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Development of a Behavioural Marker System for the Non-Technical Skills of Junior Doctors in Acute Care

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Abstract

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 acute care is influenced by the complex clinical environments in which they work. This can have profound implications for patient outcomes. The framework developed by this research allows us to be explicit about the types of behaviours that are required to keep patients safe. If this tool can be integrated into clinical training, then it could be used by clinicians to support the development of safe and effective skills and reduce the current level of avoidable patient harm.

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Dedication

This thesis is dedicated to newly qualified doctors, for their resilience, dedication and bravery during the early years of their training. It is also dedicated to patients and relatives who have experienced the tragedy of avoidable mortality and morbidity in our hospitals.

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Declaration

This thesis has been composed by Dr Edward Mellanby under the supervision of Dr Janet Skinner (Director of Clinical Skills at the Centre for Medical Education, University of Edinburgh and Consultant in Emergency Medicine, NHS Lothian) and Dr Nikki Maran (Associate Medical Director of Patient Safety and Consultant Anaesthetist, NHS Lothian and Educational Co-ordinator, Scottish Clinical Simulation Centre).

This work has been carried out by the candidate (unless indicated). All quotations have been distinguished and the sources of information specifically acknowledged. This work has not been submitted for any other degree or professional qualification.

Signature

Date 27/05/2015



Ethics

Ethical approval for all the work contained within this thesis was waived by the South East Scotland Research Ethics Service. Written consent for all audio data collection and publication of anonymised results was obtained from all participants. Whilst funding for this work was received from external agencies, no organisation had any involvement in research design, data collection or analysis, writing of this thesis or associated manuscripts or decisions to submit for publication.

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On-line dissemination:

Foundation Non-Technical Skills (FoNTS) An e-learning tool with recorded simulated scenarios has been developed and is currently being piloted. It introduces clinicians and educationalists to the NTS rating system and provide a resource for the training and calibration of raters. For access information see appendix, visit learnpro website: www.learnpro.co.uk, or email: info@learnpro.co.uk.

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Chapter 1: Introduction

Chapter 1 aims to give an overview of the subject area, and justify why this research is required. It describes some of the evidence to support the view that junior doctors are currently not adequately prepared to manage acutely unwell patients. It then goes on to explain what non-technical skills (NTS) are, and why this may be relevant to improving the performance of junior doctors within this domain. Finally it will introduce the concept of behavioural marker systems and discuss how and why these have been developed for other practitioners. This will draw on some of the literature on adverse events and NTS from healthcare, and also some of the experience from other high reliability organisations, including aviation.

This chapter will answer the following questions:

- 1) Why must we improve the training of junior doctors in the management of acutely unwell patients?
- 2) What are NTS and why may they be important in this domain?
- 3) What is a Behavioural Marker System and why is it required to improve NTS?

The chapter is broken down into three sections to represent the key areas above. It begins with an explanation of why the topic of junior doctors managing acutely unwell patients has been selected.

1.1 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'. 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. 2012b). 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? 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 patients suffering avoidable cardiac 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 arrest 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 through undergraduate medical programmes and early postgraduate training.

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. 2012b). 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 in acute care frequently point to the importance of ‘human factors’ (Thomson et al. 2007; Hogan et al. 2012). These reports recommend the training of NTS such as communication and teamworking, rather than knowledge or technical tasks. 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?

1.2 NTS: An Overview

In order to appreciate and acknowledge the underlying principles of the term ‘NTS’ it is important to briefly consider its origins and how it is currently conceptualised. It was first coined within the aviation industry and driven by a need to improve safety and performance under the heading of ‘human factors’ research.

The term ‘human factors’ is thought to date back to aviation in the second world war (Wiener and Nagel 1988; Kanki et al. 2010). Initially it was focussed on improving the usability or ergonomics of the machinery, including the layout of cockpits and instrument display (Kanki et al. 2010). Despite improvements in safety and performance, critical incidents in aviation were still occurring. Towards the end of the 20th century several of the airline industry companies and regulatory bodies undertook a relatively detailed analysis of these incidents. Well-known examples of these investigations include those performed by the National Aeronautics and Space Administration (NASA) between 1959 to 1989 and Boeing which extended this data to 1996 and included evidence from ‘near misses’ as well as fatal accidents (Kanki et al. 2010; Mjos 2001; Dhillon 2007; Murphy 1980). 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 factors involved improved reporting and extensive research into errors and near misses, including interviews with pilots and aviation experts (Kanki et al. 2010). 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. Perhaps the most well known definition of NTS is:

“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 must be acknowledged that NTS are only a part of the human factors jigsaw. The vast multidisciplinary science of human factors includes everything that influences human performance. The model developed by Moray (see figure 1) suggests that there are different ‘layers’ that contribute to the final actions of practitioners (Moray 2000).

NTS can be seen to sit somewhere within the inner layers of this model and the ways in which individuals and teams behave. It must be acknowledged that they are not a discrete entity, but are influenced and take place within the complex systems of organisations. All the layers of this diagram can affect the final performance or behaviour of a practitioner. In other words, performance is not purely a result of the “skills” of an individual practitioner, but is influenced by factors such as the expectations, culture and environments of the organisations that they take place within.

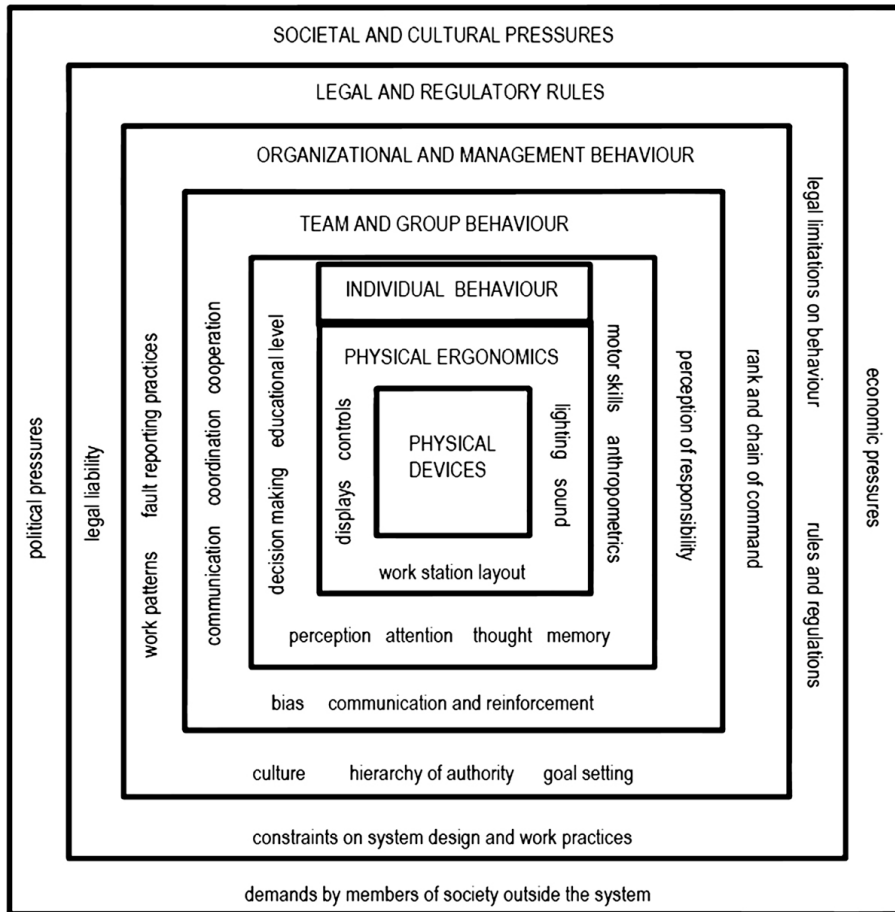


Figure 1: Moray’s model of the layers that are included within human factors (copied with permission of Taylor and Francis publishing group)

Despite this complexity, conceptualising flight crew skills in this way has had many advantages for the aviation industry. It has led to the training of NTS for pilots, within training programmes referred to as Crew Resource Management (CRM). These programmes have now become mandatory. Robust assessment methods have been developed (Flin et al. 2003) and pilots must demonstrate adequate abilities in NTS in order to maintain their license. Other industries have followed a similar approach, including the oil industry, nuclear power industry and the military (Flin et al. 2008).

