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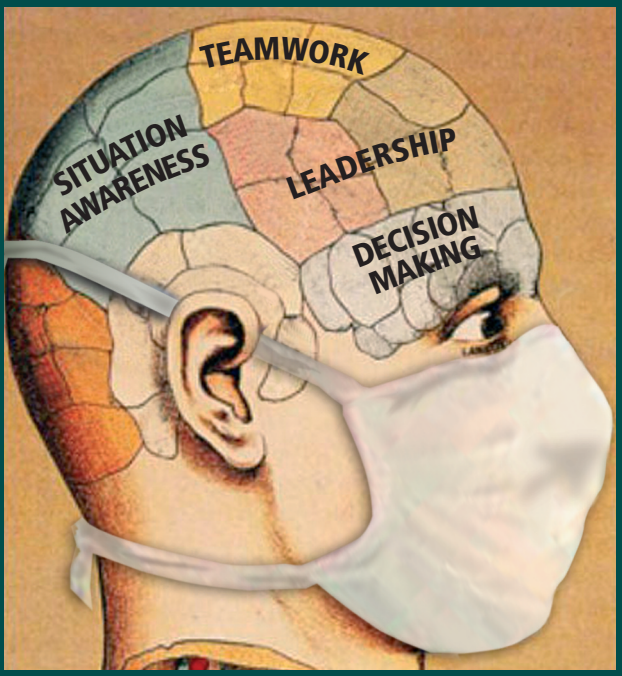
The Non-Technical Skills for Surgeons (NOTSS) System Handbook v1.2



Structuring observation, rating and feedback of surgeons' behaviours in the operating theatre

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Introduction

Outcomes based curricula are seen as an important way of developing a framework on which to base the education of surgeons of the future. In the past, the principal educational driver has been an exam which tested knowledge but failed to address behaviours or values. The current training programme in surgery has been developed to help trainees acquire the necessary knowledge, skills and values that will enable them to meet the challenges of consultant practice. The most recent major development in the UK has been the introduction of the competency based training scheme, which recommends that progress through and completion of training be based on competence. This has moved the emphasis away from set piece examinations towards learning and assessment in the workplace, and is encouraging greater emphasis on identifying the skills necessary to maximise safe and effective management of patients. The competency based approach can be thought of in terms of not only acquiring the individual skills but being able to integrate them effectively in providing solutions to clinical challenges. This requires an appreciation of the role of non-technical skills such as situation awareness and teamwork, in underpinning technical proficiency. Another important development in medical education has been the increasing recognition of the importance of reflection in the training of professionals. In a time of reduced working hours and exposure to fewer clinical challenges, it is important that clinicians, both in training and career grades, make the most of their clinical experience. Feedback on strengths and weaknesses and self-reflection are more likely to be effective when there is a terminology or vocabulary that permits analysis of performance. The NOTSS tool described in this booklet addresses the area of non-technical skills for surgeons. It provides both a framework and common terminology that allows surgeons to communicate effectively with each other in this area of practice, helping trainees (and others) develop abilities in the workplace.

What this handbook contains

This handbook provides a practical guide to the NOTSS system. Part 1: Information for users provides general guidance on the use of behavioural markers. Part 2: The NOTSS system details the complete NOTSS system, including skills taxonomy, behavioural markers, the rating scale, and rating form. Further information and downloadable NOTSS materials, including rating forms, can be found on the NOTSS website: www.abdn.ac.uk/iprc/notss

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Part 1: Information for users

What are non-technical skills?

Non-technical skills are cognitive (e.g. decision making) and interpersonal (e.g. teamwork) skills. Analyses of adverse events in surgery have revealed that many underlying causes originate from behavioural or non-technical aspects of performance (e.g. communication failures) rather than a lack of technical expertise. Therefore, technical skills appear to be necessary but not sufficient to ensure patient safety in the operating theatre. Paying attention to non-technical skills such as team working, leadership, situation awareness, decision-making, and communication will increase the likelihood of maintaining high levels of performance over time.

