

advances in patient safety: non-technical skills in surgery

Rhona Flin and Steven Yule report on the University of Aberdeen's Non-Technical Skills for Surgeons project

Patient safety problems occur across healthcare but there are particular risks in surgery and surgical patients are involved in as many as 45% of medical adverse events. Estimates of adverse events in surgery that occur while the patient is in the operating room range from 35% to 66%. Studies of safety in other high-risk industries show that adverse events are primarily attributed to human failures, rather than technical malfunction and, for experienced practitioners, it is not usually a lack of technical expertise that is responsible. Non-technical skills (e.g. leadership, decision making, assertiveness, team co-ordination) are responsible for maintaining safety. Surgeons' non-technical skills play an equally significant role in patient safety in the intra-operative environment.

Observations of performance in the operating theatre show that breakdowns in team working, leadership, communication, lack of situation awareness, and poor decision making are not uncommon and can lead to adverse outcomes for patients. Conversely, high performance practitioners demonstrate non-technical skills as an integral part of their surgical expertise. Such findings are reinforced by error analyses as well as autobiographical and anthropological accounts of surgeons' behaviour. While surgeons believe that inexperience is a prime factor in their errors, breakdowns in communication, fatigue and weaknesses in cognitive skills also contribute.

The NOTSS (Non-Technical Skills for Surgeons) project at the University of Aberdeen has been identifying the critical non-technical (i.e. cognitive and interpersonal) skills that surgeons need to complement technical proficiency, in order to maintain high levels of safety and quality in the operating theatre. Identifying the most important skills for surgeons is the first stage

in developing a behavioural rating system that can be used in theatre to provide structured feedback on non-technical aspects of performance. These systems are used in other domains such as anaesthesia, aviation and nuclear power to rate and provide feedback on performance, as well as to identify training requirements. Five methods were used to identify the critical skills.

An attitude survey was carried out with 352 theatre staff from 17 hospitals in Scotland (involving consultant surgeons, trainee surgeons and theatre nurses) to look at opinions and practice relating to non-technical skills and safety. Respondents generally demonstrated positive attitudes to behaviours associated with effective teamwork and safety. Attitudes indicating a belief in personal invulnerability to stress and fatigue were evident in both nurses and surgeons. Consultant surgeons had more positive views on the quality of surgical leadership and communication in theatre than trainees and theatre nurses. They also held different views from nurses on the importance of debriefing, the manner in which errors are discussed in theatre and suitable leadership styles. While the ubiquity of human error was well recognised, attitudes to error management strategies (incident reporting, procedural compliance) suggest that they may not be fully functioning across hospitals. While theatre staff placed a clear priority on patient safety, against other business objectives (e.g. waiting lists, cost cutting), not all of them felt that this prioritisation was shown by their hospital management.

Observations in theatre allowed the researchers to take field notes about roles and responsibilities of personnel, patterns of communication and aspects of teamwork. A review of existing literature identified

key behaviour patterns and uncovered several existing rating checklists. A review of adverse event reports from the Scottish Audit of Surgical Mortality (SASM) revealed little, probably because there is scant opportunity to report potential non-technical causes of mortality on the SASM form. Finally, cognitive interviews with 27 consultant surgeons uncovered a broad set of non-technical skills that were used or observed during the management of challenging cases in the operating theatre.

The interview transcripts were coded for non-technical skills and the resulting skill list was reduced, refined, and thematically organised into a skills taxonomy comprising 'categories' and 'elements' by four independent panels of consultant surgeons (see Table 1).

Category	Element
Situation awareness	Gathering information Understanding information Projecting and anticipating future state
Decision making	Considering options Selecting and communicating option Implementing and reviewing decisions
Task management	Planning and preparation Flexibility/responding to change
Leadership	Setting and maintaining standards Coping with pressure Supporting others
Communication and teamwork	Exchanging information Establishing a shared understanding Co-ordinating team activities

Table 1: Non-technical skills for surgeons (NOTSS) skills taxonomy v 1.0

The categories are global clusters of skill elements and emerged as follows: Situation awareness (developing and maintaining a dynamic awareness of the situation in theatre); Decision making (diagnosing the situation and reaching a judgement in order to choose an appropriate course of action); Task management (organising the resources, personnel and activities required to achieve goals); Leadership (providing direction when necessary; demonstrating standards of clinical practice and care, and being considerate about the needs of team members) and Communication and teamwork (ensuring that the team has an acceptable shared picture of the situation and can complete tasks effectively). Each category is comprised of two to three elements. For example, the three elements comprising situation awareness are 'gathering information', 'understanding information', and 'projecting and anticipating future state'. A further sample of consultant surgeons wrote example good and poor behaviours for each element. These 'behavioural markers' were written as active verbs and checked to make sure they could be directly observed or inferred through communication so the resulting system would comply with design guidelines.

In order to rate the non-technical skills, a 4-point rating scale was selected, allowing system users to rate surgeons' non-technical skills as good (4), acceptable (3), marginal (2), poor (1), or not observed (see Figure 1).

The system allows trained users to rate the five categories and 14 elements using this scale, but before the system can be used to rate behaviours in the operating theatre or simulator, its reliability must be tested. In order to achieve this, consultant surgeons are being trained in how to use the system and then asked to rate a series of standardised video scenarios showing the behaviours of surgeons in the operating theatre. If the system is used to an acceptable degree of reliability during this evaluation then it could be used to rate behaviours and provide feedback to trainee and consultants in the operating theatre or simulator. The system could also be used to pinpoint the specific

training needs of individual surgeons and tailor training in non-technical skills.

If you are a consultant surgeon and are interested in participating in an evaluation session in Glasgow, Edinburgh, Dundee or Aberdeen in summer 2005 then please contact Steven Yule (s.j.yule@abdn.ac.uk) for further details and availability of places.

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Fig. 1: Non-technical skills for surgeons (NOTSS) rating form. Version 1.0

Cat	Cat rating*	Element	Element rating*	Feedback on performance
Situation awareness		Gathering information		
		Understanding information		
		Projecting and anticipating future state		
Decision making		Considering options		
		Selecting and communicating option		
		Implementing and reviewing decisions		
Task management		Planning and preparation		
		Flexibility/ responding to change		
Leadership		Setting and maintaining standards		
		Supporting others		
		Coping with pressure		
Communication and teamwork		Exchanging information		
		Establishing a shared understanding		
		Co-ordinating team activities		

*Rating scale: 1 Poor; 2 Marginal; 3 Acceptable; 4 Good; NO Not observed
 1 Poor: Performance endangered or potentially endangered patient safety, serious remediation is required
 2 Marginal: Performance indicated cause for concern, considerable improvement is needed
 3 Acceptable: Performance was of a satisfactory standard but could be improved
 4 Good: Performance was of a consistently high standard, enhancing patient safety; it could be used as a positive example for others
 NO Not observed