However, some criticise the comparison between healthcare and high reliability organisations such as aviation (Randell 2003). They claim that differences in structure, purpose and values may mean similar approaches are not helpful. Despite or perhaps because of the wide scale acceptance of these training programmes within aviation, there is very little high quality research confirming that they improve safety, performance and technical skills (Helmreich et al. 1999). So is there any evidence that errors in healthcare can or should be viewed in a similar way? Is there any evidence that the construct of NTS can or should be applied to the performances of healthcare workers?

1.2.1 NTS in healthcare

As with aviation, there have been similar studies of critical incident and error within healthcare (Wilson et al. 1995; Kohn 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). 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). However, there is a potential limitation in looking at errors in isolation. It appears that medical errors are occurring in the presence of failures in NTS, but are the two truly associated? Is there any further evidence to suggest that improved NTS are associated with less errors or improved outcomes for patients?

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 ratings 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. These skills must help them with the challenges of having to enter into unfamiliar environments with an unfamiliar team.

The remainder of this chapter will focus on how these skills can be identified and trained. It will address the importance of developing behavioural marker systems in this process.

1.3 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. NTS taxonomies and behavioural marker systems act as a framework for developing training curricula, as a tool for delivering structured feedback during skill acquisition, and as a method for evaluating training programmes and assessing competence. Without them it is difficult to know what to train, how to train it and if this training has worked!

NTS taxonomies describe the critical NTS that are required by a practitioner in a given context. These are refined in order to develop a behavioural marker system that allows these skills to be recognised and assessed through observed behaviour. Examples in healthcare and high reliability organisations vary in their structure, format and content. Some of these considerations and, perhaps more importantly, the reasons behind them will be explored in this section.

The first variation to consider is the ‘unit of assessment’ (Flin and Martin 2001). Within healthcare there are tools such as OTAS (Observational Teamwork Assessment for Surgery) that are specifically designed for the NTS assessment of teams (Hull et al. 2010). In contrast there are tools such as NOTSS (Non-Technical Skills for Surgeons) that are aimed at training and observing performance of individual practitioners whilst they work in team situations (Yule et al. 2008). There are advantages and disadvantages to both approaches. Team assessment tools are perhaps better suited to ‘stable teams’ where individuals work together frequently and roles are well defined. Advocates of assessment tools for individuals describe practitioners as possessing a set of ‘portable NTS’ that they can use to work effectively in a variety of different teams. One argument for this approach is that the level of NTS competence may differ amongst the team, and a team assessment approach could fail to identify training needs of individuals. Another argument is that NTS may differ between different specialties and members of the team, either in the categories of skills themselves, or in the way these skills are observed in practise.

These tools may also differ in the way in which assessment is made. Some tools such as TARGET (Targeted Acceptable Responses to Generated Events or Tasks) used for military helicopter teams utilise specific behaviour checklists (Fowlkes et al. 2009). In other words there is a specific checklist of the behaviours or sequences of behaviours that are expected in a given scenario, which the rater will look for. Alternatives that have proven popular in healthcare, use examples of types of behaviour that represent different skill categories. Advantages of the latter approach are that these tools are not scenario specific. However, it is likely to require a greater degree of rater training and rater concentration to allow these tools to be used reliably.

Newly qualified doctors work across a variety of different teams, especially during out of hours hospital cover. They must adapt to different environments and scenarios and apply these portable NTS to work within those teams and initiate basic resuscitative management and escalation of care effectively. It is therefore worth considering the behavioural marker systems aimed at individuals and using exemplar behaviours (rather than a checklist approach) in a little more detail.

Examples of successful behavioural marker systems for individual practitioners in healthcare include those for surgeons (Yule et al. 2006), anaesthetists (Fletcher et al. 2004), scrub nurses (Mitchell et al. 2012) and emergency room doctors (Flowerdew et al. 2012). These NTS taxonomies are arranged in a hierarchical manner, 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. 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 that allow a rater to score each element and category. An example of the behavioural marker system for anaesthetists is provided below (Fletcher et al. 2004). This shows several exemplar behaviours for two elements of the NTS of anaesthetists.

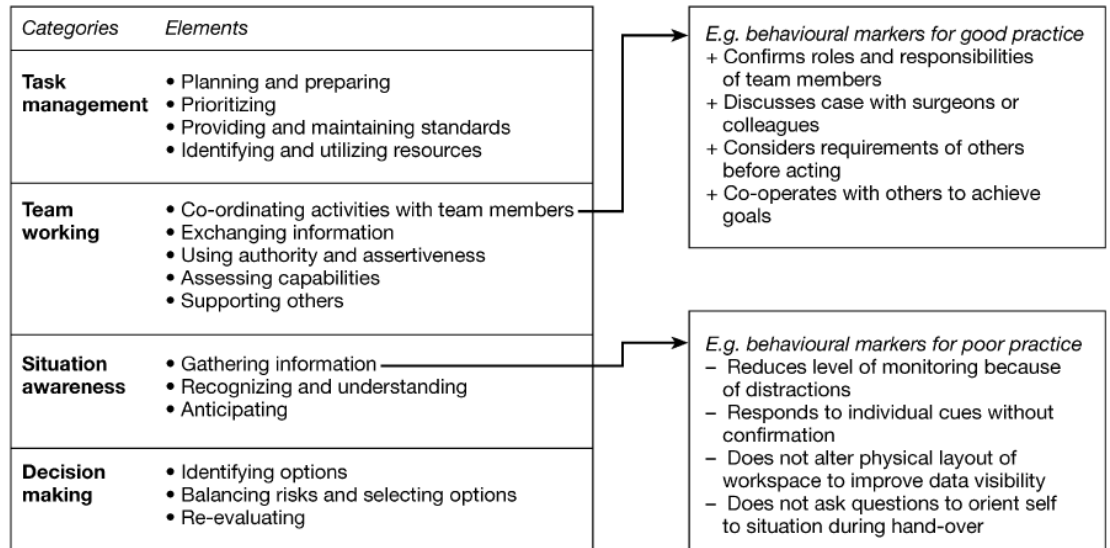


Figure 2: Categories, elements and some exemplar behaviours from the behavioural marker system for Anaesthetists' Non-Technical Skills (ANTS). Reproduced with permission of Oxford University Press publishers.

It should be noted that these focus on observable behaviours. Cognitive skills such as situation awareness and decision making are harder to assess as raters can not see what people are thinking. Instead, abilities in these skills are inferred by outwardly visible behaviours, such as how they respond to changes in patient conditions.

Typically, personal resource skills such as managing stress or fatigue are omitted from these systems due to obvious difficulties in observing them. Whilst it is acknowledged that these skills may be important, they are very difficult to observe unless ‘extreme symptoms’ are present, and in these cases other skills are likely to be affected (Flin et al. 2008).

Research and training in NTS have shown that these skills are context specific (Flin et al. 2008). 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 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 (such as situation awareness and decision-making), 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, the behavioural marker system for surgeons contains a separate category of leadership, whilst that for anaesthetists does not. Within exemplar behaviours, the anaesthetists behavioural marker systems will use exemplar behaviours relating to anaesthetic machine checks, and drug checks that clearly would not be transferable to the surgeon. 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.

Context specific behavioural marker systems based on researching the critical NTS of practitioners have been used successfully to develop training and assess performance. NOTSS has now been formally integrated into surgical training at an international level. It has improved the ability to provide specific and targeted feedback for formative assessment and in some cases has been used for summative assessment. It has provided a tool for evaluating teaching interventions and for researching factors that influence NTS. Psychometric analysis has shown that these assessment tools are not only reliable and valid, but are also accepted and useful both for candidates undertaking training and for those supervising performance in simulated and 'real world' clinical environments (Yule et al. 2008; Fletcher et al. 2003; Crossley et al. 2011).

The behavioural marker systems described above have been targeted at the NTS of specialist doctors. Newly qualified doctors are by comparison a group of novices. As the first attenders to acutely unwell patients they are frequently expected to recognise, resuscitate and escalate care. Whilst NTS are undoubtedly important for this group of individuals, the nature of these NTS and similarities and differences to that of their more experienced colleagues is so far unknown.

Developing a valid and useful behavioural marker system requires extensive research. 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). Further detail on research methodology is provided in chapter 2 and subsequent chapters in this thesis.

1.4 Conclusions

This chapter 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

As discussed earlier in this chapter, NTS form a part of the wider discipline of human factors research. As such they are only a part of the jigsaw puzzle in understanding and improving safe and effective care. NTS of individuals are influenced by many factors, including the team that are around them, the resources available to them, and the ways in which the organisation or culture supports them. However, by focussing on the NTS required on the ‘front line’ we can learn a lot about the types of behaviours that we should be encouraging and how to adapt the current systems and structures to support safe and effective behaviours, as well as how we should train our healthcare professionals. This may be particularly relevant and important for the skills of a ‘novice’ junior doctor. They are relatively new to the healthcare system, and research suggests that they are particularly susceptible to the outside influences of culture and hierarchy on their behaviour and performance (Tallentire et al. 2011; Stewart 2008a; Kennedy et al. 2009).

