

# **FoNTS**

## **Foundation**

### **Non-Technical**

#### **Skills**



**Project report for:**

**“The development of a behavioural marker system for newly qualified doctors in managing acutely unwell patients”**

**2011-2013**



## **Project Development Team:**

Ed Mellanby, Anaesthetist and Educational Fellow, Centre for Medical Education, University of Edinburgh

Megan Hume, Academic Foundation Training Programme, NHS Lothian

Ronnie Glavin, Educational Coordinator, Scottish Clinical Simulation Centre, Forth Valley Royal Hospital

Janet Skinner, Director of Clinical Skills, Centre for Medical Education, University of Edinburgh

Nikki Maran, Educational Coordinator, Scottish Clinical Simulation Centre, Forth Valley Royal Hospital

## **Forward:**

This project report aims to give an overview of the project. It purposefully does not provide an overly detailed account. Instead it aims to pick out the critical areas that are of most interest and relevance. An online resource demonstrating the behavioural marker system has been developed and is available to access via the link provided in the appendix. If any further details are required, please contact the lead researcher via email:

[edward.mellanby@ed.ac.uk](mailto:edward.mellanby@ed.ac.uk)

## **Contents:**

1. Summary .....	3
2. Introduction to Research Topic.....	4
3. Aims and Method Overview.....	8
4. Results Overview.....	11
5. Development of Prototype Behavioural Marker System.....	15
6. Implementation and Future Research .....	17
7. Dissemination .....	18
8. Conclusion .....	18
9. References .....	19
10. Appendix.....	21

# 1. Summary

## **Introduction:**

Newly qualified doctors are frequently first to the scene in managing acutely unwell in-patients. Failures in clinical assessment, basic management and early escalation of care lead to avoidable patient morbidity and mortality. Analyses of adverse events have highlighted the importance of non-technical skills training to improve patient safety. These are a combination of cognitive (such as decision making) and social skills (such as team working), which complement knowledge and technical ability, and contribute to safe and effective care. In order to train and assess junior doctors in these skills, we must first have an accurate understanding of what they involve. This research project was designed to identify the critical non-technical skills required by junior doctors to manage acutely unwell patients safely and effectively. It aimed to develop a tool to observe these skills that could be used in training, assessment and research.

## **Method:**

A literature review was used to develop an initial framework to categorise the non-technical skills required in this domain. Twenty-nine in depth semi-structured interviews were then completed with junior doctors. A critical incident technique was utilised: Junior doctors were asked to recall a challenging case in which they managed an acute medical emergency. Interviews were transcribed and coded using template analysis. A panel of subject matter experts were then consulted in order to refine this framework and develop an assessment tool for observing these skills. This involved two focus groups and an iterative process, returning to the original data to verify any changes.

## **Results:**

Four categories of critical non-technical skills were identified: Situation awareness, decision making, task management and teamwork. Each of these had between three and four sub-categories. Descriptors, exemplar behaviours and an assessment scale were developed to allow these non-technical skills to be observed and rated using a behavioural marker system. During the development of this tool, exploration of the data revealed the influence of factors such as hierarchy and culture on the behaviour of junior doctors.

## **Conclusions:**

The performance of newly qualified doctors in this critical domain are influenced by the complex clinical environments in which they take place. Some of these influences can have profound negative implications for patients. The framework developed by this research allows us to be explicit about the types of behaviours and performances that are required to keep patients safe. If this tool can be integrated into clinical training and accepted by clinicians then it may actively encourage safe and effective behaviour and reduce the current levels of avoidable patient harm.

## **2. Introduction to Research Topic**

### **2.1 Junior Doctors and Acute Care**

In the UK the importance of assessing and managing acutely unwell patients by junior doctors is recognised. The General Medical Council's guide for medical school education 'Tomorrow's Doctors' (GMC 2009) lists that medical graduates should be able to 'provide immediate care in medical emergencies' and this includes the ability to 'assess and recognise the severity of a clinical presentation and a need for immediate emergency care'. However, a recent systematic review on this topic reported that acute care was one of the learning outcomes that both newly qualified doctors and their clinical supervisors felt that they were least capable of managing (Tallentire et al. 2012). Furthermore, it was suggested that perceived competency in this domain has been declining over the last decade. Of course, perceptions of preparedness can differ to actual performance, and could be linked to other factors including changed expectations. So, is there any other evidence that performance in this domain is not adequate? Importantly, is there any evidence that the management of acutely unwell patients by junior doctors is linked to avoidable patient mortality or morbidity?

The recent National Confidential Enquiry into Patient Outcome or Death (CEPOD) report stated that '38% of cardiac arrests could be avoided' (Findlay et al. 2012). This relatively detailed retrospective analysis, suggested that it was failures of basic management and escalation of care that led to these cases of avoidable arrests. A study in the UK from 2009 reported that patients admitted on the first Wednesday in August (the day newly qualified doctors begin work) have a 6% higher in-patient mortality rate than those admitted the week before (Jen et al. 2009). There is a comparable phenomenon in the United States known as the 'July effect' that has reported some similarly disturbing findings (Young et al. 2011). Several studies investigating the care of patients prior to intensive care admission or avoidable cardiac arrests have shown that failures in the recognition, basic management and early escalation of care lead to preventable patient mortality and morbidity (McGloin et al. 1998; Mcquillan et al. 1998). These are skills that we are supposedly equipping our junior doctors with.

After five or six years of undergraduate medical education newly qualified doctors do not feel adequately prepared or supported in these situations (Tallentire et al. 2012). Like it or not, the current structure and staffing of hospitals dictate that they are likely to be placed in these scenarios. Their actions have direct effect on the lives of these vulnerable patients that they encounter. How can preparedness in this critical domain be improved? How can junior doctors be trained to recognise acutely unwell patients, to begin basic management and to escalate care in a way that will improve patient outcome and reduce the number of avoidable patient deaths and unnecessary suffering?

Studies of avoidable patient harm and medical error frequently point to the importance of 'human factors' or NTS (Wilson et al. 1995; Maurette 2002; Vincent et al. 2001; DoH 2000). Several of these have included or been specific to acutely unwell patients, perhaps most notably the 2007 Patient Safety Observatory report entitled 'Safer care for acutely ill patients: learning from serious incident' (Thomson et al. 2007). These reports frequently recommend the training of NTS. But what are NTS, and can these skills really be trained in order to improve the performance of junior doctors and the outcomes of acutely unwell patients?