The formal training of surgeons predominantly focuses on developing knowledge, clinical expertise and technical skills. Surgeons have always had non-technical skills, but aspects of performance such as decision-making, leadership, and team working have been developed in an informal and tacit manner rather than being explicitly addressed in training. The NOTSS system allows for explicit rating and feedback to be given on non-technical skills.

What is a behavioural marker system?

Behavioural marker systems are already used to structure training and evaluation of non-technical skills in anaesthesia, civil aviation, and nuclear power in order to improve safety and efficiency. These marker systems are rating scales based on skills taxonomies and are used to identify observable, non-technical behaviours that contribute to superior or substandard performance. They tend to comprise two parts: a skills taxonomy with examples of good and poor behavioural markers allied to each skill, and a rating system. Behavioural marker systems are context-specific and are developed in the domain in which they are to be used. For example, the NOTSS system was based on cognitive task analysis with consultant surgeons, supported by other data, including adverse event reports, observations of surgeons' behaviour in theatre, attitudes of theatre personnel to error and safety (Flin et al, 2006) and a literature review (Yule et al, 2006). After a prototype system was developed using four panels of consultant sugeons, it was subjected to experimental and practical evaluation. (See www.abdn.ac.uk/iprc/notss for details).

The NOTSS system can be used to structure observations, ratings and feedback in theatre, as well as to identify surgeons' training needs. It can also form the basis for non-technical skills training.

What is the NOTSS system?

The Non-Technical Skills for Surgeons (NOTSS) system is a behavioural rating system developed by a multi-disciplinary group comprising surgeons, psychologists, and anaesthetists in Scotland. NOTSS describes the main observable non-technical skills associated with good surgical practice. When used in conjunction with medical knowledge and clinical skills, NOTSS can be used to observe and rate surgeons' behaviour in theatre in a structured manner and allow a clear and transparent assessment of training needs. The system is suitable for use in the operating theatre or operating theatre simulator, but is not recommended for formal summative assessment until a more complete evaluation has been conducted.

The system was developed according to a number of design criteria and comprises only behaviours that are directly observable or can be inferred through communication. The system has been developed to have wide-ranging coverage of non-technical skills in as few categories and elements as possible, and covers behaviours in the intraoperative (gloves on, scrubbed up) phase of surgery. Surgeons developed the skills taxonomy, generated behavioural markers and ensured that the system was in surgeons' language and free of jargon.

The NOTSS system comprises a three level hierarchy consisting of categories (at the highest level), elements, and behaviours. Four skill categories and 12 elements make up the skills taxonomy (see table 1). Each category and element are defined in this handbook, and example good and poor behaviours are provided for each element. These exemplar behaviours were generated by consultant surgeons and are intended to be indicative rather than a comprehensive list.

Table 1. NOTSS skills taxonomy v1.2

Category	Elements
Situation Awareness	• Gathering information • Understanding information • Projecting and anticipating future state
Decision Making	• Considering options • Selecting and communicating option • Implementing and reviewing decisions
Communication and Teamwork	• Exchanging information • Establishing a shared understanding • Co-ordinating team activities
Leadership	• Setting and maintaining standards • Supporting others • Coping with pressure

Using the NOTSS system

The NOTSS system is intended to be used as a debrief tool for consultant surgeons who are involved in training, to rate trainees' non-technical performance, and give feedback in a structured manner immediately after the case. Initial piloting of this method suggests that the debrief takes under five minutes to complete.

General recommendations

It may take some time for users to become familiar with the language and structure of the NOTSS system. Training and practice should help facilitate this process.

- As with other in-theatre training, teaching and assessment should not interfere with clinical care; if circumstances in theatre dictate, use of NOTSS should be abandoned.
- Formative assessment and feedback on non-technical skills should occur routinely in both clinical and simulator environments and so should not be perceived as threatening.

