of empirical and

theoretical considerations, and much importance is now placed on the way in which the system as a whole is designed. Unfortunately the complexity of healthcare today is such that some of its properties are best explained through analogies to chaos theory. Furthermore, empirical work suggests that human beings are clearly strong at recognizing patterns, and are less adroit at analyzing complex and unfamiliar situations from first principles in a short time. It follows that the very extensive experience of some of the older practitioners may have been more valuable in decision making than many of the very reasonable and logical advances that have influenced modern practice.

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Outcomes in healthcare depend a great deal on the quality of decisions made by the people who care for patients. Those (like perfusionists, cardiac surgeons, and cardiac anesthetists) who work with the critically ill using sophisticated technology often have to make life determining decisions quickly and under stress. Today, such decisions are seldom the sole responsibility of a single individual: each team member brings his or her unique expertise and abilities to each situation, and depends on the expertise and abilities of the others. Furthermore, a common view of the relevant facts is essential before a sound course of action can be chosen: Communication is therefore fundamental to decision making in cardiac surgery.

A HISTORICAL PERSPECTIVE—COMMAND MODE DECISION MAKING

The mixture of skills seen in the cardiac operating room today is very different from that typically present in the 1950s and 1960s. After the Second World War, medicine

was dominated by senior doctors who, in the military, had faced enormous challenges with few resources. Many of these doctors had developed a view of the role of the surgeon best described as “Heroic”; surgeons typically had very wide ranging capabilities, but many aspects of surgical care current at the time were in retrospect somewhat basic by today’s standards. Many conditions need only simple and straightforward management, and for these results tended to be satisfactory; in more demanding cases results were indifferent by the standards of today.

In surgery, great emphasis was placed on first principles, and the all-capable generalist was greatly admired. Individual surgeons managed illnesses ranging from bowel cancer to hyperparathyroidism. Decisions were predicated on the authority that came with position, extensive training, and substantial experience. These doctors worked very long hours by today’s standards, and saw a huge range of pathology.

Anesthesia was typically provided by non-specialist doctors or (in many parts of the world, including the United States) nurses, who tended to defer to the authority of the surgeons. Again, however, these individuals worked long hours and became very experienced.

Technical and nursing support was provided within hierarchical structures with steep authority gradients. The

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relationship with patients was paternalistic. Doctors were expected to be highly dedicated and completely committed to their patient's best interests. However, there was little scope for discussion: it was understood that surgeons would do the right thing, day or night, whatever personal or family sacrifice it took, and in return patients would gratefully accept their recommendations and submit to their treatments without question or complaint.

Decisions in this model were mostly made by the chief, and communication tended to be ritualized and reflective of the authority gradients in the team. There was a pioneering spirit and leading surgeons responded to the opportunities for innovation by innovating (1,2).

In the 1950s the advent of cardiopulmonary bypass opened up new opportunities to extend the work of general, thoracic, and vascular surgeons from simple closed heart surgical procedures (such as valvotomies) to treating more complex conditions of the heart. The support requirements of this work demanded increasingly wider expertise and skill on the part of all members of the team. In 1949, Elizabeth M. Smith, RN published an account of nursing preparations for the advent of cardiac surgery unit at the Children's Orthopedic Hospital of Seattle (3). Amongst other things, a library of all available literature on cardiac surgery was assembled and each nurse was required to review this material before being entrusted with the care of these children. Results were audited and thought was given to factors requiring more prolonged and intensive nursing care postoperatively. The implications of endotracheal anesthesia were considered. This nurse was clearly engaged at a high level in the systems thinking fundamental to setting up a new service. It became imperative for anesthetists to expand their knowledge base (4–7) and the discipline of perfusion was born (8,9).

For many years to come, cardiac surgeons of this generation were still in the unique position of having been integral to and often the drivers of the development of all aspects of this specialty. Many of them had impressively detailed knowledge of every aspect of their patients' management, and their expertise spanned anatomy, pathology, cardiology anesthesia, and perfusion. Their claim to being "captain of the ship" had substantial legitimacy. They made the decisions and operated in command mode.

RECENT DEVELOPMENTS—THE ADVENT OF EVIDENCE BASED MEDICINE AND DOING THE RIGHT THING

More recently this situation has changed. This change is nowhere more evident than in perfusion, where advances in technology and expertise have been substantial. Perfusionists have increased the depth of their expertise, and

have been drivers in developing the knowledge that underpins that expertise: They have become initiators of research projects, databases, and collaborative initiatives to promote better patient care (10–13). The changes in anesthesia have also been profound. Cardiac anesthesia has emerged as a sub-specialty in its own right, a development made more explicit by the virtually universal adoption by cardiac anesthesiologists of transesophageal echocardiography (14). The changes in surgery have been somewhat different. More recently trained surgeons have no less expertise or ability, but their training today tends to be much narrower and often focused on sub-specialized areas of practice. Their knowledge is, as always, impressive, but the field of that knowledge is more circumscribed. As stated above, cardiac surgery today is undertaken by a group of people with different areas of expertise, and who need to work together as a team, and who cannot usually take over and perform each other's duties.