## **2.2 Non-Technical Skills: An Overview**

Perhaps the most well known definition of NTS describes it as:

*'a combination of cognitive (such as decision making and situation awareness), social skills (such as communication, team working and leadership) and personal resource skills (such as coping with stress and fatigue) which complement knowledge and technical skills, and contribute to safe and effective performance'*(Flin et al. 2008)

It was first described within the aviation industry and driven by a need to improve safety and performance under the heading of 'human factors' research. Towards the end of the 20<sup>th</sup> century several of the airline industry companies and regulatory bodies undertook a relatively detailed analysis critical events(Kanki et al. 2010; Helmreich et al. 1999). The most striking finding of these reports was that in around 70% of cases the primary factor leading to the error was not attributed to the equipment or even to the technical ability of the pilot to fly the plane, but instead to other 'human factors'.

Further analysis of these errors involved improved reporting and extensive research into errors and near misses, including interviews with pilots and aviation experts. This work explored the skills required by a pilot to avoid error. Pilot skills were categorised and studied by teams of human factors experts and subsequently this led to the conceptualisation and description of NTS. Over time, this has led to the training of NTS for pilots, often referred to as Crew Resource Management (CRM). These programmes have now become mandatory. Robust assessment methods have been developed and pilots must demonstrate adequate abilities in NTS in order to maintain their license. It is accepted that the wide-scale use of these educational interventions has improved the safety record of the aviation industry(Helmreich et al. 1999).

As with aviation, there have been similar studies of critical incident and error within healthcare(Wilson et al. 1995; Maurette 2002; DoH 2000; Vincent et al. 2001; Hogan et al. 2012; Richardson et al. 2000). Some of these have focussed on the alarmingly high level of iatrogenic mortality and morbidity within hospitals. Perhaps the most influential of these was the report from the Institute of Medicine in 2000 'To err is human'(Richardson et al. 2000). It estimated between 44,000 to 98,000 Americans die each year as a result of medical error. A similar report the year after from Department of Health in England confirmed the concerning scale of medical error(DoH 2000). Subsequent analysis of medical error has been conducted on an international scale. The common theme amongst the many studies that have been conducted on medical error and avoidable patient harm is the association with human factors. The majority of errors are attributed to failures in NTS such as communication and teamwork. Many reports have suggested that NTS training should be introduced in order to improve error rates and patient outcomes(Richardson et al. 2000).

Measuring both NTS and their relationship to patient outcomes represents significant challenges. However, research is growing to suggest that teams and individuals with improved NTS have better outcomes for their patients. For example, validated NTS rating of surgeons and surgical teams have demonstrated a link between improved NTS and a decrease in both technical and non-operative errors (McCulloch et al. 2009; Mishra et al. 2008; Carthey et al. 2003; ). A further study in surgery demonstrated that when theatre teams exhibited fewer positive behaviours, this was associated with an increase in patient death and major complications(Neily et al. 2014).

Furthermore, there is evidence that NTS can be improved through training(McCulloch et al. 2009; Savoldelli et al. 2006), and there is now emerging evidence that training can be linked to improved outcomes for patients. Several studies in the United States and Europe

have demonstrated an improvement in outcomes such as length of intensive care admissions, post operative outcomes, indemnity expenses and even overall standardised patient mortality and morbidity following training in key NTS areas(Armour Forse et al. 2011; Mann et al. 2006; Morey et al. 2002; Neily et al. 2014; Mazzocco et al. 2009).

Some of these successful educational packages have involved the training of teams that work together. The challenge for graduating medical students and junior doctors in acute care is that they are frequently moving between different unfamiliar teams and environments. In all these environments they must be prepared to instigate resuscitative measures for acutely unwell patients. They require a set of 'portable NTS' that are both achievable and relevant to their performance in each setting and perhaps can help them with the challenges of having to enter into unfamiliar environments with an unfamiliar team.

### **2.3 NTS taxonomies and Behavioural Marker Systems**

The importance of NTS and their impact on safety has now been discussed. There is encouraging evidence to suggest that these skills can be trained and improved, and that this may be linked to improvements in performance and patient outcomes. But how are these skills trained? In many ways, the recommendations for training NTS are no different from training technical tasks. There must be an adequate understanding of the skills required to develop training objectives and learning outcomes. In order to ascertain if these outcomes are achieved, a valid and reliable method of assessment is required. In high reliability organisations and some healthcare specialties this has led to the development of NTS taxonomies and subsequently to methods of observing and rating these skills known as behavioural marker systems.

Examples of successful NTS taxonomies and behavioural marker systems include those developed in aviation for pilots(Flin et al. 2003) and more recently in healthcare for surgeons(Yule et al. 2006), anaesthetists(Fletcher et al. 2004), scrub nurses(Mitchell 2011) and emergency room doctors(Flowerdew et al. 2012). These NTS taxonomies are arranged in a hierarchical manor, with a number of critical categories of NTS, and each category broken down into a smaller number of sub-categories, often referred to as elements. A common method for assessing these categories or sub-categories is the use of behavioural marker systems. Example behaviours demonstrating poor and good performance are attached to each element of a skill. These exemplar behaviours allow observers to understand the types of behaviour that they are looking for in order to demonstrate performance of that category and element. Finally, each category and sub-category can be given likert scales with anchored descriptors which allow a rater to score each element and category.

Methods to identify the skills vary depending on the nature of the individuals and context within which they are operating. Commonly they include methods of task analysis, including reviews of critical incidents, interviews, observational studies and questionnaires(Flin et al. 2008).

Research and training in NTS have shown that these skills are context specific(Flin et al. 2008). In other words, a behavioural marker system for surgeons cannot and should not be used as a framework to train and assess anaesthetists. Training programmes that have not taken into account the cultural and context specific needs of the learners have often proven ineffective(Flin et al. 2008). Whilst there may be some categories of cognitive and social skills that are similar across different high reliability organisations, there are often differences at the element level, and certainly differences in the behaviours with which

these skills can be observed. Sometimes these differences can appear subtle, but it is at the finer level of detail that these taxonomies and behavioural marker systems become crucial in the way that they are used, particularly within training and assessment. For example, if the critical elements and behaviours are not described appropriately, then it will affect the ability of observers to target feedback effectively in order to improve performance.

This introduction has given an overview of the topic of research through evidence from within healthcare and other high reliability organisations. The key points that have been addressed are summarised below:

- Junior doctors are currently perceived as being inadequately prepared to manage acutely unwell patients
- Failures in the management of these patients are leading to avoidable mortality and morbidity and this is frequently linked with the performance of NTS
- Training NTS has been demonstrated to improve performance and emerging evidence suggests that this can be linked with improved patient outcomes
- NTS can be reliably trained, observed and assessed through the development of context specific NTS taxonomies and behavioural marker systems
- In order to develop training and assessment in this area it is important to conduct research to have an adequate understanding of the skills required for junior doctors in these environments

### **3. Aims and Method Overview**

#### **3.1 Aims**

The overarching aims of this research project is to:

- Identify the NTS used by junior doctors in the recognition and management of acutely unwell patients
- Develop a behavioural marker system for the NTS of junior doctors in the management of acutely unwell patients

The term 'junior doctors' refers to graduating medical students within a period of generic non-specialist training. In the UK this would refer to the first two years of postgraduate training: Foundation years 1 and 2. This population has been chosen as these are doctors in generic training who are required to begin initial resuscitative measures and escalate care when required in the management of acutely unwell patients. This is based on the curriculum of this training period and on the structure and function of medical and surgical in-patient teams(UKFPO 2012).