Trainer selection and training

- Training is required to learn how to rate behaviours using the NOTSS system effectively. This should include:
  - Background knowledge on human performance, error management and non-technical skills, so constructive, directive feedback can be given to trainees
  - Principles of using psychometric tools for rating performance
  - The contents of the NOTSS system and how they relate to everyday activities
  - Practice in observing non-technical skills and rating behaviours with the NOTSS system.
- If the NOTSS system is to be used for formative or summative assessment, trainers should undergo calibration to ensure that they can provide reliable judgements.
- Regular updates may be required, so recurrent training and calibration programmes should be developed.
- It is recommended that a small group of consultant surgeons are selected in each department to become NOTSS trainers/assessors.

Trainee selection and training

- Trainees should also receive training on human performance and error management to support development of their non-technical skills. In the future this may begin at medical school and then be further developed throughout postgraduate training. The Royal College of Surgeons of Edinburgh began running NOTSS training courses for consultant surgeons and higher surgical trainees in February 2006.
- Trainees should receive their own copy of the NOTSS system booklet for reference.
- The NOTSS system should be used appropriately for the level of experience of the trainee:
  - With junior trainees, the focus of training is on developing basic surgical expertise; the NOTSS system can be used for general discussion of non-technical skills and their importance to clinical practice
  - For more senior trainees, the NOTSS system can be used to rate skills and provide feedback during increasingly challenging cases
  - Towards completion of training it can also be used to help senior trainees (i.e. Specialist Registrars) learn how to observe and assess non-technical skills in others.

- Consultant surgeons should explain to trainees why it is important to assess and provide feedback on non-technical skills during training, highlighting that the NOTSS system has been designed to aid the development of professional skills.

Suggested functions

- To assess and review trainees' non-technical skills on a periodic basis to identify strengths and weaknesses and support skills development:
  - Use in a case or list where the trainee can operate as lead with consultant observing and providing assistance as requested/required.
- To guide general discussion of NOTSS and their role in case management:
  - Consultant and trainee can discuss case/list issues from a non-technical perspective e.g. role of situation awareness – what is it for, how is it to be developed and maintained, how can it be lost or why good team working is important
  - This more informal use is appropriate with new users and junior trainees when numerical ratings are premature, and with senior trainees in more complex cases.
- As a framework for self-reflection both by consultants and trainees after a list.

Practical tips

- Use the NOTSS system in a variety of different cases as appropriate for the list type, health of patient, trainee level and consultant load.
- New users are recommended to work at the element level, as ratings can be more directly related to observed behaviours.
- Consultants and trainees should have a feedback and discussion session after the case:
  - Use element level observations/ratings to give specific feedback on skills
  - Use category level to describe more general performance.
- Use whole NOTSS system during training and assessment but focus on areas relating to weakness or of particular importance for the type of case.
- Make notes of specific circumstances of the case and trainees' experience, tasks, etc. (e.g. if very complex case, trainee new to grade, been on-call all night).

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Part 2: The NOTSS system

Situation Awareness: Developing and maintaining a dynamic awareness of the situation in theatre based on assembling data from the environment (patient, team, time, displays, equipment); understanding what they mean, and thinking ahead about what may happen next.

Gathering information — Seeking information in the operating theatre from the operative findings, theatre environment, equipment, and people.

Good behaviours:
- Carries out pre-operative checks of patient notes, including investigations and consent
- Ensures that all relevant investigations (e.g. imaging) have been reviewed and are available
- Liaises with anaesthetist regarding anaesthetic plan for patient
- Optimises operating conditions before starting e.g. moves table, lights, AV equipment
- Identifies anatomy/ pathology clearly
- Monitors ongoing blood loss
- Asks anaesthetist for update

Poor behaviours:
- Arrives in theatre late or has to be repeatedly called
- Does not ask for results until the last minute or not at all
- Does not consider the views of operating room staff
- Fails to listen to anaesthetist
- Fails to review information collected by team
- Asks for information to be read from patient notes during procedure because has not been read before operation started

Understanding information — Updating one's mental picture by interpreting the information gathered, and comparing it with existing knowledge to identify the match or mismatch between the situation and the expected state.