The next chapter gives an overview of the aims and methods that have been used in this research. The concepts described above of NTS, behavioural marker systems and their place within human factors research will be revisited during the course of this chapter and the remainder of the thesis.

Chapter 2: Aims and Method Overview

This chapter describes the main aims and purpose of this research project, and gives an overview of the methods that have been selected along with justification and explanation of this choice. It includes the theoretical and philosophical underpinnings that have influenced both the choice of research topic and methods selected. This has been included as it will undoubtedly affect the way in which the subsequent chapters and findings should be interpreted.

Detailed versions of each research method are provided within the separate chapters, but it is hoped that this chapter will give an overview of the process to aid the understanding of subsequent sections.

2.1 Aims

The overarching aim of this research project is to:

- Develop a behavioural marker system for the NTS of junior doctors in the management of acutely unwell patients

To achieve this overarching aim, there are several secondary aims that must be addressed during this process. These include:

- Identify the critical NTS categories and elements required by junior doctors in acute care
- Develop and present descriptors of each category and element that will allow both trainers and junior doctors to be able to identify these skills with minimal training
- Develop example behaviours for each element that will aid junior doctors and their supervisors to observe these skills with minimal training

Definitions for the terms behavioural marker system and NTS can be found in chapter 1. The definitions for junior doctors and the management of acutely unwell patients refer to the population and context of this research.

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 and are required to begin initial resuscitative

measures and escalate care when necessary. 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 based on previous research on analysis of avoidable patient harm and competency curriculum guidelines for these junior doctors (UKFPO 2012; Thomson et al. 2007). 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).

2.2 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. Previous research on NTS has been instrumental in this project, and thus conclusions about the body of NTS research as a whole, as well as those of the author will be discussed here. The main aim of this section is to acknowledge some influences and guiding principles on the process and output of this research. This will start with the theoretical perspective.

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 they are 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, experts advise that research to develop taxonomies and behavioural marker systems should take place in 'naturalistic' real world settings to avoid ignoring external influences (Flin et al. 2008). These principles point towards a post-positivist or even constructivist perspective, although there is very little explicitly written about the philosophical underpinnings in published work.

In a constructivist approach, 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 nor 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.

2.3 Key Research Influences

It is important to briefly acknowledge some personal influences of the lead researcher and author of this thesis. As a doctor, a senior anaesthetic trainee and an individual with an interest in training the acute care skills of junior doctors there are two key motivations behind pursuing this research topic. Firstly the drive to improve the standard of care offered to these vulnerable patients. The author has witnessed acutely unwell patients on wards and taken referrals first hand from junior doctors, where earlier recognition, resuscitation and escalation could have improved outcomes. In addition there is a motivation that comes from the wellbeing of the junior doctors themselves. This stems from first hand experiences of challenging events as a junior doctor, and more recently from involvement in training of senior medical students and newly qualified doctors. Witnessing the fear and concerns of these inexperienced junior doctors is a powerful reminder that they do not feel adequately prepared for this task, as the literature confirms. These factors have undoubtedly affected the choice of research, and the manor in which it has been conducted, and provided motivation to produce a ‘useful’ output that can improve performance in this domain.

There are several factors that impact on an assessment tools usefulness or ‘utility’. One framework for considering these factors is Van der Vleuten’s work that suggests 6 key components to utility (van der Vleuten and Schuwirth 2005).

- 1) Educational impact
- 2) Validity
- 3) Reliability
- 4) Cost
- 5) Acceptability
- 6) Feasibility

This conceptual model for the design specification of assessment describes how these factors combine to produce overall utility. In this model, van der Vleuten suggests that the weighting of each element is different depending on the purpose of the assessment, and that sometimes one factor is compromised for another.

A more in depth discussion of some of these concepts, particularly those of validity, reliability, and feasibility are discussed further in chapter 5. However, three of these key concepts and how they have influenced the research are described below.

2.3.1 Validity

Whilst different types and definitions of validity are discussed in the literature (Downing 2003; van der Vleuten and Schuwirth 2005), an overview can be described simply as how well an assessment tool tests the things it is supposed to. Striving for validity has meant that the research remained focussed around the key skills that junior doctors are required to perform in naturalistic settings. In other words, making sure that these skills really are critical to the safe and effective performance of junior doctors in their place of work and events that they are exposed to. This type of validity is sometimes referred to as ‘face validity’ (van der Vleuten and Schuwirth 2005). Previous research in NTS has suggested that collecting detailed empirical evidence from practitioners is required to identify skills and improve face validity (Flin et al. 2008). Where this does not occur there is a risk that the skills are related to performance only in assessment or simulator conditions, and may not truly reflect the skills required in real clinical contexts. As will be discussed in subsequent chapters, the desire for face validity has influenced the choice of qualitative methods and iterative approach.

Another concept within validity literature is the term ‘internal structure’ (Downing 2004). This refers to the extent that different items of an assessment tool reflect different skill areas of a candidate. In this setting it would equate to how well the categories and elements of NTS behave as different domains of skill and ability. Whilst it is acknowledged that some overlap between categories is unavoidable, a degree of category exclusivity is important to achieve in this project, due to the desire to use the assessment tool to deliver targeted feedback in order to improve performance. In other words, it should identify separate skill areas that a candidate can seek to develop following feedback. Methods that could improve the mutual exclusivity of skill categories would therefore be beneficial. This objective

influenced the way data analysis was performed and also the refinement process and iterative approach.

2.3.2 Acceptability

Ensuring this tool was acceptable to the learners and the clinical educators that will use it is vital. As discussed in chapter 1, the behaviour of junior doctors in the workplace is strongly influenced by the culture and expectations of colleagues, and particularly their more 'senior' colleagues. With this in mind, it was acknowledged that the categorisation and description of these skills must be one that is comprehensible and acceptable to both the junior doctors and their supervising colleagues. It was important to avoid a structure that only 'made sense' to the author. This influenced the choice of method and particularly the inclusion and make up of the research team and use of focus groups in the refinement process. Involving relevant practitioners in both the analysis and refinement process would also have the additional benefit of improving reliability, particularly inter-rater reliability as is discussed further in chapter 5.

The acceptance and inclusion of previous NTS categorisation already used in healthcare was seen as an influence that should not be ignored. In other words, the familiarity of some NTS terms amongst the medical educational community would improve the acceptability and ease of use if similar terms were used where appropriate. This particularly affected the data analysis process, where it was decided that previous NTS categories could be used as a starting template for subsequent development (see chapters 3 and 4).

2.3.3 Educational Impact

As discussed, the aim of this research was to improve the performance of junior doctors. For this reason, the skills identified should address areas that could be trained and improved by individuals and were not solely a function of personality, or a product of only organisational and cultural influences. Whilst this underlying philosophy influenced the research and development process, it was also accepted that testing this property of the assessment tool may fall outside the scope of the initial development process.

2.4 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 the way this thesis is presented. 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 representative of the data. This is in keeping with other NTS research and in alignment with the aims and influences described above (particularly validity).

The next section of this chapter gives an overview of the methods used and how they relate to the subsequent chapters of this thesis. Further details of the specific method for each section are provided in those chapters.

Phase 1: Identification of skills and behaviours

Flin and Martin suggest a number of critical steps in the development and implementation of a behavioural marker system (Flin and Martin 2001). The first of these is to set the ‘unit of assessment’ that the tool is intended for. This has been discussed in chapter 1 and within the aims of this chapter: This tool is aimed at the performance of individual junior doctors (not healthcare teams) working within teams in clinical environments to care for acutely unwell patients. The second step is to identify the NTS of these practitioners.

Various methods have been suggested and used in this process. Flin et al. (Flin et al. 2008) have divided them into three groups: event-based analyses, questioning techniques and observational techniques.

Event-based analyses uses reports from accidents or near misses to identify NTS. This has been particularly useful within the aviation industry where robust and detailed incident reporting systems exist. It has been used to demonstrate examples of NTS and both negative and positive behaviours of pilots. However, within healthcare it has proved less useful in this regard. In the development of healthcare NTS taxonomies and behavioural marker systems it has been observed that the reporting systems rarely contain the depth and detail of information required and reporters frequently failed to observe or describe the contribution of human factors (Fletcher et al. 2004). In this study local level reporting systems were deemed likely to encounter similar problems. Even if some description of human behaviour were included, it was felt unlikely that the researcher would be able to be certain if these related to junior doctors, or other members of the team.