The definition of acutely unwell patient is also described in chapter 1. It is based on previous research on analysis of avoidable patient harm and competency curriculum guidelines for these junior doctors. It includes any 'live' patient where resuscitative measures are required by the junior doctor, but excludes patients in cardiac arrest where there is no longer a central pulse. Patients in cardiac arrest are excluded as the process of care and policies of escalation are well defined for this group and outcomes are less favourable(Findlay et al. 2012).

#### **3.2 Theoretical Perspective**

The aims and motivation for this project are driven by the fundamental philosophical and theoretical underpinnings of the research. As such, explaining the stance of the researcher and acknowledging these influences is imperative in order that the subsequent method, results and conclusions drawn can be understood and interpreted correctly.

Within social science research it is commonplace to explain theoretical perspectives and epistemological stances and their influences(Illing 2007). Frequently the framework for this process involves discussing 'metaphysical' concepts such as ontology (the study of being and the nature of reality) and epistemology (the theory of knowledge). For example, a Positivist researcher would believe that there is only one true reality, and that 'facts' and knowledge can be accurately collected from the social world that have a true meaning, independent from the researcher(Illing 2007). It is stated that this encourages an objective approach to research, where researchers attempt to avoid influencing or being influenced by the results. At first glance it could appear that NTS research may fit into this philosophical framework. It includes a set of skills that must be found, and then put into a tool that attempts to quantify and measure them in a relatively objective manner. However, the detail of the methods used and the current understanding within the literature paints a different picture.

For example, it is accepted that skills frameworks or behavioural marker systems are not set in stone, and indeed is not the 'only' way of representing these skills(Flin et al. 2008). Its place within the human factors research acknowledges the importance of organisational and cultural influences that have to be considered when constructing and reviewing these systems. Although simulation is frequently used in training, it is widely accepted that the research into the skills must take place in 'naturalistic' real world settings to avoid ignoring



external influences. Although there is very little explicitly written about the ontological and epistemological assumptions in previous NTS research, much of the theory points closer towards a post-positivist or even constructivist perspective to the research. In the latter, there are believed to be multiple realities and knowledge is often thought of as being 'socially constructed' where subjectivity is demanded (Illing 2007). This research will produce a prototype behavioural marker system, which is neither definitive, fixed or the only 'correct' framework for presenting these skills. For example, the shifting cultural and organisational influences may change the balance of how these skills should be displayed, and the wording of the descriptors or exemplar behaviours that are selected. Such changes are accepted in the development and evolution of NTS frameworks and training within other high reliability organisations (Flin et al. 2008).

It is the view of the author that a degree of subjectivity is not only inevitable, but is required in order to improve the methods and output of this work. It is therefore necessary to outline the key factors that have affected this subjectivity, and influenced not just the method selected, but the way in which results and output have been interpreted.

### **3.3 Method Overview**

The method was based on the aims of the project and influenced by the theoretical perspective and key factors described above. It was also strongly influenced by previous NTS research in healthcare and other settings. The two main stages advised by Flin et al. in the development of a behavioural marker system are the identification of the skills required, and then the refinement of the behavioural marker system itself (Flin et al. 2008). These stages are presented in a linear format in this report. However, in reality this was an iterative process with each stage returning to the data of the stage before. Particularly in the latter stages of the research, there was a conscious effort to return to the phases of data collection and ensure that the final framework of skills was truly represented by the data. This is in keeping with other NTS research and in alignment with the aims and influences described previously.

#### **Phase 1: Identification of skills and behaviours**

**A systematic search of the literature** was performed to review the current understanding of the NTS of junior doctors in acute care. A search strategy was developed and two reviewers identified all studies that met the pre-determined inclusion criteria. Studies were analysed using a process based on template analysis by two researchers, one of which was a junior doctor. This started with an initial *a priori* template of categories of NTS based on the literature, but remained open to the possibility that adaptations and additions to the template may be required.

**A qualitative semi-structured interview study** was completed in order to gather further data on the NTS of junior doctors. Following ethical approval, 29 junior doctors were interviewed using a critical incident technique (CIT). This technique has been widely used for identifying NTS and involves participants recalling a challenging event, with probing questions to explore behavioural and cognitive aspects. Interviews lasted between 45 and 100 minutes. Each interview was transcribed and underwent template analysis by two researchers. This was based on output and experience from the systematic literature review.

## **Phase 2: Prototype Behavioural Marker System Development**

The output from phase 1 and 2 was reviewed by a panel of 6 'subject matter experts' in order to develop a behavioural marker system. The panel included clinicians from across different specialties with experience in supervising and training junior doctors and in the development of behavioural marker systems in other healthcare settings. Two focus groups with the panel were completed, each lasted a half-day. These involved a review of the potential categories and elements of NTS and the data from the interviews and literature review.

These discussions centred on how best to conceptualise these skills in order to optimise the utility of the behavioural marker system. An iterative process was implemented which involved returning to the interview transcripts to ensure the prototype remained true to the original data. Both of these sessions were recorded and a tracking document was kept to ensure that all changes to the template could be justified and explained. Following each of the facilitated sessions, a report of changes and decisions was generated and circulated to the panel to confirm consensus opinion and clarify any ambiguities.

The output from this phase was a consensus agreement of the categories, elements and example behaviours for the prototype behavioural marker system.

## 4. Results Overview

### 4.1 Literature Review Results Overview

The review identified no studies that had developed a behavioural marker system or NTS taxonomy in this domain. Only seven studies that examined the behaviour of junior doctors in the management of acutely unwell patients were identified. The included studies demonstrated behaviour that fell under all five of the generic skill categories that were identified in the *a priori* template. In addition a sixth category relating to the role and limitations of a junior doctor may form part of the NTS categories that are required of them.

Table 1 gives an example of the data collected from the categories of NTS included at this stage.