Good behaviours:
- Acts according to information gathered from previous investigation and operative findings
- Looks at CT scan and points out relevant area
- Reflects and discusses significance of information

Poor behaviours:
- Overlooks or ignores important results
- Misses clear sign (e.g. on CT scan)
- Asks questions which demonstrate lack of understanding
- Discards results that don't 'fit the picture'

Projecting and anticipating future state — Predicting what may happen in the near future as a result of possible actions, interventions or non-intervention.

Good behaviours:
- Plans operating list taking into account potential delays due to surgical or anaesthetic challenges
- Verbalises what equipment may be required later in operation
- Shows evidence of having a contingency plan ('plan B') (e.g. by asking scrub nurse for potentially required equipment to be available in theatre)
- Cites contemporary literature on anticipated clinical event

Poor behaviours:
- Overconfident manoeuvres with no regard for what may go wrong
- Does not discuss potential problems
- Gets into predictable blood loss, then tells anaesthetist
- Waits for a predicted problem to arise before responding
- Operates beyond level of experience

Decision Making: Skills for diagnosing the situation and reaching a judgement in order to choose an appropriate course of action.

Considering options — Generating alternative possibilities or courses of action to solve a problem. Assessing the hazards and weighing up the threats and benefits of potential options.

Good behaviours:
- Recognises and articulates problems
- Initiates balanced discussion of options, pros and cons with relevant team members
- Asks for opinion of other colleagues
- Discusses published guidelines

Poor behaviours:
- No discussion of options
- Does not solicit views of other team members
- Ignores published guidelines

Selecting and communicating option — Choosing a solution to a problem and letting all relevant personnel know the chosen option.

Good behaviours:
- Reaches a decision and clearly communicates it
- Makes provision for and communicates 'plan B'
- Explains why contingency plan has been adopted

Poor behaviours:
- Fails to inform team of surgical plan
- Is aggressive/ unresponsive if plan questioned
- Shuts down discussion on other treatment options
- Only does what she/he thinks is best or abandons operation
- Selects inappropriate manoeuvre that leads to complication

Implementing and reviewing decisions — Undertaking the chosen course of action and continually reviewing its suitability in light of changes in the patient's condition. Showing flexibility and changing plans if required to cope with changing circumstances to ensure that goals are met.

Good behaviours:
- Implements decision
- Updates team on progress
- Reconsiders plan in light of changes in patient condition or when problem occurs
- Realises 'plan A' is not working and changes to 'plan B'
- Calls for assistance if required

Poor behaviours:
- Fails to implement decisions
- Makes same error repeatedly
- Does not review the impact of actions
- Continues with 'plan A' in face of predictably poor outcome or when there is evidence of a better alternative
- Becomes hasty or rushed due to perceived time constraints

Communication and Teamwork: Skills for working in a team context to ensure that the team has an acceptable shared picture of the situation and can complete tasks effectively.

Exchanging information – Giving and receiving knowledge and information in a timely manner to aid establishment of a shared understanding among team members.

Good behaviours:
- Talks about the progress of the operation
- Listens to concerns of team members
- Communicates that operation is not going to plan

Poor behaviours:
- Fails to communicate concerns with others
- Attempts to resolve problems alone
- Does not listen to team members
- Needs help from assistant but does not make it clear what assistant is expected to do

Establishing a shared understanding – Ensuring that the team not only has necessary and relevant information to carry out the operation, but that they understand it and that an acceptable shared 'big picture' of the case is held by team members.

Good behaviours:
- Provides briefing and clarifies objectives and goals before commencing operation
- Ensures team understand the operative plan before starting
- Encourages input from all members of the team
- Ensures relevant members of team are comfortable with decisions
- Checks that assistant knows what they are expected to do
- Debriefs relevant team members after operation, discussing what went well and problems that occurred

Poor behaviours:
- Does not articulate operative plan to team
- Does not make time for collective discussion and review of progress
- Fails to discuss the case beforehand with unfamiliar team members
- Makes no attempt to discuss problems and successes at end of operation
- Fails to keep anaesthetist informed about procedure (e.g. to expect bleeding)
- Appears uncomfortable discussing the operative plan if challenged

Co-ordinating team activities – Working together with other team members to carry out cognitive and physical activities in a simultaneous, collaborative manner.

