Excellence in Anesthesiology

The Role of Nontechnical Skills

Editor's Note: This is the second in a four-part series of Editorial Views on the topic of excellence in anesthesia, which includes how it is designed, how it is measured, and how interventions to improve it might be assessed.

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> All truths are easy to understand once they are discovered; the point is to discover them.—*Galileo Galilei*

> I invent nothing, I rediscover.—*Auguste Rodin*

THIS is the second editorial of four looking at excellence in anesthesiology. In the introductory editorial,[1] Smith set the scene by encouraging us to look beyond the more conventional and obvious areas of the curriculum, such as knowledge of applied physiology or performance of regional anesthetic techniques, and to explore those areas that are less well defined but of equal importance for the complexity of our tasks as clinical anesthesiologists.

The theme that is common to this series of editorials is that the different components of excellence are already present in the practice of anesthesiology and always have been, as Rodin observed in the quote above. Although present, these components are tacit and not explicit.

In this editorial, I shall look at nontechnical skills (NTS), the set of skills used by humans when performing tasks and carrying out procedures while interacting with each other and the underlying systems. What are the key NTS that will promote excellence in anesthesiologists? How can we effectively teach them or assess for them? One of the difficulties we have faced is that many of the terms that have been used in both the past and the present are woolly, ill-defined, and imprecise; this imprecision impairs communication of these concepts. One current approach can be described in top-down terms. A framework of generic competencies for all doctors, such as the six competencies of the Accreditation Council for Graduate Medical Education* or the seven roles of the CanMEDS 2005† project are applied to our specialty. One difficulty with this approach is that we may not always be aware of these skills because so few of them have been consciously acquired. Consciously thinking about these skills may not identify the ones that are most important for us as anesthesiologists. We may have to employ a wider range of research methods to identify the key skills. A recurring theme of this series of editorials is the use of different qualitative research methodologies, more commonly associated with sociology and psychology, to explore tacit components of anesthetic practice. These methods favor a bottom-up approach, an approach that seeks to first elicit data and then build those data into a framework, and will be explored in greater detail in the next of the series. This is not to imply that one approach is better than the other. They should be seen as complementary.

Our group of industrial psychologists and clinical anesthetists took such an approach. We were interested in safety and looked to methods used by other industries, notably aviation. The 1970s saw several high-profile civil aviation disasters on both sides of the Atlantic. Investigation of the causes of these incidents, using the very rich datasets available to the investigating psychologists, revealed a set of skills and behaviors that were complementary to the then formal aviation curriculum. Planes were falling out of the sky, or in the case of the worst civil aviation disaster to date (Tenerife, 1977) not even getting off the ground, because pilots were not effective in communication, prioritization, decision-making, etc. The impetus for inclusion of these NTS into aviation training was therefore driven by the safety agenda. As this movement expanded, it became clearer that, although there was an overlap of NTS across different domains, they were not generic. Helmreich[2] has shown that organizational and cultural influences bring about variations in these skills, especially as they become less general and more specific. The safety-driven use of generic NTS in anesthesiology was not new. Gaba *et al.*[3] have been using a modified set of generic NTS as the key Crisis Resource Management principles in their influential approach to providing countermeasures to human error—Anesthesia Crisis Resource Management courses.

Our group sought therefore to identify those NTS specific to anesthesiology, such as the components of deci-

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Table 1. The Anaesthetists' Non-Technical Skills (ANTS) System Categories and Elements

Category	Elements
Task management	Planning and preparing
	Prioritizing
	Providing and maintaining standards
	Identifying and utilizing resources
Team working	Coordinating activities with team members
	Exchanging information
	Using authority and assertiveness
	Assessing capabilities
	Supporting others
Situation awareness	Gathering information
	Recognizing and understanding
	Anticipating
Decision making	Identifying options
	Balancing risks and selecting options
	Reevaluating

sion-making or teamwork, and then assemble them into a usable system. The two methods used were cognitive task analysis and grounded theory.[4] Cognitive task analysis uses one or more probe questions to bring the tacit from the subconscious to the conscious mind. The research fellow in the group conducted such a technique with 29 consultant anesthetists working in Scotland. Grounded theory is a technique in which the researcher generates hypotheses and then tests them against the data generated.