Category	Example text from the literature and reference
Situation Awareness	“You can stop and think what you have done and haven’t done and it would help if you train yourself to do that in a real world situation.(O’Brien et al. 2001)”
Decision Making	“you realise that if you make the wrong decision you can cause serious harm to someone. So you get over looking stupid really quickly and just ask for help.(Kennedy & Regehr 2009)”
Teamwork	“I think the first thing I should have done is introduce myself to the nurse then ask the history from her. I went straight to the patient.(O’Brien et al. 2001)”
Communication	“In scenarios in which the interns mentioned an atmosphere of open communication, the interns reflected in a positive way on their performance and stated that they had managed effectively.(O’Brien et al. 2001)”
Leadership	“Make a decision as to who is the leader ... I would make the decision beforehand.(O’Brien et al. 2001)”
Awareness of Roles and Limitations	“The juniors described some uncertainty about their new roles, often precipitated by a disparity between the level of responsibility imposed upon them and that which they felt happy to accept.(Tallentire et al. 2011)”

**Table 1:** Examples of data from the literature extracted for each category.

The review was useful in demonstrating the importance of NTS for junior doctors, and in identifying categories of NTS that may be required. It also highlighted the challenge of identifying ‘skills’ within these example behaviours. Specifically it identified the difficulty in deciding if some of these behaviours represent a trainable NTS or more accurately are a symptom of the organisational culture or environment that they take place within.

## 4.2 Interview Study Results Overview

29 CIT interviews with FY1 and FY2 doctors from SE Scotland were completed. These events took place on medical or surgical inpatient wards across central teaching hospitals and district general hospitals throughout SE Scotland. A breakdown of the key characteristics of candidates and scenarios are shown in tables 2 and 3.

The types of cases varied, but common examples included patients suffering from sepsis or myocardial infarction and myocardial failure (including pulmonary oedema). Other scenarios included pulmonary embolism, haemorrhage, respiratory failure, renal failure and severe electrolyte abnormality, ischaemic bowel and acute neurological events.

Age: median (range)	25(23-29)
Gender	18 female, 11 male
Graduating University	17 University of Edinburgh, 12 Other <sup>†</sup>

**Table 2:** Participant details. <sup>†</sup>Other graduating universities were 4 participants from Glasgow, 2 from Newcastle, 2 from Aberdeen, 1 each from Leeds, London (Queen Mary), Nottingham and Malta.

Scenario Details		Number of scenarios
Location: Hospital	District General Hospital	18
	Teaching Hospital	11
Location: Ward	Medical	15
	Orthopaedic	3
	Surgical	11
Timing	'In hours' (Mon-Fri 9am-5pm)	10
	'Out of hours'	19
Scenario description	Sepsis	9
	Myocardial Infarction/Cardiac failure	7
	Other	13

**Table 3:** Scenario details by location, timing and description.

Meaningful phrases or 'items' were coded deductively into the five *a priori* categories of non-technical skills. Items that did not fit clearly into the categories were coded inductively and through discussion between the researchers five additional categories of non-technical skills were formed. Discussions of coding differences between researchers were constructive and led to the clarification and refinement of descriptors. Final categories along with some examples from the data are shown in table 4.

Category	Example from interview transcripts
Communication	<i>"I kept repeating myself you know I kept saying is someone getting the ECG machine you know is someone doing this? Cause I kept forgetting about you know I kept asking for things and wasn't really listening to maybe what people were saying"</i>
Decision Making	<i>"if we should give some morphine to wade off some of this fluid or was that a bad idea as she was woozy already, and she wasn't maintaining her SATs even on high flow Oxygen" "one thing to recognise quite quickly is it doesn't really matter whether it is your inexperience, or lack of skills, or your patient – if you can't make progress then call for help."</i>
Leadership	<i>"I don't like coming across as being bossy so sometimes I may not be as assertive as I could be...you know as it's not even as if I am being bossy, more that I am being assertive and I do find that difficult"</i>
Situational Awareness	<i>"I didn't put 1 and 1 and 1 together, she was cold and clammy, the clinical signs were there, and perhaps if I put them all in context and put them altogether I could have determined the clinical situation quicker than I did." "I think it (the A-E approach) definitely did erm cause I think if I hadn't you could have easily kind of missed the most crucial point in that how unresponsive the patient was and the fact that he wouldn't be maintaining his airway"</i>
Teamwork	<i>"perhaps involving everyone from the word go....kind of verbalise your thoughts and do what you do and involve everyone like "would you mind getting the trolley", "would you mind trying to cannulate", and "I will do this in the meantime" and so that is a team effort from the word go."</i>
Task Management	<i>"just little things.....I always have numbers on me and you know like er bits of paper things in my pocket like the HAN office and just seeing that bit of paper and seeing people I can contact is quite useful. Asking for help of people around you."</i>
Coping with Stress and Fatigue	<i>"when you are stressed there is so many things like I was trying to think like don't stress just think ABC, whether you are so focussed on that you just kind of go into automatic pilot and just shut everything else off" "just get people to help you, because that's the only thing you can do if you are in a panic"</i>
Accepting Responsibility	<i>"it was like "this person's unwell, shall we get their doctor" and now it's like "oh dear that's me" and the complete feeling of responsibility I think, this person is in front of you and you are being paid to do it and yeah quite frightening."</i>
Awareness of Role and Limitations	<i>"it's that whole thing that you think you should be able to deal with things but you realise you don't....you can't, whereas now I don't mind if I can't deal with something, better just to ask" "but I felt that that was a situation that was too much to deal with with only 2 weeks of experience."</i>
Knowing your environment	<i>"but I actually called her reg who was in a clinic at a different hospital.....this was at the*** and he was at the ***(different hospital)" "to know what the on-call loop is and who to call in that instance, as looking back on it I didn't"</i>

The method of interview technique in this study has proven highly successful in producing open, honest and rich accounts of junior doctors and their behaviour in managing these patients. It has allowed us to identify behaviours that fit into all a priori categories of NTS, and the expansion of this template to include five further potential categories of NTS. Through analysis and discussion it has highlighted several areas that are particularly pertinent for the NTS of novice junior doctors.

The process of analysis and discussion between researchers has revealed the challenges of the overlap and interdependence between categories. In addition the complex influence of external and internal factors on the performance of NTS has also been demonstrated. This has led to a discussion about the scope of NTS and whether some of these items represent skills that can be trained, or are purely a symptom of cultural and organisational factors that are adversely affecting behaviour. For example, junior doctors frequently commented on the difficulties of escalating care effectively and speaking up to senior colleagues.

Whilst the answer to this question is not clear at this stage, the next step in the process is to review and refine the current template taking into account other factors that will affect the utility of the final framework and behavioural marker system. This next stage must be appropriately designed to address these issues.