During this period there has been a parallel development of a different view of decision making. The authority mode of decision making is no longer seen as appropriate in healthcare (or at least not usually) (15). Evidence based medicine has emerged, underpinned by the concept that patients expect the right thing to be done, which may not be the thing any particular authority happens to decide on the day (16) (albeit with some dissension (17)). A much greater emphasis on the autonomy of patients has been integral to this change in thinking (18): today, patients are expected to have a considerable role in understanding and determining their medical care.

Great opportunity is inherent in these sociological changes, but also great challenges. There are few data to demonstrate that better decisions are made today than those made in the past; possibly at least some of the decisions today are in fact worse. A plausible argument could be (and often is) made that the constraints on surgical autonomy and authority from all quarters have undermined the ability of these great champions of patient care to deliver the treatments actually needed by their patients. Without doubt, outcomes have improved dramatically, and many patients who previously would have been beyond the capacity of healthcare now survive extremely serious illnesses to enjoy excellent long term quality of life (19), but the reasons for this are obviously multiple (20). Unfortunately, things still go wrong, and there is much greater awareness of the problems of iatrogenic harm in healthcare (21–23). The medico-legal environment is also less accommodating of the medical autonomy of previous years (24).

THE SURGICAL VIEW OF MISTAKES

Charles Bosk has undertaken fascinating anthropological research into the ways surgeons work in the United

States. According to him, much emphasis is on honesty in this regard. A distinction is made between errors thought unacceptable, and those seen as inherent in surgical development. If anything the latter are viewed as necessary attributes of a person suitable for the role of heroic surgeon (25). This latter category includes technical errors and errors in judgment; and provided a trainee surgeon who makes such an error is honest, seeks help in resolving it, and takes steps to avoid it in the future, he or she would be commended. The former category involves behaviors viewed as untrustworthy, attempts to cover up the error, or failures to recognize or acknowledge mistakes. These errors were viewed as incompatible with excellence in surgery (26).

There is a moot point as to whether Bosk is actually describing errors on one hand and violations on the other, but the approach described by him is consistent with at least one contemporary analysis of blame in relation to things which go wrong in healthcare (27). One deficiency identified by Bosk in this response to errors lies in the way those trainees seen as prone to unacceptable behavior in this regard tend to be managed: often they end up moving to increasingly isolated practices where their deficiencies became more of a hazard to patients than they would be with the checks and balances of a major unit, or if they were prevented from proceeding with surgery altogether (25). In addition, the environment in which errors could be discussed openly and constructively within the framework of quality improvement has fluctuated, and there may be less acceptance today by the public that surgical mortality committees are an adequate forum for resolving mistakes that lead to serious patient harm (28,29). This is a pity, because the power of stories is under rated in relation to improving decision making (see below).

HOW DECISIONS ARE MADE—THE REASON RASMUSSEN MODEL

James Reason's classic book "Human Error" introduced an approach to understanding errors and mistakes based on the cognitive processes at play when these occur (30). Reason's work, which draws from many sources but notably the earlier work of Rasmussen, has profoundly influenced medical thinking in relation to things that go wrong and how to prevent them. In essence he divides mistakes into failures of action and failures of decision making or planning. The former are known as slips and lapses and the latter as mistakes. He draws from empirical and theoretical research in developing and justifying this framework. He emphasizes the fact that human beings are not Boolean thinkers, but are avid recognizers of patterns. It is suggested that people store schemata in their memories,

which represent the essential features of situations seen before. They also tend to store schemata that contain the key elements of responses to these situations. In rule based reasoning a situation is recognized from a stored schema and a learned rule (in effect another schema) is applied. The choice of rule is influenced by the strength of emotion associated with previous experiences and how recent those experiences happen to have occurred, amongst other things. This is a profoundly different view of human decision making from the idea of a computer analyzing the facts, weighting the probabilities, and deciding to do the most logical thing.

Reason describes a different process, which he calls "knowledge based." Merry and McCall Smith argued that this is a somewhat misleading name because the key element of this type of thinking is the use of deliberative reasoning from first principles (27): The name "errors of deliberation" may be better (but see below). Deliberative reasoning is the thought process of the scientific method. It is powerful, but effortful and slow. It relies on trial and error, incorporating feedback into an iterative process of decision refinement. In contrast, rule based reasoning is feed forward – one knows in advance what to expect because one has seen it before. One definition of a crisis is that it is a situation in which one has run out of rules and out of time for deliberation.