Observational techniques have been used in the development of behavioural marker systems for surgeons, anaesthetists and scrub practitioners (Fletcher et al. 2004; Yule, Flin, Paterson-Brown, Maran, et al. 2006; Mitchell 2011). The main disadvantage of this technique is related to feasibility. In this study the acute care events are relatively infrequent and unpredictable. In addition there are obvious ethical issues involved with allowing an inexperienced junior doctor to manage a challenging and stressful situation by themselves without the observer intervening. Whilst video recording real events has also been utilised in other research, the practical and legal issues surrounding this were deemed to be too great. Whilst observation of simulated scenarios could be utilised, there would be a danger that these may not always reflect 'real world' events. These scenarios are designed and steered by faculty, and whilst candidates frequently report high levels of realism, there is no guarantee that they are behaving as they would in real clinical environments.

Questioning techniques to identify NTS include interviews, focus groups and questionnaires and surveys. Questionnaires have been used to obtain useful information about practitioners' attitudes to NTS, or to CRM training, but have rarely been used to gather the initial empirical data to identify the skills themselves. Focus groups have been used to gather this data in anaesthetic nurse practitioners,

scrub nurses and neonatal resuscitation teams (Rutherford et al. 2012a; Mitchell et al. 2011; Thomas et al. 2004). Advantages of focus groups include the ways in which interactions between the group can increase the breadth and depth of information around a particular topic (Barbour 2005). Disadvantages that are frequently cited include the effect that group dynamics may have on some individuals within the group. There may be a reluctance to express honest and personal accounts in public. This may be particularly true if individuals feel they have underperformed and may prevent deep exploration of behavioural elements (Barbour 2005). There was felt to be a risk of this phenomenon for junior doctors who may have experienced highly challenging and stressful events with significant consequences. Whilst one-on-one interviews are not immune to these processes, if a confidential and safe environment can be created they can allow an in depth analysis of behaviour and cognitive processes (Lingard and Kennedy 2007). The choice of interview technique depends on several factors including the nature of data to be obtained, the candidates and also on issues of feasibility such as interviewee time constraints and interviewer experience.

After discussion with experienced researchers in this field the decision was made to use a method of semi-structured interview called a critical incident technique (CIT) as the mainstay for the data collection in this phase. It was felt that this method aligned with the research aims and methodology, the nature of the study population and would also meet feasibility requirements. This was used in combination with a literature review. The literature review would ascertain if any other research had been produced in this domain that would allow the identification of NTS. It is a recommended and recognised first step in the development of behavioural marker systems from healthcare and other industries (Flin et al. 2008). A short description of these two strategies and where they appear in the thesis is provided below.

Chapter 3 describes a systematic search of the literature that was performed to review the current understanding of the NTS of junior doctors in acute care. Studies were analysed using a process based on template analysis by two researchers, one of whom was an appropriately trained junior doctor. This started with an initial 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.

Chapter 4 describes a qualitative study involving 29 semi-structured interviews using a critical incident technique. Interviewees were FY1 and 2 doctors working across South East Scotland in medical and surgical wards. The interview involved them recalling a challenging scenario where they had managed an acutely unwell patient. 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 process of developing and refining a behavioural marker system normally involves a multi-disciplinary approach. In the aviation and healthcare sectors, a combination of psychologists with experience of NTS and ‘subject matter experts’ (usually experienced practitioners) have been used to achieve this process. This approach is taken to ensure that the NTS are accurately portrayed, but also that the tool can be understood and accepted by the practitioners it is intended for. Another approach that is frequently taken is to return to the original empirical data once changes to the taxonomy framework are made. This iterative approach confirms that any changes can be justified by the data.

Within this study it was difficult to identify who the subject matter experts should be. It was important that they would be individuals who would understand the working environment that the data was gathered from. In addition they should be able to help ensure that the tool would be acceptable to practitioners involved in training. Decisions about the design of this phase aligned with the overall aims of the research project and took into account practical and feasibility issues. They are discussed in more detail within the relevant section of the thesis:

Chapter 5 describes how the output from phase 1 and 2 was reviewed by a panel of six ‘subject matter experts’ in order to develop a behavioural marker system. This was an iterative process which involved several panel focus groups, whilst returning

to the interview transcripts and re-coding data to ensure the prototype remained true to the original data. The panel included clinicians from across different medical and surgical specialties with experience in supervising and training junior doctors. It also included several clinicians who had previously been involved with the development of behavioural marker systems in other healthcare settings.

2.5 Conclusion

This chapter has outlined the aims and method of this research, along with some guiding influences that have affected this process. The theoretical perspective of the researcher dictates that the process has a degree of subjectivity. The key influences of this subjective approach have been outlined and are mainly concerned with the aim of the research output to produce a tool that can benefit the performance of junior doctors in this setting.

The acknowledgement of these influences on the research process is in line with a constructivist approach. The concept of socially constructed meaning and multiple realities indicates that this research will produce output that should not be viewed as the definitive or only way of categorising and representing these skills. Furthermore, it is possible that as cultural and organisational factors change over time, there may be a need to adapt this tool. This research must therefore be seen as producing a prototype that can be developed and scrutinised by further research. However, by explicitly stating the influences of the development of this prototype, it is hoped that others can understand the underlying philosophy behind the research process and that this tool will have the desired utility and improve the performance of junior doctors in this critical domain.

The subsequent chapters describe the three phases in detail and their findings before presenting the final behavioural marker system.

Chapter 3: Literature Review

3.1 Introduction

This chapter begins the process of identifying the critical NTS required by junior doctors in the management of acutely unwell patients. The previous chapters have highlighted the importance of context specificity in the development of behavioural marker systems. In other words, it is not advisable to take a behavioural marker system developed for one purpose and apply it to another.

This review will therefore focus on the empirical evidence of the NTS that are specific for junior doctors managing critically unwell patients. It is possible that some of the NTS required by other healthcare professionals will be applicable to junior doctors. Equally, it may be that some of the NTS may transfer across the different roles of the junior doctor and that NTS for managing ward rounds, for example, may be similar to those for managing acutely unwell patients. However, this work adopts the stance that it cannot be assumed without evidence that any of these skills are transferable, particularly given the relative inexperience of newly qualified doctors, the variations in the tasks that are expected of them and the time critical and stressful nature of managing acutely unwell patients.

3.2 Aims

This literature review was conducted to search for and extract studies that identified the NTS of junior doctors in the management of acutely unwell patients. It aimed to analyse these studies in order to identify NTS categories for safe and effective performance that could help guide a NTS taxonomy or behavioural marker system in this critical domain. Although this analysis included the identification of exemplar behaviours and potentially element level skills, the main aim at this early stage in the research is to focus on the category level skills before further refinement at later stages in the research. Attention is paid not just to the skills themselves, but what we can learn about the importance of NTS for junior doctors within these critical and challenging contexts.

3.3 Method

The design of this literature review follows similar methods used to identify NTS in the literature specific to other specialties (Rutherford et al. 2012a; Yule, Flin, Paterson-Brown and Maran 2006; Fletcher et al. 2002; Mitchell and Flin 2008). It uses the generic classification of NTS categories put forward by Flin et al. to act as a framework for data identification and extraction (Flin et al. 2008). These categories include the cognitive skills of situation awareness and decision making, and the social skills of team work, leadership and communication. Personal resource skills such as coping with stress and fatigue have not been included in this review process, due to the fact that it is difficult to reliably judge performance in these areas from observations (Flin et al. 2003).

3.3.1 Search Strategy

The following online databases were searched using a standardised strategy: Medline, Embase, Cumulative Index to Nursing and Allied Health Care Literature, PsychINFO, Web of Science, Education Resources Information Centre and Scopus. The search terms and complete search strategy is described in appendix 1. Key words and Medical Subject Headings were generated around three categories in line with the research aims. The categories were:

- *Category 1: Non-technical skills:* Keywords were based on the descriptions of NTS categories as described by Flin et al (Flin et al. 2008) and by previous literature reviews on this subject for different specialties (Mitchell and Flin 2008; Fletcher et al. 2002; Yule, Flin, Paterson-Brown and Maran 2006; Rutherford et al. 2012a).
- *Category 2: Acute care:* A combination of appropriate Medical Subject Headings and Keywords were used to search for terms related to acute care.
- *Category 3: Junior doctor:* Keyword searches were based on search terms for junior doctor and all variations.

