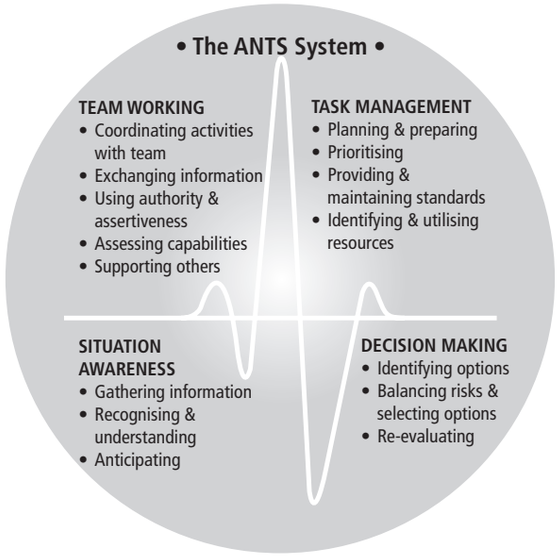
Produced by the University of Aberdeen / Version 1.0 June 2012
Printed by **UniPrint**, University of Aberdeen

1 4 9 5
UNIVERSITY OF ABERDEEN

SCSC
Scottish Clinical Simulation Centre

Framework for Observing and Rating Anaesthetists' Non-Technical Skills

Anaesthetists' Non-Technical Skills (ANTS) System Handbook v1.0



Acknowledgement

The ANTS System was developed and evaluated in a collaborative project between the University of Aberdeen Industrial Psychology Research Centre and the Scottish Clinical Simulation Centre. The first phase of the study (1999-2003) was funded by NHS Education for Scotland. We particularly wish to acknowledge the significant contribution made by Georgina Fletcher to the design of this system.

Introduction

Background

The training programme in Anaesthesia 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 in turn places the emphasis on teaching and assessment in the workplace, and is encouraging greater emphasis on those components necessary to provide effective management of patients. The competency based approach can be thought of in terms of not only acquiring the individual components but being able to integrate them effectively in providing solutions to clinical challenges. 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 or self-reflection are more likely to be effective when there is a terminology or vocabulary that permits analysis of performance. The tool described in this booklet addresses the area of non-technical skills. It provides both a framework and common terminology that allows anaesthetists to communicate effectively with each other in this area of practice, helping trainees (and others) develop abilities in both the real workplace or simulated work environment.

This handbook provides a condensed guide to the Anaesthetists' Non-Technical Skills System and includes suggestions on how the system can be used. Part 1: Information for Users is written in the form of answers to frequently asked questions. These have been based on research for the ANTS project and literature on the use of behavioural marker systems to support non-technical skills training. Part 2: System Details provides the full contents of the ANTS System, the rating scale, and the rating form. Further information and rating forms can be found at the ANTS website: **www.abdn.ac.uk/iprc/ANTS**

For further information contact:

Professor Rhona Flin
Industrial Psychology Research Centre, University of Aberdeen, Aberdeen, AB24 3UB
Tel. 01224 273210 Email: r.flin@abdn.ac.uk

Dr Ronnie Glavin
ronniejglavin@gmail.com

Dr Nikki Maran
Scottish Clinical Simulation Centre, Forth Valley Royal Hospital, Stirling Road, Larbert, FK5 4WR
Tel. 01786 434480 Email: n.maran@nhs.net

Dr Rona Patey
Department of Anaesthesia, Aberdeen Royal Infirmary, Aberdeen AB25 2ZN
Tel: 01224 553237 Email: r.patey@nhs.net

Part 1 Information for users

What are Non-Technical Skills?

As in other industrial domains, accidents and incidents in anaesthesia are usually caused by a combination of organisational and operational factors. Investigations into adverse events or 'human errors' have shown that as many as 80% of them are the result of human factors breakdowns such as poor communication, inadequate monitoring, failures to cross-check drugs and equipment, rather than lack of technical knowledge or equipment problems. Research observing medical teams in operating theatres has also highlighted difficulties arising from loss of situation awareness and poor team interactions*.

Reducing the likelihood of such problems requires anaesthetists to have an additional set of skills, known as non-technical skills, that are used integrally with medical knowledge and clinical techniques. These non-technical skills can be defined as behaviours in the operating theatre environment not directly related to the use of medical expertise, drugs or equipment. They encompass both interpersonal skills e.g. communication, team working, leadership, and cognitive skills e.g. situation awareness, decision making. Such skills are not new in anaesthesia, good anaesthetists have always demonstrated these competencies. In the past, these skills have not been explicitly addressed through any formal education and trainees have had to acquire them along the way. However, with an increased focus on reducing adverse events and the introduction of competency based training and simulators, this is now changing.