Good behaviours:
- Checks that other team members are ready to start operation
- Stops operating when asked to by anaesthetist or scrub nurse
- Ensures that team works efficiently by organising activities in a timely manner

Poor behaviours:
- Does not ask anaesthetist if it is OK to start operation
- Proceeds with operation without ensuring that equipment is ready

Leadership: Leading the team and providing direction, demonstrating high standards of clinical practice and care, and being considerate about the needs of individual team members.

Setting and maintaining standards – Supporting safety and quality by adhering to acceptable principles of surgery, following codes of good clinical practice, and following theatre protocols.

Good behaviours:
- Introduces self to new or unfamiliar members of theatre team
- Clearly follows theatre protocol
- Requires all team members to observe standards (e.g. sterile field)

Poor behaviours:
- Fails to observe standards (e.g. continues even though equipment may be contaminated or inadequate)
- Breaks theatre protocol
- Shows disrespect to the patient

Supporting others – Providing cognitive and emotional help to team members. Judging different team members' abilities and tailoring one's style of leadership accordingly.

Good behaviours:
- Modifies behaviour according to trainee needs
- Provides constructive criticism to team members
- Ensures delegation of tasks is appropriate
- Establishes rapport with team members
- Gives credit for tasks performed well

Poor behaviours:
- Does not provide recognition for tasks performed well
- Fails to recognise needs of others
- Engages in 'tunnel vision' approach to technical aspects of operation
- Shows hostility to other team members (e.g. makes sarcastic comments to nurses)

Coping with pressure – Retaining a calm demeanour when under pressure and emphasising to the team that one is under control of a high-pressure situation. Adopting a suitably forceful manner if appropriate without undermining the role of other team members.

Good behaviours:
- Remains calm under pressure
- Emphasises urgency of situation (i.e. by occasionally raising voice)
- Takes responsibility for the patient in emergency/ crisis situation
- Makes appropriate decision under pressure
- Delegates tasks in order to achieve goals
- Continues to lead team through emergency

Poor behaviours:
- Suppresses concern over clinical problem
- 'Freezes' and displays inability to make decisions under pressure
- Fails to pass leadership of case when technical challenge requires full attention
- Blames everyone else for errors and does not take personal responsibility
- Loses temper

The NOTSS rating scale

The scale below is used to rate non-technical skills based on observed behaviour. The same scale is used to rate category and element-level skills. If a skill is not required or not relevant in the particular case being observed then 'N/A' should be used. If a skill should be displayed but is lacking, then '1 – poor' should be used.

NOTSS System Rating Options

Rating Label	Description
4 – Good	Performance was of a consistently high standard, enhancing patient safety; it could be used as a positive example for others
3 – Acceptable	Performance was of a satisfactory standard but could be improved
2 – Marginal	Performance indicated cause for concern, considerable improvement is needed
1 – Poor	Performance endangered or potentially endangered patient safety, serious remediation is required
N/A – Not Applicable	Skill was not required or relevant in this case

Not all skill elements may be required or desirable in any given clinical encounter.

You should expect to see behaviours in order to provide ratings 2 (marginal), 3 (acceptable), or 4 (good). You should expect to see poor behaviours or the absence of required behaviours to rate 1 (poor). Rating N/A means that you did not see behaviours to rate because they were not required or not relevant for the clinical encounter being rated.

Hospital ..... Trainer name ..... Date .....

Trainee name ..... Operation .....

Category	Category rating*	Element	Element rating*	Feedback on performance and debriefing notes
Situation Awareness		Gathering information		
		Understanding information		
		Projecting and anticipating future state		
Decision Making		Considering options		
		Selecting and communicating option		
		Implementing and reviewing decisions		
Communication and Teamwork		Exchanging information		
		Establishing a shared understanding		
		Co-ordinating team activities		
Leadership		Setting and maintaining standards		
		Supporting others		
		Coping with pressure		

* **1** Poor; **2** Marginal; **3** Acceptable; **4** Good; **N/A** Not Applicable

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
N/A	Not Applicable

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