Results were combined to only include articles that were retrieved in all three categories, and limited to manuscripts published in English language. There were no date restrictions and the search was conducted in June 2012.

3.3.2 Inclusion criteria

The inclusion criteria are described in figure 3. The criteria are justified by the aim of the review, to identify which NTS are required by junior doctors in acute care scenarios.

1. The study must be primary empirical research
2. Study participants are “junior doctors” (not medical students or training grade doctors) or the data collected related to “junior doctors”. This is defined as doctors within two years of graduation.
3. The study must be relevant to NTS (areas related to communication, teamwork, leadership, situation awareness and decision-making)
4. The NTS described in the study must yield identifiable critical observable behaviours desirable for junior doctors in acute care scenarios.
5. The study must be relevant to the management of acutely unwell patients.

Figure 3: Inclusion criteria

Judgements as to the suitability of citations were made independently by researchers EM and MH, based on titles, abstracts or full content. Discrepancies were resolved by discussion until consensus was reached. In one case, an author was contacted to clarify the population used in the study (Kennedy et al. 2009).

3.3.3 Data extraction and quality indicators

Two researchers (EM, MH) independently undertook data extraction and quality scoring of all the studies that met the inclusion criteria. This was followed by discussion in order to identify any disagreements and reach a consensus. Data extraction was performed using an Excel spread sheet (Microsoft Office 2010) with the following categories:

- Author
- Title
- Country of Origin
- Population
- Sample Size
- Method(s) of data collection
- Categories of NTS under investigation
- Exemplar behaviours or skills identified
- Quality scoring

Any exemplar behaviours associated with safe and effective performance were independently coded using a method based on template analysis (King 2004). An *a priori* template of coding was developed from the generic NTS categories (communication, teamwork, situation awareness, leadership and decision-making) as described by Flin et al. (Flin et al. 2008). Simple descriptors were developed based on this literature to help with this process (see appendix 2). Researchers remained open to the possibility that new categories may exist. In other words, there may be behaviours or skills identified in the papers that seemed to fit the definition of NTS, but did not appear to fit under the generic categories of NTS that have been defined in the literature.

The quality of included studies was assessed using Buckley et al's Best Evidence in Medical Education Quality Indicators (BEMQI) (Buckley et al. 2009), (see appendix 3) whereby a score of 7 or greater suggests a study of sufficient quality. This scoring system was selected as it was suitable for assessing the varying research methods used in the included papers.

3.4 Results

The initial search identified 492 unique citations, which were reviewed by MH and EM (using EndNote Web 3.5). See figure 4 for flowchart of articles through the screening process. Consensus was agreed that seven met the inclusion criteria and were included in this study.

All studies were deemed of adequate quality according to the BEMQI criteria. The breakdown of quality scoring is found in the appendix 3. There were three studies from the UK (Tallentire et al. 2011; Tallentire et al. 2012a; Stewart 2008a), two from Canada (Kennedy et al. 2009; Kennedy and Regehr 2009), and one each from the USA (Wu et al. 2003) and Australia (O'Brien et al. 2001). They were qualitative, observation, in-depth interview, focus group or questionnaire based studies. All study populations included junior doctors as defined by the inclusion criteria.

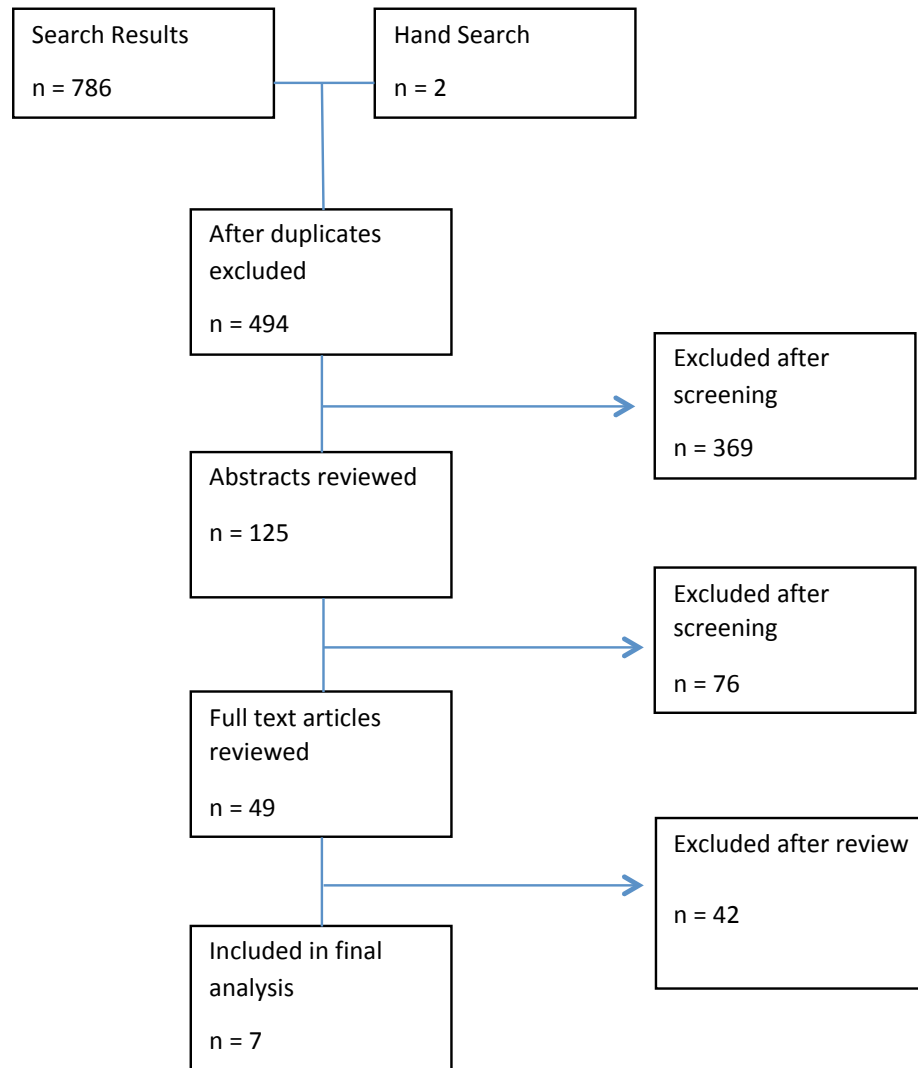


Figure 4: Results of systematic search

None of the papers referred to the identification of NTS in their primary research aims, but all contained data from two or more categories of NTS. Several of the studies did not focus exclusively on acute care (Stewart 2008a; Kennedy et al. 2009; Kennedy and Regehr 2009; Wu et al. 2003), but included data that was based on acute scenarios and were therefore deemed appropriate to be included.

There was some thematic homogeneity amongst the studies, with most studying the subjective experiences of junior doctors, reflected in common use of qualitative methods. Three studies focused on junior doctors accessing senior help (Kennedy et al. 2009; Kennedy and Regehr 2009; Stewart 2008a), two on the errors made by

junior doctors (Wu et al. 2003; Tallentire et al. 2012a), whilst the remaining two focused on behaviours of junior doctors during real or simulated practice (Tallentire et al. 2011; O'Brien et al. 2001).

The process of data analysis for exemplar behaviours involved considerable discussion between researchers. The main points of discussion focussed on how to differentiate between certain categories, such as team working, leadership and communication. This led to an improved clarity of understanding of the descriptors for each category.

Exemplar behaviours were identified from five of the studies that both researchers agreed did not fit the *a priori* template developed from the literature (Flin et al. 2008). These behaviours all related to an awareness of limitations or roles, and were coded in a new category. Table 2 gives an overview of the categories of NTS identified from the data in each study.