To achieve successful non-technical skills training, it is first necessary to identify the requisite skills for the job in the given operational environment and culture. It is also important to be able to assess these skills, to provide feedback about performance and to allow training to be evaluated. To structure the training and assessment of pilots' non-technical skills, the aviation industry uses behavioural marker systems. Behavioural marker systems are empirically derived taxonomies of the principal non-technical skills required for the job, with an observation-based rating system for assessing their component behaviours*. Their explicit nature and the reliance on assessment of observable behaviour by trained instructors means behavioural marker systems can provide a structured tool for making reliable assessments. At a more basic level, they also provide a common language for discussing non-technical skills. Such systems can play an important role in supporting non-technical skills training in anaesthesia, in both simulator and on-the-job training.

It is important to remember that non-technical skills should not be considered in isolation to other aspects of anaesthetic competence. The purpose of examining these skills is to support the development of overall good practice. Successful task performance depends on the effective integration of both technical and non-technical skills for any given situation.

*For more information see the reports and journal articles on the ANTS website

What is the ANTS System?

The Anaesthetists' Non-Technical Skills (ANTS) System is a behavioural marker system developed by industrial psychologists and anaesthetists during a four year collaborative research project in Scotland. Used integrally with medical knowledge and clinical skills, non-technical skills should help to support safe and effective performance in everyday tasks and emergency situations. ANTS describes the main observable non-technical skills associated with good anaesthetic practice. The purpose of the system is to provide the anaesthetic community with a framework for describing non-technical skills and a tool to guide their assessment in an explicit and transparent manner. In short, the ANTS System supplies consultants and trainees with a language for discussing the 'behavioural aspects' of performance. It can be used for assessing an individual's behaviour, to provide input for the training process and for structuring feedback on skills development. Until a fuller understanding of the in-theatre validity and reliability of the ANTS System has been achieved, it is not recommended for formal summative assessment.

The ANTS System comprises a three level hierarchy. At the highest level are four skill categories and beneath these are fifteen skill elements (see table below). Each element has a definition and some examples of good and poor behaviours that could be associated with it. These are the behavioural markers, as they help to indicate the presence or absence of the skill elements. They have been derived from real examples given by consultant anaesthetists during interviews describing their experiences on a variety of cases. The ANTS System is not intended to provide a totally exhaustive list of all non-technical skills used by anaesthetists. It is limited to the principal skills that can actually be identified through observable behaviour.

ANTS System v1.0: Categories and Elements

Category	Elements
Task Management	• Planning and preparing • Prioritising • Providing and maintaining standards • Identifying and utilising resources
Team Working	• Co-ordinating activities with team members • Exchanging information • Using authority and assertiveness • Assessing capabilities • Supporting others
Situation Awareness	• Gathering information • Recognising and understanding • Anticipating
Decision Making	• Identifying options • Balancing risks and selecting options • Re-evaluating

The full ANTS System is shown in this guide. More information on how to use it follows.

This advice is based on feedback from consultant anaesthetists who trialled the ANTS System with trainees in the operating theatre.

How should I implement the ANTS System?

User selection and training

- In order to use the ANTS System effectively, training is required. 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 ANTS System and how they relate to everyday activities;
  - practice in observing non-technical skills and making ratings with the ANTS System.
- If the ANTS System is to be used for assessment, trainers should undergo calibration to ensure that they can provide standardised judgements.
- Recurrent training and calibration programmes should be developed.
- It is recommended that a small group of consultants is selected in each department to become ANTS trainers/assessors.

Trainee selection and training

- Trainees should receive training on human performance and error management to support development of their non-technical skills. In future, this may begin at medical school and then be further developed throughout postgraduate training
- Trainees should receive their own copy of this ANTS System Handbook for reference.
- The ANTS System should be used appropriately for the level of experience of the trainee:
  with junior trainees, the focus of training is on developing basic anaesthetic expertise; the ANTS System can be used for general discussion of non-technical skills and their importance to clinical practice;
  - for more senior trainees, the ANTS 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 learn how to assess ANTS in others.
- Consultants should explain to trainees why it is important to provide feedback on non-technical skills during training, highlighting that the ANTS System has been designed to aid the development of professional skills.

How should the ANTS System be used?