After a series of iterative trials, the current framework was produced (table 1). A large-scale study was undertaken and demonstrated favorable results for validity, reliability, and feasibility of the Anaesthetists' Non-Technical Skills (ANTS) system.[3]

The ANTS system is a hierarchical structure consisting of four categories, each of which is divided into a number of elements. The elements are supported by a set of behavioral markers that serve an illustrative purpose to help make them more comprehensible and so applicable. This approach has also been successfully used in other high-reliability industries.[5]

A simple clinical example will demonstrate how the system can be used to reflect on clinical performance. Let us consider the following scenario. An attending anesthesiologist (Dr. A) has just taken up a post in hospital Z. Orientation to the main operating room (OR) suite, but not anesthesia sites outside of the OR suite, has

taken place. Due to unexpected circumstances Dr. A has been asked to take over at late notice from Dr. B (who had phoned in sick). Dr. A now finds himself in an OR distant from the main OR complex, already behind schedule and under pressure to proceed. Having induced anesthesia in the first patient, he discovers that the surgeon, Dr. C, is using a camera technique and wishes the OR lights dimmed. Dr. A reaches for where he thinks the anesthetic machine light switch should be. However, he inadvertently presses the power switch for the anesthetic machine (different from those in the main OR suite) and now finds himself in the dark with no gas flow, no ventilation for his paralyzed patient, and no monitoring.

If we review how Dr. A got into this situation, then the key category is *Situation Awareness* (or rather, lack of). This has three elements, *gathering information* (Dr. A did not find out information about the anesthetic machine), *making sense of what is happening*, and *anticipation.* If Dr. A had gathered more information from Dr. C or the OR nurses (*exchanging information* from the category *Team Working*) or had used *authority and assertiveness* (also from *Team Working*) to say to Dr. C, "There will be a delay because I have to familiarize myself with the environment" (*gathering information*). Then, he may have *anticipated* the reduced lighting and may have formulated a plan (*Task Management*) to deal with those circumstances. Under the category of *Decision Making*, it would appear that Dr. A either did not *identify options* or did not *balance the risks when selecting this option*. The pressures on Dr. A to act as he did are understandable, but application of the relevant NTS may have provided countermeasures to the subsequent errors. A definition and list of behavioral markers for the element *gathering information* is provided in table 2.

I have concentrated on how Dr. A got to the crisis and how the use of the ANTS system could provide a framework that would help structure subsequent reflection and review. The ANTS system would also be helpful in reviewing his management of the crisis that ensued. Although I do not wish to diminish this role of the system, I wish to place more emphasis on how we avoid getting into trouble. The above example also illustrates that the ANTS system is not adding new knowledge,

Table 2. Definition and Behavioral Markers for the Element *Gathering Information*

Gathering Information: actively and specifically collecting data about the situation by continuously observing the whole environment and monitoring all available data sources and cues and verifying data to confirm their reliability (*i.e.*, that they are not artifactual)

Behavioral Markers for Good Practice	Behavioral Markers for Poor Practice
Obtains and documents patient information preoperatively	Reduces level of monitoring because of distractions
Conducts frequent scan of the environment	Responds on individual cues without confirmation
Collects information from team to identify problem	Does not alter physical layout of workspace to improve data visibility
Watches surgical procedure, verifying status when required	Does not ask questions to orient self to situation during hand-over
Cross-checks information to increase reliability	

skills, or behaviors to the practice of Anesthesiology. No, the purpose is to make explicit what has been largely implicit. Excellent anesthesiologists seem to sail through the OR without problems, providing perioperative care efficiently and effectively. How do they do that? They do so by making effective use of NTS (in addition to the other areas covered in this series).

The example illustrates how the ANTS system can be used as a framework to help residents reflect on their own performance and review why some aspects went so well and others not so well. It can also help them reflect on the performance of their teachers (Why does Dr. X make her list go so smoothly?) and use those lessons to influence their subsequent performance. The system encourages learners and teachers to look at behaviors and so move away from making personal judgments about character when reviewing performance. However, as with all tools, it requires training and familiarization to use it to best effect, and that is a challenge that several international centers are currently addressing. Also, the ANTS system should not be viewed as the definitive version of nontechnical skills, but as work in progress to help us refine our understanding of those NTS that are most important for anesthesiologists.

Reflection and review of performance is not confined to the teaching and assessment of residents. As professionals, we aspire to achieve not only high standards but also to continually raise those standards of practice. That drive applies to all aspects of our practice, whether that is new drugs and techniques, new equipment, or improving our own individual NTS. Other high-risk industries that have incorporated NTS frameworks use these to describe critical incidents and near misses. We can continue to build on some excellent critical incident reporting systems by applying one or more NTS frameworks and in doing so in an iterative fashion further refine those key skills that are necessary for excellence. Other industries have placed the teaching and assessment of NTS at the heart of their drives to improve safety by equipping their workforces with countermeasures against human error. As a specialty that has led the way in the patient safety movement in medicine, we have already demonstrated that we can rise to that challenge.

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