Authors	Research Question/Aim	Origin	Methods used	Population & Sample size
O'Brien et al. 2001	To identify effects of a simulator education program on interns' perceptions of their own performance in managing a real or simulated cardiac arrest.	Australia	Interviews De-briefing sessions	30 interns
Kennedy et al. 2009	To explore the pressure on medical trainees to be independent and implications for patient safety.	Canada	Observation Interviews	Observation: Emergency medicine and general medicine wards. Interviews: 19 Attending doctors, 13 residents, 4 medical students
Kennedy & Regehr 2009	To develop a conceptual framework of the influences on medical trainees' decisions regarding requests for clinical support	Canada	Observation Interviews	Observation: Emergency medicine and general medicine wards. Interviews: 19 Attending doctors, 13 residents, 4 medical students
Stewart 2008a	To identify what influences a junior doctor's judgement to contact a senior.	UK	Observation Interviews	21 pre-registration house offices
Tallentire et al. 2011	To investigate the factors that influence the behaviour of junior doctors in acute care context	UK	Focus groups	11 FY1s, 12 FY2s, 13 senior doctors
Tallentire et al. 2012a	To investigate errors made by junior doctors in simulated acute care settings.	UK	Observation and Debriefing	38 junior doctors
Wu et al. 2003	To investigate what type of mistakes junior doctors made and what they learned from this.	USA	Questionnaire	254 junior residents

Table 1: Details of included studies

Study	Situation Awareness	Decision-Making	Teamwork	Communication	Leadership	Roles and Limitations
O'Brien et al. 2001	X	X	X	X	X	X
Kennedy et al. 2009	X	X				X
Kennedy & Regehr 2009	X	X				X
Stewart 2008	X	X				
Wu et al. 2003	X					X
Tallentire et al. 2011	X	X				X
Tallentire et al. 2012a	X					

Table 2: NTS categories identified in the included studies

3.5 Category level results and discussion

The main results of the category level findings are discussed below. This is a summary of the data that was coded under each category during the analysis phase, with the aim of portraying to the reader the significance of this category and how it relates specifically to junior doctors and acute care. Table 3 provides some examples of the data collected in each category that this discussion is based on.

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 and 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 3: Examples of data from the literature extracted for each category.

3.5.1 Situation Awareness

Situation awareness has been defined as ‘the perception of the elements in the environment within a volume of time and space, the comprehension of their meaning and the projection of their status in the near future (Endsley 1995)’. This category of NTS is frequently conceptualised in three stages: gathering information, interpreting information and anticipating future states (Flin et al. 2008; Endsley 1995). Current understanding of cognitive architecture suggests that situation awareness is formed within the limited capacity of working memory.

There are several reasons why this skill may be particularly challenging for a relatively inexperienced junior doctor. Firstly the cognitive load of tasks including technical skills is higher for the less experienced novice, and they may be unable to free up working memory for situation awareness. Secondly situation awareness itself is likely to require more time and mental energy for the novice, who has less experience in allowing pattern recognition to aid in the interpretative phase (Flin et al. 2008; Endsley 1995). In other words, novices require more brain space to interpret findings, but have less of it available because they cannot do things on 'autopilot'.

Several of the studies in this review support this theory, reporting on errors and mistakes that appear to be attributed to a lack of situation awareness (Tallentire et al. 2012a; Wu et al. 2003). Wu et al. describe how 'paying attention to detail', and checking information personally at the information gathering stage may help to prevent these errors (Wu et al. 2003). Tallentire et al. describe the importance of a systematic approach to information gathering and the difficulties that junior doctors have in the practical application of this approach (Tallentire et al. 2011).

In a study of simulated acute medical emergencies, junior doctors were observed to make frequent 'rule based mistakes', where candidates applied the wrong rules to a clinical situation (Tallentire et al. 2012a). For example, they described a junior doctor giving fluid slowly to avoid heart failure, when the findings pointed clearly towards sepsis and hypovolaemia. The explanations provided by the junior doctors would suggest that many of these arise from a lack of, or poor interpretation of the clinical signs that were clearly present. O'Brien et al. mentions that junior doctors report the need to 'stop' and think when managing acutely unwell patients (O'Brien et al. 2001). This supports the idea that the interpretative phase has a high cognitive load for the novice and by explicitly pausing activities for a moment they may be able to improve their situation awareness by freeing up working memory.

The need for junior doctors to consider consequences and use projection in order to determine urgency was reported in the studies looking at decisions to call more senior doctors (Sargeant 2008; Kennedy and Regehr 2009; Kennedy et al. 2009).

The limited reserves of working memory may require us to promote a more distributed approach to situation awareness as is suggested by Tallentire et al (Tallentire et al. 2012a). Here the sharing of information, ideas and projections within teams is encouraged (Fioratou et al. 2010). Further evidence for the importance of sharing situation awareness is discussed within the teamwork section of this review.

3.5.2 Decision Making

There is a wealth of literature investigating the process of reaching a judgement or selecting an option within high-risk and time pressured environments. The majority of these have focussed on the cognitive processes of experts and suggest that different circumstances may require different methods of decision making such as rule based, intuitive, analytical or creative (Flin et al. 2008; Croskerry 2005; Flin et al. 2007; Croskerry 2009).

The decisions that are required by junior doctors are often around generating options for initial investigations, basic management and escalation of care, and prioritising between these three areas with limited resources, time and information. The challenge for the novice junior doctor is that low cognitive load decision making techniques, such as intuitive decision making, may come at a higher risk given their lack of experience (Croskerry 2009). However, they may not have the cognitive reserve or experience to apply analytical or creative thought processes to these demanding situations.

Five studies in this review include data that can contribute to our understanding of the cognitive processes and desirable behaviour within this context (Kennedy et al. 2009; Kennedy and Regehr 2009; O'Brien et al. 2001; Stewart 2008a; Tallentire et al. 2011).

Three of the studies report specifically on the process of judging if senior help or escalation of care is required (Kennedy et al. 2009; Stewart 2008a; Kennedy and Regehr 2009), with other studies confirming this process as a critical decision for junior doctors (Tallentire et al. 2011; Wu et al. 2003). In general there is agreement

that this is a complex process and involves the balance between competing influences, motivations and overcoming significant barriers. These include the desire to demonstrate independence, to act responsibly, to avoid interfering with colleagues' productivity and to overcome the cultural barriers of a hierarchical healthcare system where contacting seniors can be seen as a failure. Whilst the interaction between competing demands is beyond the scope of this review, it appears that the critical behaviour for the junior doctor is to ensure that concerns about patient care should 'trump other factors' (Kennedy et al. 2009; Stewart 2008a; Kennedy and Regehr 2009).

Interestingly, Tallentire et al. report a reluctance to make any decisions at all amongst some junior doctors (Tallentire et al. 2011). There is a suggestion that they may decide to focus on the completion of a task they know they can perform, rather than attempt to decide on a treatment or action they are uncertain about.

Evidence of fixation errors are provided from junior doctors' focus group data of the same study (Tallentire et al. 2011). The inability to change decisions even when evidence accumulates to suggest it is incorrect, may reflect a lack of outcome review process. It is also possible that it is due to the insufficient cognitive reserve of the junior doctor who is overwhelmed by stress, unfamiliar environments and the demands of technical tasks that cannot yet be performed with automaticity.

3.5.3 Teamwork

Junior doctors often rotate through different medical and surgical specialties and may be required to cover multiple hospital wards especially during out of hours cover. This means that they frequently find themselves managing an acutely unwell patient with unfamiliar teams and environments.

In reflecting on real and simulated scenarios, junior doctors in the study by O'Brien et al. describe the importance of introducing yourself to nursing staff, and establishing roles for effective teamwork (O'Brien et al. 2001). They also report the importance of not overloading nursing staff with tasks. This may be particularly

pertinent in the early stages of management, where there may be limited staff and resources available.

O'Brien et al. also demonstrates the importance of discussing “with people around what is going on” and communicating concerns (O'Brien et al. 2001). There is support from other domains for this type of behaviour where sharing ‘mental models’ or shared situation awareness encourages safe and effective teamwork (Mathieu et al. 2000). It is similar to the concept of distributed situation awareness and decision making referred to by Tallentire et al (Tallentire et al. 2012a).

Despite the importance of team working skills for junior doctors there is some evidence within the studies that this behaviour is challenging for them. For example, if sharing situation awareness is perceived to reveal a lack of understanding or an inability to make a decision, then there may be considerable resistance to this behaviour, despite its importance for patient care (Kennedy et al. 2009). In other words, admitting you don't know what you are doing may be important for patient care, but may not be seen as a desirable behaviour to exhibit in front of colleagues.

3.5.4 Leadership

Leadership skills have been linked with improvements in markers of safe and effective performance in healthcare and across other professions, and there is a lot of literature discussing the skills, principles and importance of effective leadership within time critical and stressful conditions (Flin et al. 2008; Flin et al. 2002; Flin and Yule 2004; Day et al. 2004).

However, the role and types of leadership skills for inexperienced newly qualified doctors is uncertain. As escalation of care takes place, team members with increasing clinical experience can arrive and the likely shifts in leadership could be confusing and potentially threaten patient safety.

Junior doctors in the study by O'Brien et al. reflect on real and simulated scenarios and confirm that establishing a leader (often explicitly) who can delegate specific roles is fundamental to effective management (O'Brien et al. 2001).