## 5. Development of Prototype Behavioural Marker System

The facilitated subject matter expert discussions took place over two half days. They involved several critical stages, including:

- Specifying design criteria for the behavioural marker system
- Developing a prototype taxonomy
- Reviewing and refining this taxonomy
- Attaching exemplar behaviours
- Attaching an assessment scale

The final output of the behavioural marker system is found in the appendix. The final marker system contained four categories, each with two to three elements. The process of refinement included returning to the original data with revised templates in order to verify that these categories truly represented achievable and realistic skills required of junior doctors. Whilst it is not possible to discuss every change that was made, a brief summary of the key discussions and principles behind some of these changes are discussed below.

### 5.1 Critical areas of discussion

Several design criteria were agreed on at the start of this process. It was felt that the final marker system should contain the least number of categories and elements as possible in order to capture the critical skills required. A tool that contains all behaviours that have been identified into all the possible different skill and element groups, may be too complex and onerous for a rater to complete (Flin et al. 2008). In order to produce a marker system that can be completed accurately and is acceptable to clinicians who will be using it, a degree of parsimony is required. Other criteria that were agreed are outlined in figure 1.

1. It should have a three level hierarchical structure, containing categories, and sub-categories (elements) with exemplar positive and negative behaviours
2. Focus on skills that are critical for junior doctors in real clinical events and are either directly observable or inferred from direct observation.
3. Categories and subcategories should represent skills that could be improved and not personality traits or values and attitudes that are influenced by external factors
4. Categories and elements should have the maximum exclusivity as possible
5. The system should be parsimonious and contain the least amount of categories and elements possible whilst still capturing the critical skills and behaviours
6. The language of categories, behaviours and descriptors should be simple, concise and comprehensible to clinicians with minimal training.

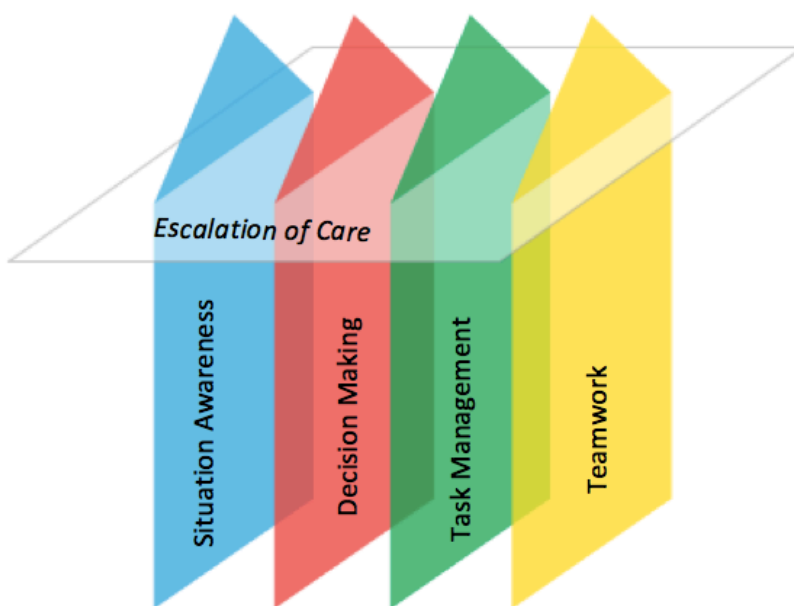
**Figure 1:** Design criteria for the behavioural marker system

With these design criteria in mind, changes to the structure of categories and elements were made. As discussed previously, these changes were made whilst reviewing the original data from phase 1, and an iterative approach was taken, returning to the data to ensure that these changes could be justified. A brief overview of the major category level changes is described in table 5.

Description of change	Justification/Description
Removal of communication	It was felt that this would frequently be the means by which all categories could be observed. The communication of junior doctors during scenarios would demonstrate their other cognitive and social skills. This approach has been adopted in some other behavioural marker systems in healthcare(Fletcher et al. 2004)
Removal of leadership	On reviewing the data it was felt that the critical skills within this category could form part of teamwork elements and behaviours.
Removal of knowing your environment	On reviewing the data it was felt that the critical skills within this category could form part of task management elements and behaviours
Removal of accepting responsibility	It was felt that data within this category may not represent skills, but may be closer to attitudes of junior doctors
Removal of awareness of roles and limitations	On reviewing the data it was felt that the critical skills within this category could form part of situation awareness and decision making categories
Representing the importance of escalation of care	Escalation of care was noticed to be a prominent feature in all categories and elements. It was decided that this needed to be highlighted in the way the behavioural marker system was portrayed

**Table 5:** Overview of main changes made to NTS taxonomy during refinement process. For further details of elements and exemplar behaviours of final marker system- see appendix

One area of considerable discussion was the importance of safe and effective escalation of care in these clinical events. It was felt that this was of critical importance, but did not represent a discrete category of NTS. Instead failures or success across all other categories and elements could impact on the ability to escalate care effectively. This was portrayed schematically in a way that demonstrated the four pillars of NTS categories supporting the effective escalation of care (see figure 2).



**Figure 2:** Schematic representation of the four categories of skills representing pillars that support the effective escalation of care



## **6. Implementation and Future Research**

This tool provides a framework of the most critical NTS for junior doctors in acute care. It uses observable behaviours to allow NTS to be recognised, categorised and assessed. It therefore has numerous potential implications for training, assessment and research.

### **6.1 Current implementation**

This tool has been successfully implemented into some areas of training and curriculum development at a local level. It is being used as a structure for simulated acute care training at the University of Edinburgh and throughout Lothian for Foundation Year simulation training. This has facilitated scenario design and refinement and also it is used to allow supervisor and medical student targeted feedback during debriefing.

To facilitate this process and integrate this tool into the curriculum an online learning module has been developed to introduce candidates and facilitators to the concept of NTS and to the categories, subcategories and exemplar behaviours of this marker system (please see appendix for overview of the training and link to access this module). This was designed using some of the guidance for rater training as described by Flin et al. It briefly describes the importance of NTS and the research behind the behavioural marker system. It then introduces the categories using recorded simulated scenarios and allows a calibration process for each element. Whilst this training is far shorter than recommended for reliable rater training, it is hoped that it allows dissemination of the importance and principles of this tool, and potentially would allow others to use it to observe behaviour and discuss performance in simulated or clinical settings.

Finally this tool has also been used to investigate the NTS for simulated ward rounds by a funded research project at the University of Edinburgh. It is currently being used as a starting point for template analysis in the categorisation of NTS for safe and effective ward round skills required by newly qualified doctors.

### **6.2 Future research**

Future research in this area is required to collect further evidence of the validity and reliability of this assessment tool. Assuming that this behavioural marker system stands up to psychometric analysis, it could then be used to evaluate training, research different training strategies, and research the effects of different environmental and context specific factors on the behaviours of junior doctors.

Adaptation of this tool could also be used to structure debriefing of real clinical events, to form part of formative workplace assessments or potentially in the summative assessment of senior medical students and junior doctors.