Ratings can be made at both the element and category levels. The recommended method is first to observe performance, making notes of any specific behaviours or omissions. Any assessment should be based **only** on behaviours observed directly. Using these observations, the rating can then be carried out, first at element level, then at the more general category level. A four point scale is used to describe the level of performance demonstrated (with an option to record skills that were not observed) – see page 14. A copy of the rating form is shown on page 15. Before using the ANTS System for teaching and assessment in training, it is important that you have received training on the system. This should consist of practice in observation and rating, receiving feedback on your scores, and discussion of appropriate use of the system.

Time scheduling

- Formative assessment using the ANTS System requires feedback to be given to trainees.
- Trainers/assessors will require to have time available for feedback sessions.
- Trainees who are taking part in a non-technical skills review should be given time out of their in-service commitment to attend a feedback discussion.

General recommendations

- It may take some time for users to become familiar with the language and structure of the ANTS System; training 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, concurrent use of ANTS should be abandoned.
- Formative assessment and feedback on ANTS should occur routinely in both clinical and simulator environments.

Suggested functions

- To assess/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 manage the patient(s), as taking the lead, with consultant observing and providing assistance as requested/required, this can be as second anaesthetist or just stepping in if a problem occurs.
- To guide general discussion of ANTS and their role in case management
  - consultant and trainee work together more as a team and discuss with case/list issues being considered 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 so important?;
  - this more informal use is appropriate with new users, junior trainees when numerical ratings are premature, and senior trainees in more complex cases.
- As a framework for self-reflection both by trainees and other grades
  - questions could be asked about the categories and elements either following or in advance of a case, e.g. what resources would be needed for a vascular emergency case, what are the situation awareness requirements in this case?
- As above but during simulator-based training
  - videos of scenarios could be reviewed by the trainees with their instructors for more focussed feedback sessions.

Practical issues

- Use ANTS 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.
- If using the ANTS System for skills assessment, make brief notes about observations on the form during the case if possible e.g. of things seen, not seen, key events. Following the case/list make ratings based on these observations.
- Consultants and trainees should have a feedback and discussion session after the case or list being reviewed

- use element level observations/ratings to give specific feedback on skills.
- use category level to describe more general performance.

- Use whole ANTS System during training and assessment but focus on areas relating to weakness or of particular importance for type of case, e.g. co-ordinating with team in shared airway work.
- Make notes of specific circumstances of the case and trainee's experience, tasks, etc. (e.g. if very complex case, trainee new to grade, been on-call all night).

Key references

Flin, R., Glavin, R., Patey, R. & Maran, N. (2010) Anaesthetists' non-technical skills. *British Journal of Anaesthesia*, 105, 38-44.

Fletcher, G., Flin, R., McGeorge, P., Glavin, R., Maran, N. & Patey, R. (2004) Development of a prototype behavioural marker system for anaesthetists' non-technical skills. *Cognition, Technology and Work*, 6, 165-171.

Fletcher, G., Flin, R., McGeorge, P., Glavin, R., Maran, N. & Patey, R. (2003) Anaesthetists' non-technical skills (ANTS). Evaluation of a behavioural marker system. *British Journal of Anaesthesia*, 90, 580-588.

Flin, R., Fletcher, G., McGeorge, P., Sutherland, A. & Patey, R. (2003) Anaesthetists' attitudes to teamwork and safety. *Anaesthesia*, 58, 233-242.

Fletcher, G., McGeorge, P., Flin, R., Glavin, R. & Maran, N. (2002) The role of non-technical skills in anaesthesia: A review of current literature. *British Journal of Anaesthesia*, 88, 418-429.

Flin, R., O'Connor, P. & Crichton, M. (2008) Safety at the Sharp End: *A Guide to Non-Technical Skills*. Aldershot: Ashgate.

Glavin, R. & Patey, R. (2009) Integrating non-technical skills into anaesthetists' workplace-based assessment tools. In R. Flin & L. Mitchell (Eds.) *Safer Surgery. Analysing Behaviour in the Operating Theatre*. Aldershot: Ashgate.

Part 2 The ANTS System

Task Management: Skills for organising resources and required activities to achieve goals, be they individual case plans or longer term scheduling issues. It has four skill elements: planning and preparing; prioritising; providing and maintaining standards; identifying and utilising resources.

Planning and preparing – developing in advance primary and contingency strategies for managing tasks, reviewing these and updating them if required to ensure goals will be met; making necessary arrangements to ensure plans can be achieved.