The dynamics and requirement of leadership skills for junior doctors in this context is not well documented. Given their inexperience and the prevalent culture of medical hierarchy, it is unlikely that they would have much of a role as leader once more senior experienced help has arrived. However, perhaps they could play a part in the explicit identification of a leader.

In recent years there has been an increasing interest in the skills of followership (Grint and Holt 2011; Collinson 2006). These skills relate to ways in which ‘followers’ can engage constructively in critical thinking, interact and provide support for leaders. Further research is required for us to understand the leadership or followership skills that we should be encouraging in junior doctors to improve performance in these scenarios.

3.5.5 Communication

Communication can be seen as the sending and receiving of information, feedback or response, ideas or feelings (Flin et al. 2008). The fallibility of communication and its impact on error are well documented (Flin et al. 2008; Lingard et al. 2004; Greenberg et al. 2007).

However, we have found very limited evidence of the specific communication skills related to safe and effective performance by junior doctors in acute care settings.

Junior interns in the study by O’Brien et al. identify that poor communication is a source of concern and that there is a lack of confidence in the ability to communicate effectively, particularly to senior colleagues. They describe how ‘open communication’ reflects positively on perceived performance and that it is important to be concise and communicate your concerns effectively using salient points in order to demonstrate the imminent instability of a patient (O’Brien et al. 2001).

The skill of providing concise information is likely to be important for several reasons. Firstly, it may be harder to pick out the key points if they are presented in a large volume of less important information. Secondly the process of sending and receiving information requires attention and demands considerable cognitive resource (particularly for the novice) that cannot be put to other uses (Flin et al.

2008). However, this is likely to be a skill that the novice finds difficult and it is integral to the other NTS that have already been discussed. If a doctor has poor situation awareness they may not know what the salient points are, and encouraging brevity could lead to them missing out key information.

3.5.6 Awareness of role and limitations

Several of the studies in this review discussed behaviours that related to an awareness of the roles and limitations of junior doctors (Kennedy et al. 2009; Tallentire et al. 2011; Kennedy and Regehr 2009; O'Brien et al. 2001). For example, Kennedy et al. discusses at length the difficulties, but importance of admitting that you are beyond your limits and 'don't know what to do' as a junior doctor (Kennedy and Regehr 2009). Although this process is likely to have strong links with situation awareness, it also involves an understanding and acceptance of personal limitations, expectations and roles. This may be especially important for a newly qualified doctor rotating to different specialties where roles and expectations can change significantly from one week to the next.

Wu et al., Tallentire et al. and O'Brien et al. describe how newly qualified doctors report the importance of taking responsibility for decisions and actions that are required of them (Tallentire et al. 2011; Wu et al. 2003; O'Brien et al. 2001).

Whilst these behaviours may be associated with safe and effective performance, it is uncertain if they should be conceptualised as representing a category of NTS. The literature suggests that these behaviours are strongly influenced by external factors such as workplace culture and the impact of transitioning from medical student to junior doctor (Kennedy et al. 2009; Stewart 2008a; Kennedy and Regehr 2009). Several of the studies in this review explain these behaviours using situated learning theory (Lave and Wenger 1991; Tallentire et al. 2011; Kennedy et al. 2009). Lave and Wenger describe how the apprentice strives to become a member of a 'community of practise' and the identity that this entails. They suggest that junior doctors see their medical community of practise as one that operates with independence and without the need to seek to help. In seeking to embrace this identity the junior doctors can potentially compromise patient safety. There is a

similar concept described in the medical educational literature as the ‘hidden curriculum’ (Anderson 1992). This describes learning that is outwith the formal curriculum. Different learning processes have been described, including the acceptance of hierarchy and the acceptance of ethical integrity (Lempp and Seale 2004). It is concerning that for some junior doctors and senior medical students, the hidden curriculum may be encouraging operating beyond their level of experience and not admitting you are out of your depth.

If performance in this category is purely a reflection or a symptom of these external influences then it may not be helpful or valid to view them as a ‘skill’ that a junior doctor can obtain. However, if we acknowledge these behaviours are important and encourage them, then maybe we could remove some of the cultural barriers that influence them. For example, if we can demonstrate that explicitly stating you are out of your depth is associated with improved performance and forms part of an accepted behavioural marker system, then perhaps this behaviour will be encouraged in workplace culture and this in turn will remove some of the negative connotations associated with it.

3.6 Limitations

This review extracted data from a small number of studies, which were not specifically designed to investigate NTS. For this reason the results of any exemplar behaviours, elements or categories of NTS that have been identified must be done so with caution. This as a limitation of the available data and an indication that further research in this area is required. In using two researchers to independently analyse the data it is hoped that this has minimised the potential to misreport any of the findings.

Only studies that investigate the NTS of junior doctors within the context of acute care have been included in this review. It is possible that some NTS relating to different participants and different domains may be relevant. However, the literature on this topic has advised us to be cautious in assuming that these issues may extrapolate directly between different contexts (Flin et al. 2008; Yule et al. 2008; Fletcher et al. 2003; Mitchell et al. 2012). As discussed in the introduction to this

chapter, the relative inexperience of a junior doctor combined with the time critical and highly challenging nature of acute care may impact on the cognitive processes and social skills in a way that requires us to define these skills specifically within the context described.

3.7 Conclusion

In this review no behavioural marker systems or taxonomies of NTS were identified that were specifically designed for the NTS of junior doctors within the context of acute care. The included studies have demonstrated some data that helps us to understand the NTS that are important in this context. Evidence for skills and behaviours that fall under all five of the generic skill categories as described by Flin et al. have been identified (Flin et al. 2008). In addition, behaviours relating to the role and limitations of a junior doctor may form part of the NTS that are required of them, but do not fit clearly under these five generic categories.

This review has been useful in demonstrating the importance of NTS for junior doctors, and in identifying categories of NTS that may be required. However, it has revealed a lack of research that has been specifically designed to investigate the NTS within these contexts. Further work, including task analysis is required to formally identify the critical NTS for junior doctors in acute care in order to construct a taxonomy and subsequent behavioural marker system.

Chapter 4: Interview Study

4.1 Introduction

The previous chapter demonstrated no published research that has developed a NTS taxonomy or behavioural marker system specifically for junior doctors and acute care. Whilst it provided some evidence for the importance and nature of these skills, it revealed a lack of studies designed specifically to identify the NTS in this context.

This chapter presents an interview study to identify the NTS for junior doctors in the management of acutely unwell patients. The justification for the use of interviews as opposed to other methods of task analysis is described in chapters 1 and 2.

4.2 Aims

The aim of this interview study was to identify the NTS required by junior doctors to safely and effectively manage critically unwell patients. More specifically it was designed to ascertain how these skills could be categorised, and if they appeared to fit with the current understanding of the NTS categories from the literature review. Whilst this process identified potential exemplar behaviours and element level skills, the main aim at this stage in the research was to focus on the category level skills before further refinement at the next stage of the research process.

4.3 Methods

This study was conducted using semi-structured interviews with junior doctors between April and November 2012. Ethical approval was deemed not to be required by the South East Scotland Research Ethics Service and informed written consent for audio recordings and the publication of anonymised results was obtained from all participants (see appendix 4 for ethics confirmation and appendix 5 for consent form).

4.3.1 Sampling and Data Collection

Twenty-nine junior doctors in their first two years of postgraduate training (FY1 and FY2) were recruited from across South East Scotland. Purposive sampling was used with the aim of interviewing FY doctors from a variety of central teaching and district general hospitals and medical and surgical specialties in the region. To

achieve this, EM presented a brief overview of the project and an invitation to attend an interview at seven of the acute hospitals in the deanery during timetabled lunchtime training sessions. Sample size was based on previous studies to identify NTS in healthcare professions (Fletcher et al. 2004; Yule, Flin, Paterson-Brown, Maran, et al. 2006), where it appeared that between 25-30 interviews would be required in order to extract sufficient detail about each category of NTS to develop a valid behavioural marker system.

Participants were sent pre-interview information about the purpose and requirements of the study via email (see appendix 6). This included a brief outline of the project and asked them to recall a challenging and memorable occasion when they managed a critically unwell patient as an FY doctor.

Interviews took place in a suitable undisturbed location within the hospital that the FY doctor was currently working and took between 45 and 100 minutes.

4.3.2 Interview Structure

The interview was based on a critical incident technique (CIT). It was first described by Flanagan et al. for the analysis of fighter pilot performances during World War II (Flanagan 1954). CIT has been widely used in studies to identify NTS within high-risk industries including healthcare (Rutherford et al. 2012b; Mitchell et al. 2011).