## **7. Dissemination**

### **7.1 Presentations:**

2013 ASME annual conference, oral presentation: The non-technical skills required by junior doctors: the results of a critical incident technique interview study.

2013 AMEE annual conference, oral presentation: A behavioural marker system for the assessment of the non- technical skills for junior doctors.

2013 Lothian Human Factors Conference: The non-technical skills required by junior doctors.

### **7.2 Publications:**

The Importance of non-technical skills for junior doctors managing acutely ill patients: Key findings from a literature review. Mellanby E, Hume M, Glavin R, Skinner J, Maran N. Postgraduate Medical Journal. *Under revision*

The non-technical skills of junior doctors managing acutely unwell patients: results of a critical incident technique interview study. Mellanby E, Hume M, Glavin R, Skinner J, Maran N. *In draft.*

Development of a behavioural marker system for the rating of junior doctors in the management of acutely unwell patients. Mellanby E, Hume M, Glavin R, Skinner J, Maran N. *In draft.*

### **7.3 On-line dissemination:**

An e-learning tool with recorded simulated scenarios has been developed and is currently being piloted. It will introduce clinicians and educationalists to the NTS rating system and provide a resource for the training and calibration of raters. For access information see appendix.

## **8. Conclusion**

This project has successfully developed a prototype behavioural marker system for junior doctors in acute care settings. It is now ready to be evaluated further, and integrated into training. It furthers our understanding of the NTS of novices and the difficulties in viewing their performance behaviours as representing a skill or as a symptom of the underlying culture. This supports the current understanding and theory of workplace learning and communities of practise, in the way that learning and behaviour are inextricably linked to the environments that they take place in (Lave & Wenger 1991). It also signifies a similar message to the literature on the hidden curriculum, whereby there is much about what is learnt in clinical environments that is not explicitly taught (Lempp & Seale 2004). This may include how to behave with colleagues, and when to escalate care.

This behavioural marker system, with its exemplar behaviour can be viewed as a way of being more explicit about what we accept from our junior doctors. It can be seen as a way of uncovering the hidden curriculum, or the values of a community of practise. Of saying, this is how we would like you to behave in this organisation to keep our patients safe. If this can be done it must be fully integrated into the clinical contexts and organisations that these performances take place. It must be fully accepted by the clinicians that influence the junior doctors. As such it must be seen more as simply an assessment tool, but as a manifesto that supports safe and effective care. Although this may take time, if it can be successfully accepted by senior clinicians, and integrated into training and everyday work to support junior staff it could not only improve individual performances, but improve the culture of clinical environments and training.

## 9. References

- Armour Forse, R., Bramble, J.D. & McQuillan, R., 2011. Team training can improve operating room performance. *Surgery*, 150(4), pp.771–8.
- Carthey, J. et al., 2003. Behavioural markers of surgical excellence. *Safety Science*, 41(5), pp.409–425.
- DoH, 2000. *An Organisation with a Memory*, London.
- Findlay, G. et al., 2012. *Time to Intervene? A review of patients who underwent cardiopulmonary resuscitation as a result of an in-hospital cardiorespiratory arrest*, London.
- Fletcher, G. et al., 2004. Rating non-technical skills: developing a behavioural marker system for use in anaesthesia. *Cognition, Technology & Work*, 6(3), pp.165–171.
- Flin, R. et al., 2003. Development of the NOTECHS ( non-technical skills ) system for assessing pilots ' CRM skills. *Human factors and aerospace safety*, 3(2), pp.95–117.
- Flin, R., O'Connor, P. & Crichton, M., 2008. *Safety at the sharp end. A guide to non-technical skills*, Aldershot: Ashgate.
- Flowerdew, L. et al., 2012. Development and validation of a tool to assess emergency physicians' nontechnical skills. *Annals of emergency medicine*, 59(5), pp.376–385.
- GMC, 2009. *Tomorrow ' s Doctors The duties of a doctor registered with the General Medical Council*, London.
- Helmreich, R., Merritt, A. & Wilhelm, J., 1999. The Evolution of Crew Resource Management Training in Commercial Aviation. *International Journal of Aviation Psychology*, 9(1).
- Hogan, H. et al., 2012. Preventable deaths due to problems in care in English acute hospitals: a retrospective case record review study. *BMJ quality & safety*, 21(9), pp.737–45.
- Illing, J., 2007. *ASME guide: Thinking about research: frameworks, ethics and scholarship*, London.
- Jen, M.H. et al., 2009. Early in-hospital mortality following trainee doctors' first day at work. *PloS one*, 4(9), p.e7103.
- Kanki, B., Helmreich, R. & Anca, J., 2010. *Crew Resource Management* 2nd ed., California: Academic Press.
- Kennedy, T. & Regehr, G., 2009. Preserving professional credibility: grounded theory study of medical trainees' requests for clinical support. *BMJ*, (338), p.b128.

- Lave, J. & Wenger, E., 1991. *Situated Learning: Legitimate Peripheral Participation*, Cambridge University Press.
- Lempp, H. & Seale, C., 2004. The hidden curriculum in undergraduate medical education: qualitative study of medical students' perceptions of teaching. *BMJ*, 329(7469), pp.770–773.
- Mann, S., Marcus, R. & Sachs, B., 2006. Lessons from the cockpit: How team training can reduce errors on L&D. *Contemporary Obstetrics and Gynaecology*, pp.1–7.
- Maurette, P., 2002. *To err is human: building a safer health system*,
- Mazzocco, K. et al., 2009. Surgical team behaviors and patient outcomes. *American journal of surgery*, 197(5), pp.678–85.
- McCulloch, P. et al., 2009. The effects of aviation-style non-technical skills training on technical performance and outcome in the operating theatre. *Quality & safety in healthcare*, 18(2), pp.109–15.
- McGloin, H., Adam, S. & Singer, M., 1998. Unexpected deaths and referrals to intensive care of patients on general wards. Are some cases potentially avoidable? ... *College of Physicians of London*, 33(3), pp.255–259.
- Mcquillan, P. et al., 1998. Confidential inquiry into quality of care before admission to intensive care. *Annals of Internal Medicine*, pp.1853–1858.
- Mishra, A. et al., 2008. The influence of non-technical performance on technical outcome in laparoscopic cholecystectomy. *Surgical endoscopy*, 22(1), pp.68–73.
- Mitchell, L., 2011. Development of a Behavioural Rating System for Scrub Nurses' Non-Technical Skills.
- Morey, J.C. et al., 2002. Error Reduction and Performance Improvement in the Emergency Department through Formal Teamwork Training : Evaluation Results of the MedTeams Project. *Health Services Research*, 37(6), pp.1553–1581.
- Neily, J. et al., 2014. Association Between Implementation of a Medical Team Training Program and Surgical Mortality. *JAMA: The Journal of the American Medical Association*, 304(15), pp.1693–1700.
- O'Brien, G., Haughton, A. & Flanagan, B., 2001. Interns' perceptions of performance and confidence in participating in and managing simulated and real cardiac arrest situations. *Medical teacher*, 23(4), pp.389–395.
- Richardson, W.C. et al., 2000. To Err is Human: Building A Safer Health System - Institute of Medicine. *Medscape*. Available at: <http://www.iom.edu/Reports/1999/To-Err-is-Human-Building-A-Safer-Health-System.aspx>.
- Savoldelli, G.L. et al., 2006. Value of Debriefing during Simulated Crisis Management. *Anesthesiology*, 105(2), pp.279–285.