Behavioural markers for good practice
- communicates plan for case to relevant staff
- reviews case plan in light of changes
- makes post-operative arrangements for patient
- lays out drugs and equipment needed before starting case

Behavioural markers for poor practice
- does not adapt plan in light of new information
- does not ask for drugs or equipment until the last minute
- does not have emergency/alternative drugs available suitable for patient
- fails to prepare post-op management plan

Prioritising – scheduling tasks, activities, issues, information channels, etc., according to importance (e.g. due to time, seriousness, plans); being able to identify key issues and allocate attention to them accordingly, and avoiding being distracted by less important or irrelevant matters.

Behavioural markers for good practice
- discusses priority issues in case
- negotiates sequence of cases on list with surgeon
- conveys order of actions in critical situations

Behavioural markers for poor practice
- becomes distracted by teaching trainees
- fails to allocate attention to critical areas
- fails to adapt list to changing clinical conditions

Providing and maintaining standards – supporting safety and quality by adhering to accepted principles of anaesthesia; following, where possible, codes of good practice, treatment protocols or guidelines, and mental checklists.

Behavioural markers for good practice
- follows published protocols and guidelines
- cross-checks drug labels
- checks machine at beginning of each session
- maintains accurate anaesthetic records

Behavioural markers for poor practice
- does not check blood with patient and notes
- breaches guidelines such as minimum monitoring standards
- fails to confirm patient identity and consent details
- does not adhere to emergency protocols or guidelines

Task Management: continued

Identifying and utilising resources – establishing the necessary, and available, requirements for task completion (e.g. people, expertise, equipment, time) and using them to accomplish goals with minimum disruption, stress, work overload or underload (mental and physical) on individuals and the whole team.

Behavioural markers for good practice

- identifies resources that are available
- allocates tasks to appropriate member(s) of the team
- ensures time is free for busy/critical periods
- requests additional resources if needed

Behavioural markers for poor practice

- fails to utilise available resources
- overloads team members with tasks
- does not recognise when task load is unworkable
- does not request necessary resources in advance

Team Working: Skills for working in a group context, in any role, to ensure effective joint task completion and team member satisfaction; the focus is particularly on the team rather than the task. It has five skill elements: co-ordinating activities with team members; exchanging information; using authority and assertiveness; assessing capabilities; supporting others.

Co-ordinating activities with team members – working together with others to carry out tasks, for both physical and cognitive activities; understanding the roles and responsibilities of different team members, and ensuring that a collaborative approach is employed.

Behavioural markers for good practice
- confirms roles and responsibilities of team members
- discusses case with surgeons or colleagues
- considers requirements of others before acting
- co-operates with others to achieve goals

Behavioural markers for poor practice
- does not co-ordinate with surgeon(s) and other groups
- relies too much on familiarity of team for getting things done – makes assumptions, takes things for granted
- intervenes without informing/ involving others
- does not involve team in tasks

Exchanging information – giving and receiving the knowledge and data necessary for team co-ordination and task completion.

Behavioural markers for good practice
- gives situation updates/reports key events
- confirms shared understanding
- communicates case plans and other relevant information to appropriate people
- maintains clear case documentation

Behavioural markers for poor practice
- does not inform team of plan or subsequent alterations
- gives inadequate handover briefing
- does not include relevant people in communications
- fails to express concerns in a clear and precise manner

Using authority and assertiveness – leading the team and/or the task (as required), accepting a non-leading role when appropriate; adopting a suitably forceful manner to make a point, and adapting this for the team and/or situation.

Behavioural markers for good practice
- makes requirements known with necessary level of assertiveness
- takes over task leadership as required
- gives clear orders to team members
- states case and provides justification

Behavioural markers for poor practice
- does not challenge senior colleagues or consultants
- does not allow others to put forward their case
- fails to attempt to resolve conflicts
- does not advocate position when required

Team Working: continued

Assessing capabilities – judging different team members' skills, and their ability to deal with a situation; being alert to factors that may limit these and their capacity to perform effectively (e.g. level of expertise, experience, stress, fatigue).

Behavioural markers for good practice
- calls for assistance when it is needed
- asks new team member about their experience
- notices that a team member does not perform a task to the expected standard
- adapts level of monitoring to expertise of other team members
- observes that a member of the team has returned from sick leave and enquires about their general health

Behavioural markers for poor practice
- does not ask if trainee/assistant can cope with task
- allows team to accept case beyond its level of expertise
- does not pay attention to the performance of other members of the team, e.g. scrub nurse
- joins established team without ascertaining their capabilities
- fails to respond to obvious cues of fatigue – person yawning, not remembering simple instructions, etc.

Supporting others – providing physical, cognitive or emotional help to other members of the team.