REFINING THE MODEL

Runciman et al. introduced the idea of technical errors into this framework (15). In essence this reflects the difference between expectation and achievement that is a function of the skill of any particular person and the difficulty of the task. Should a golfer score a hole in one on every hole (or at least on all the short holes)? Is it an error if he or she does not? Is it an error if he or she does not even hit the ball onto the green? Certainly it is a failure to achieve what was intended. What of the insertion of an arterial line – surely this should be achieved successfully every time? Obviously failures occur, and these are not well categorized as slips, lapses, or mistakes, so the idea of technical error is helpful in understanding that there are tolerances to human performance (15).

OTHER INSIGHTS

Thaler and Sunstein provide a slightly different view of the Reason model (31). They distinguish a wider range of apparently automatic actions, recognizing that much rule based decision making is in effect subconscious and refer to "knowledge based reasoning" as "reflective system" thinking. This may be helpful clarification of the nuances of the Reason model.

CHAOS THEORY

One of the central tenets of this model of mistakes and errors is that their prevention lies in focus on the system rather than the person. But what sort of a system are we dealing with?

In 1972 Lorenz gave a talk to the American Association for the Advancement of Science, entitled "Predictability: Does the Flap of a Butterfly's Wings in Brazil set off a Tornado in Texas?" (see obituary: Palmer T, *Physics Today* 2008, 81-2. Available at: <http://scitation.aip.org/getabs/servlet/GetabsServlet?prog=normal&id=PHTOAD000061000009000081000001&idtype=cvips&gifs=yes&bypassSSO=1>; accessed December 15, 2010). This was the birth of Chaos Theory. It turns out that dynamical systems, such as the weather, are highly sensitive to initial conditions. Of course, initial conditions are a function of starting points, and one can intervene in a process and start again as it were. The idea is that these systems are not random, but that in practice they are too complex for predictions to be possible beyond a very short time frame. There are many aspects of the health-care system that are analogous to systems of this type, and decisions often need to incorporate a substantial degree of uncertainty if they are to be as effective as possible.

TYPES OF PROBLEM

Gawande has drawn attention to a classification of processes proposed by Glouberman and Zimmerman (32,33). Processes can be simple (like baking a cake), complicated (like going to the moon), or complex (like raising a child). The difference between the second and third examples lies in repeatability. Having succeeded in going to the moon once, we can do this again (presumably). Having succeeded in raising a child, we may be able to do this again, but we may not. Complex processes resemble dynamical systems—only very short term predictions are possible. Healthcare includes all three types of process, and decisions need to include an understanding of these.

WHITE BEARS

Wegner et al. has added further complexity to the framework by drawing attention to the paradoxical effects of thought suppression: If one attempts to avoid thinking of a white bear, one will almost certainly ensure the opposite result (34)!

IMPROVING DECISIONS IN HEALTHCARE

From these various considerations it can be seen that the concept of avoiding mistakes by simply trying harder

is doomed to fail. On first blush, it seems a more sophisticated approach is needed. The use of algorithms has been strongly advocated to assist with difficult decisions (35), and no doubt has a place. Checklists are another useful cognitive aid (36), and have been widely adopted in perfusion.

However, empirical work by Kline suggests that experience is critical to good decisions, at least during crises (37). Perhaps the authority model of the surgeons of the 1950s and 1960s had merit after all: as stated above, these doctors typically worked extremely long hours and built up experience that few practitioners today can match. Also the broad base of that experience was a huge asset when faced with the unusual or the unexpected. These doctors are remembered as highly competent and very good at making decisions. Perhaps these memories are entirely accurate.

Unfortunately this type of practice is no longer tenable. Also, there are costs along the way in gaining such experience that patients today would be unwilling to tolerate.

One way of achieving the huge store of schemata needed for good decisions in the heat of the moment may be through the use of simulation (38,39). Simulation underpins training in aviation, and many other high risk activities. Simulation is expensive, and in healthcare much work is still needed to reach the level of reliability and validity that has become the norm in aviation (38). In one form or another, however, simulation is probably going to be the tool which contributes most to improving performance of teams in healthcare, and particularly in cardiac surgery.

A less expensive and very effective technique which has perhaps received too little attention is story telling. Stories are powerful. Mortality and morbidity meetings can be a valuable source of stories if this emphasis is permitted. Simply spending time with seniors and colleagues and sharing experiences is perhaps one of the safest and easiest ways of obtaining schema for future use.

Our theoretical knowledge of the ways humans make decisions has progressed substantially from early concepts based on exhortations to try harder. It is fascinating to speculate that the practical benefit of modern insights into decision making may be rather limited. In respect to decisions, the real challenge facing cardiac surgical teams today may well be to do no worse than those that went before.

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