- Tallentire, V.R. et al., 2012. The preparedness of UK graduates in acute care: a systematic literature review. *Postgraduate medical journal*, 88(1041), pp.365–71.
- Tallentire, V.R. et al., 2011. Understanding the behaviour of newly qualified doctors in acute care contexts. *Medical education*, 45(10), pp.995–1005.
- Thomson, R. et al., 2007. *Safer care for the acutely ill patient: learning from serious incidents*,
- UKFPO, 2012. *Foundation Programme Curriculum*,
- Vincent, C., Neale, G. & Woloshynowych, M., 2001. Adverse events in British hospitals: preliminary retrospective record review. *BMJ*, 322(7285), pp.517–9.
- Wilson, R.M. et al., 1995. The Quality in Australian Health Care Study. *The Medical Journal of Australia*, 163, pp.458–471.
- Young, J. et al., 2011. “July Effect”: Impact of the Academic Year-End Changeover on Patient Outcomes. *Annals of Internal Medicine*, 155, pp.309–315.
- Yule, S. et al., 2006. Development of a rating system for surgeons’ non-technical skills. *Medical education*, 40(11), pp.1098–104.

## **10. Appendix**

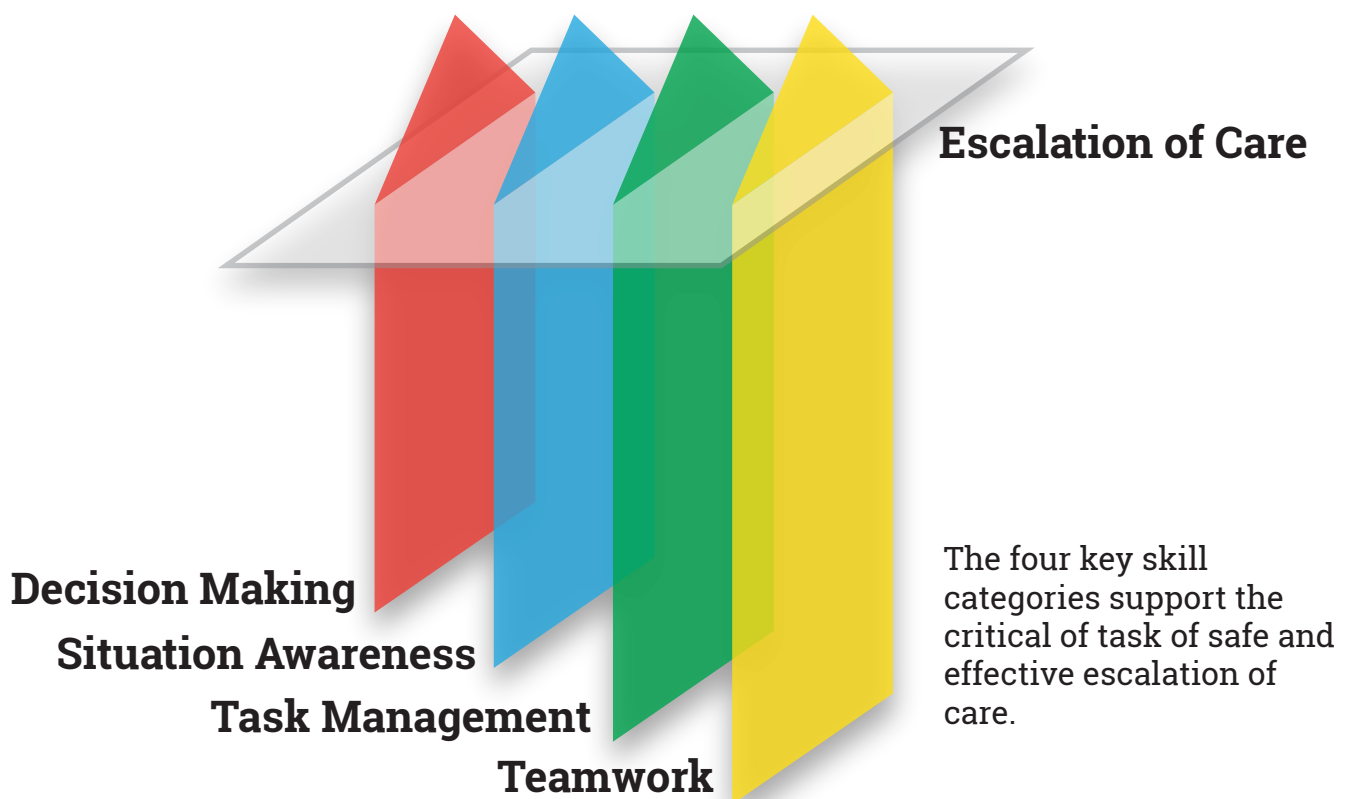
Category and element descriptors, exemplar behaviours, assessment scale and marking sheet are included in this section.

In addition an information sheet is provided describing details of how to access the online module that demonstrates the behavioural marker system.

## **Introduction**

How can newly qualified doctors learn to manage medical emergencies effectively and safely? Research looking at avoidable patient mortality and morbidity in this domain frequently point to the failure of escalation of care and of non-technical skills.

This handbook outlines a behavioural marker system based on a non-technical skills framework for junior doctors in acute care. It accompanies an on-line learning resource that describes the development and utility of this tool. Please use the contact details below to gain access to the on-line introduction, or to find out more about the project and other resources.



### **For access to online resource:**

[info@learnpro.co.uk](mailto:info@learnpro.co.uk)

### **For further information about the FoNTS project:**

Contact Edward Mellanby by email:

[edward.mellanby@ed.ac.uk](mailto:edward.mellanby@ed.ac.uk)



## FoNTS Definition

**“The gathering of information in the current situation, the comprehension of their meaning and the projection of their status in the near future. In this context the 'information' may be gathered from the patients, notes, charts, monitoring, relatives and the communication and behaviour of co-workers.”**

## Key Skill Elements

### Information Gathering

Gathering information about the patient's current condition, their background and rate of deterioration from available sources.