Behavioural markers for good practice
- acknowledges concerns of others
- provides reassurance/encouragement
- debriefs and thanks staff after a difficult case
- anticipates when colleagues will need equipment/information

Behavioural markers for poor practice
- asks for information at difficult/high workload time for someone else
- does not offer assistance to team members
- fails to recognise needs of others requiring task reallocation
- uses a dismissive tone in response to requests from others

Situation Awareness: Skills for developing and maintaining an overall awareness of the work setting based on observing all relevant aspects of the theatre environment (patient, team, time, displays, equipment); understanding what they mean, and thinking ahead about what could happen next. It has three skill elements: gathering information; recognising and understanding; anticipating.

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 artefactual).

Behavioural markers for good practice
- obtains and documents patient information pre-operatively
- conducts frequent scan of the environment
- collects information from team to identify problem
- watches surgical procedure, verifying status when required
- cross-checks information to increase reliability

Behavioural markers for poor practice
- reduces level of monitoring because of distractions
- responds to individual cues without confirmation
- does not alter physical layout of workspace to improve data visibility
- does not ask questions to orient self to situation during hand-over

Recognising and understanding – interpreting information collected from the environment (with respect to existing knowledge) to identify the match or mis-match between the situation and the expected state, and to update one's current mental picture.

Behavioural markers for good practice
- increases frequency of monitoring in response to patient condition
- informs others of seriousness of situation
- describes pattern of cues and their meaning to other team members

Behavioural markers for poor practice
- does not respond to changes in patient state
- carries out inappropriate course of action
- silences alarms without investigation

Anticipating – asking 'what if' questions and thinking ahead about potential outcomes and consequences of actions, intervention, non-intervention, etc.; running projections of current situation to predict what might happen in the near future.

Behavioural markers for good practice
- keeps ahead of the situation by giving fluids/drugs
- reviews the effects of an intervention
- sets and communicates intervention thresholds
- takes action to avoid or mitigate potential problems

Behavioural markers for poor practice
- does not consider potential problems associated with case
- fails to increase level of monitoring in keeping with patient condition
- is caught unaware by surgical actions
- does not foresee undesirable drug interactions

Decision Making: Skills for reaching a judgement to select a course of action or make a diagnosis about a situation, in both normal conditions and in time-pressured crisis situations. It has three skill elements: identifying options; balancing risks and selecting options; re-evaluating.

Identifying options – generating alternative possibilities or courses of action to be considered in making a decision or solving a problem.

Behavioural markers for good practice
- generates options for decisions
- discusses various anaesthetic techniques with patient
- asks other anaesthetists for suggestions on a difficult case

Behavioural markers for poor practice
- even though time is available jumps straight to one option without considering alternatives
- fails to ask other team members for options, when appropriate
- ignores suggestions from other team members

Balancing risks and selecting options – assessing hazards to weigh up the threats or benefits of a situation, considering the advantages and disadvantages of different courses of action; choosing a solution or course of action based on these processes.

Behavioural markers for good practice
- considers risks of different treatment options
- weighs up factors with respect to patient's condition
- assesses time criticality associated with possible options
- implements chosen option

Behavioural markers for poor practice
- does not find out about the risks associated with an unfamiliar condition/drug
- does not preview courses of action with relevant people to assess their suitability
- fails to review possible options with the team

Re-evaluating – continually reviewing the suitability of the options identified, assessed and selected; and re-assessing the situation following implementation of a given action.

Behavioural markers for good practice
- re-assesses patient after treatment or intervention
- reviews situation, if decision was to wait and see
- continues to list options as patient's condition evolves

Behavioural markers for poor practice
- fails to allow adequate time for intervention to take effect
- fails to include other team members in re-evaluation.
- is unwilling to revise course of action in light of new information

Rating Anaesthetists' Non-Technical Skills

The scale below can be used for rating non-technical skills based on observed behaviour. If it is not relevant for a particular element to be demonstrated in a situation, the 'not observed' rating should be used.

ANTS 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 – Not observed	Skill could not be observed in this situation

Category	Element	*Rating	Observation on Performance	Category rating and debriefing notes
Task Management	Planning & preparing			
	Prioritising			
	Providing & maintaining standards			
	Identifying & utilising resources			
Team Working	Co-ordinating activities with team			
	Exchanging information			
	Using authority & assertiveness			
	Assessing capabilities			
Situation Awareness	Supporting others			
	Gathering information			
	Recognising & understanding			
	Anticipating			
Decision Making	Identifying options			
	Balancing risks & selecting options			
	Re-evaluating			

*__4__ Good; __3__ Acceptable; __2__ Marginal; __1__ Poor; __N__ Not Observed