#### Positive Behaviours

- Applies a structured A-E approach to assessment
- Verifies/cross checks information with nurse or patient
- Requests further history/information from available sources

#### Negative Behaviour

- Takes a lengthy non-focussed history, despite need for urgency
- Misses critical information by using unstructured and disorganised approach
- Overlooks critical information available on notes or charts

### Recognising and Understanding

Putting together the information gathered in order to identify the nature and severity of the current situation. This may require a pause in other activities.

#### Positive Behaviours

- Stops tasks temporarily to put together information
- Summarises key findings and significance
- Verbalises the significance of trends in patient condition

#### Negative Behaviour

- Remains task focussed without assimilating current status
- Overlooks critical information about patients' condition despite having observed it
- Interprets patient condition incorrectly

### Projection to Future States

Thinking ahead to predict what might happen and consequences of actions, interventions, non-interventions.

#### Positive Behaviours

- Communicates the expected course of the clinical condition
- Recognises that patient may need higher level of care
- Communicates likely effects of interventions

#### Negative Behaviour

- Does not communicate what he or she expects to happen
- Does not give follow on instructions after commencing an intervention
- Waits for predictable deterioration to arise before responding



## FoNTS Definition

The skills that Junior Doctors can use to work with others in team contexts. This includes skills in any role within the team that ensures it functions effectively and safely in achieving its goals. As a leader, the junior doctor will allocate tasks to identified individuals, as a follower the junior doctor will perform the allocated task and report back to the leader on completion of that task.

## Key Skill Elements

### Speaking Up

Using the required level of confidence and assertiveness.

#### Positive Behaviours

Asks for clarification to aide understanding  
Communicates critical information without being asked  
Clearly asks seniors to attend when required and gives timeframe

#### Negative Behaviour

Fails to express concern even when patient safety at risk  
Accepts that help is not available despite deciding it's required  
Accepts tasks that are not appropriate given level of experience without expressing concern

### Establishing Shared Understanding

Seeks and gives enough information to ensure a shared understanding of the situation.

#### Positive Behaviours

Regularly updates team on progress and checks understanding  
Uses closed loop communication to verify task completion  
Invites information from staff more familiar with patient/situation  
Provides clear, structured handover to senior help

#### Negative Behaviour

Gives incomplete or irrelevant information  
Fails to recognise differences in understanding amongst team  
Relays information whilst other team members are distracted

### Establishing a team

Thinking ahead to predict what might happen and consequences of actions, interventions, non-interventions.

#### Positive Behaviours

Introduces self and identifies other team members  
Checks team members capabilities before allocating tasks  
Establishes who is leading the team and takes leadership role when required

#### Negative Behaviour

Fails to clarify own or team members roles  
Fails to delegate tasks to specific team members  
Overloads self or other team members with tasks





## FoNTS Definition

**The process of reaching a judgement or choosing a course of action to meet the needs of a given situation. Decisions in this context include diagnoses, interventions, investigations and the need for escalation of care. This category includes the generation of different options, selecting an option and reviewing of decisions that have been made.**

## Key Skill Elements

### **Generating Options**

Generating differential diagnosis or potential courses of actions

#### **Positive Behaviours**

Verbalises or documents differential diagnosis  
Invites other team members to help generate options  
Identifies promptly that help may be required

#### **Negative Behaviour**

Fixates on one particular diagnosis  
Does not consider possible alternative strategies  
Fails to consider contacting senior support

### **Balancing Options**

Weighing up different options and balancing risks and benefits

#### **Positive Behaviours**

Takes into account own skills and limitations when choosing action plan, making patient safety the priority  
Identifies risks and benefits of potential action plans  
Assesses the time criticality when considering options

#### **Negative Behaviour**

Does not base management plan on patient diagnosis or condition  
Allows personal agenda to influence decision  
Operates beyond level of experience without escalating care

### **Reviewing of Decisions**

Reviewing the suitability of the option or course of action

#### **Positive Behaviours**

Adopts an alternative strategy when patient is not responding as anticipated  
Reviews plan when condition changes

#### **Negative Behaviour**

Does not re-assess impact of actions  
Perseveres with one plan despite presence of new conflicting information  
Fails to give appropriate time for action to take effect



## FoNTS Definition

The skills that Junior Doctors can use to organise tasks and achieve goals safely and efficiently. This includes skills relating to planning and preparation, prioritisation and providing and maintaining standards.

## Key Skill Elements

### **Prioritising (Tasks and Patients)**

Prioritising according to importance and avoiding being distracted by less important or irrelevant matters.

#### **Positive Behaviours**

- Maintains and reviews task list frequently
- Makes priorities clear to other members of team
- Uses A to E approach to prioritise interventions

#### **Negative Behaviour**

- Does tasks in inflexible or haphazard order
- Delays doing unfamiliar, difficult or unpleasant tasks
- Concentrates on individual tasks without attempting to relate one to another

### **Maintaining Accepted Standards**

Using guidelines and adhering to accepted principles and codes of practice.

#### **Positive Behaviours**

- Utilises algorithms in emergency situations
- Maintains accurate and legible documentation
- Adheres to infection control measures

#### **Negative Behaviour**

- Does not check results of ordered tests
- Fails to adhere to accepted standards of practice
- Ignores available protocols to take unnecessary short cuts

### **Being Prepared**

Planning and preparing for scenarios and eventualities where possible.

#### **Positive Behaviours**

- Actively seeks out information of support structures and hospital systems
- Assembles all equipment required before beginning a task
- Is aware at all times who and how to contact senior support

#### **Negative Behaviour**

- Does not keep IT passwords up to date
- Arrives late without vital pieces of equipment
- Makes no attempt to familiarise self with ward or location of critical equipment

## Key Skill Elements continued

### **Identifying and Utilising Resources**

Selecting the most suitable resource for the situation

#### **Positive Behaviours**

Selects appropriate person to escalate care  
Uses 2222 to get people and expertise when needed urgently  
Contacts available allied healthcare professionals or other resources to help when required

#### **Negative Behaviour**

Contacts the wrong person by the wrong means given the urgency and available resources  
Does not use resus trolley in an emergency situation  
Fails to identify resources leading to task overload

## FoNTS: Rating Form

Description	Category Rating	Example Behaviour	Element Rating	Comments
Situational Awareness		Gathering Information		
		Recognising and Understanding		
		Projection to Future States		
Decision Making		Generating Options		
		Balancing Options		
		Reviewing of Decisions		
Task Management		Prioritising (Tasks and Patients)		
		Maintaining Standards		
		Being Prepared		
		Utilising Resources		
Teamwork		Speaking Up		
		Establishing Shared Understanding		
		Establishing a Team		

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