There are different adaptations and interpretations of the technique within the literature, but the basic principle involves participants recalling a challenging experience, with probing questions to explore behavioural or cognitive aspects.

Whilst it is not immune to the effects of memory bias or other factors affecting recall accuracy, challenging events are rich sources of data and are often remembered with vivid detail by the subjects. Behaviours and cognitive processes that are elicited are anchored to a real event, rather than inquiring about these skills in general. It is believed this allows the interviewer to uncover tacit knowledge and thought processes that may be more relevant to naturalistic performance (Flin et al. 2008; Flanagan 1954; Klein et al. 1989).

The ‘Critical Decision’ (CD) method described by Klein et al. is based on Flanagan’s CIT, but uses a series of stages or ‘sweeps’ where the interviewee recalls and reflects

on the experience a number of times in the same interview (Klein et al. 1989). This allows the identification of critical cues and decision points. Although initially developed to focus on the cognitive or decision making processes, it has also been successful at eliciting relevant social and personal resource skills in other studies to identify NTS (Fletcher et al. 2004; Flin et al. 2007).

An interview schedule (see appendix 7) was developed as a guide for data collection. Each interview was preceded by an initial introduction, explanation of proceedings, assurance of confidentiality and written consent. Explanations and assurance of confidentiality were particularly important in order to ensure that consent was informed and that candidates were comfortable to discuss these memorable incidents openly and honestly. It included explicitly explaining that the interviewer was not trying to judge performances, but was interested in the subjects' honest recollections of what the experience was like, and what was required of them in this challenging scenario.

Four 'sweeps' of the scenario were performed based on the description by Klein (Klein et al. 1989), allowing a deeper understanding of the cognitive and social processes used by the participant.

Sweep 1- Uninterrupted description: The participant described the incident in as much detail as possible from beginning to end. (Stage 1 in schedule)

Sweep 2- Filling in the gaps: The interviewer verified the description to check understanding and allow the interviewee to identify any gaps or mistakes. Critical points were expanded upon using probe questions. (Stage 2 in schedule)

Sweep 3- Expanding: The interviewer went through the event again, this time with probing questions aimed at identifying the categories of cognitive and social NTS. (Stage 3 in schedule)

Sweep 4- 'What if' queries: The interviewer discussed hypothetical variations of the scenario in order to get a better understanding of the thought processes and actions that are required of junior doctors in these situations. It also

included asking interviewees what advice they would give to other FY doctors managing similar scenarios. (Stage 4 in schedule)

The structure of questions within sweep 3 were based around the current categories of generic NTS from the literature. In addition to these questions, background demographics of the candidates were collected including age, graduating University and the location and specialty of all junior doctor posts to date. Information regarding the scenario location, time of day and type of ward was also gathered. This information was used to guide purposive sampling so that the data reflected experiences of doctors managing emergencies on medical and surgical wards in district general and teaching hospitals.

Two pilot interviews were performed by the clinician researcher EM and transcribed. Advice on structure and technique was provided by RG and NM who had conducted NTS research in other healthcare domains and MH, an FY1 with a previous degree in psychology and experience in qualitative research.

4.3.3 Data Analysis

All interviews were transcribed and underwent a modified template analysis process (King 2004). This method of thematic analysis is particularly suited to hierarchical coding, where existing understanding of the topic can be used to develop *a priori* themes. It typically follows an iterative approach where the researchers remain open to the need to refine the template and that new categories may be required in order to capture the data.

The initial template for coding the interview included five categories of NTS: situation awareness, decision making, teamwork, communication, and leadership. The selection and description of categories was based on the generic template described by Flin et al. The decision was made not to start with the additional category of ‘awareness of roles and limitations’ that was identified in the literature review. This was based on the fact that the studies included in the review were not specifically designed to elicit NTS and the uncertainty about the scope of NTS and the conceptualisation of this as a useful and included category of ‘skill’ as described in chapter 3 (section 3.5.6).

A coding protocol with simple descriptors was developed and updated for this process (see appendix 8). Initial coding of the data was performed by two researchers (EM and MH) using the software NVivo. Meaningful phrases representing NTS were indexed into the template whilst remaining open that new categories may exist. An example of this coding process demonstrating the items that were coded individually is provided in appendix 8. Where the data did not fit the *a priori* template new categories and descriptors were developed. This process took into account the categories that had been identified in the literature review process (chapter 3) and also the descriptions of other categories successfully deployed in behavioural marker systems for other healthcare professionals (Fletcher et al. 2004; Yule, Flin, Paterson-Brown, Maran, et al. 2006; Mitchell 2011). This process included frequent discussions to deepen understanding and to reach consensus in the addition of new categories and their descriptors.

4.4 Results

Although timing interviews around the shift patterns of the junior doctors was difficult, the interviews were extremely successful resulting in rich and often lengthy accounts of challenging clinical situations that have been faced by junior doctors. In general, candidates remembered these events vividly and appeared to have little problem in recalling their thought processes, feelings and behaviour.

4.4.1 Candidate and Critical Incident Details

Twenty-nine 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 4 and 5.

Candidates had graduated from seven different Universities from across the UK, and one from elsewhere in Europe. Scenarios took place in the medical, surgical and orthopaedic wards of the six acute care hospitals across South East Scotland. The critical incidents that were chosen by interviewees all involved unwell inpatients that initially were not in cardiac arrest. Several, but not all scenarios progressed to patient

cardiac arrest. Only ten of the 29 events took place within Monday to Friday 9am to 5pm hours.

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 [†]

Table 4: Participant details. [†]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 5: Scenario details by location, timing and description.

4.4.2 Categories of NTS Identified

Meaningful phrases or 'items' were coded deductively into all of the five generic categories of NTS described by Flin et al. Both researchers identified items that did not fit clearly into any of these *a priori* categories, and were coded inductively. They were grouped into themes that may represent additional categories of NTS. After reviewing these items and discussing between coders, new categories and their descriptors were developed. It was felt that some of these items represented a category of 'Task Management'. This is a category that features in other behavioural

marker systems (Fletcher et al. 2004), but was not included in the initial generic classification described by Flin et al. Another grouping of items fell under the category of 'Coping with Stress and Fatigue'. This was not included in the initial template due to the difficulties in observing these behaviours, making it unsuitable for a behavioural marker system. However, the junior doctors described performance behaviours regularly that related to stress and fatigue. It was therefore decided to include this category at this stage, and further discussions in phase 2 would be used to ascertain if any observable behaviours could or should be included in the final behavioural marker system.

There was considerable discussion between coders about the remaining items that did not fit well into categories. It led to the development of three further categories: Accepting responsibility, awareness of roles and limitations and knowing your environment. Further details of these categories and the items within them are discussed further below.

Category	Descriptor
Communication	Exchange of information, feedback, ideas or feelings. It should include the sending and receiving of information, and identifying and addressing barriers to effective communication
Decision Making	The process of reaching a judgement or choosing a course of action to meet the needs of a given situation. It should include the generation of different options, the selection of an option and the reviewing of decisions that have been made.
Leadership	The behaviours and strategies adopted by the team leader that influence how and whether the team achieves its objective. This may include skills relating to leading, asserting one's position, directing others, allocating tasks and organising team structure.
Situation Awareness	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 patient, charts, communication and behaviour of co-workers, etc.
Teamwork	The skill of working with others in a team context. This category includes skills required for working effectively in a group. It may include supporting others, resolving conflict and co-ordinating activities.
Task Management (added category)	The skill of management of resources and organisation of tasks to achieve goals. This may include skills relating to planning and preparation, prioritisation, providing and maintaining standards and the identification and utilisation of resources.
Coping with Stress and Fatigue (added category)	Coping with pressure, managing stress and fatigue. This may include skills relating to the identification of symptoms of stress and fatigue, recognising their significance and adopting coping strategies.
Accepting Responsibility (added category)	Skills that relate to an acknowledgment of professional responsibility. It should include behaviour that accepts appropriate responsibility and does not shirk tasks, procedures, or actions that are appropriate for the professional role of a junior doctor.
Awareness of Role and Limitations (added category)	Skills that relate to an understanding of one's own limitations. It should include behaviour that accepts the appropriate limits of knowledge, experience and or capabilities in managing scenarios.
Knowing your environment (added category)	Skills that relate to the acknowledgement of the importance of knowing the environment (such as hospital procedures, protocols, equipment, layout, etc.). It should include behaviour that seeks to clarify and obtain this environmental knowledge and understanding.

Table 6: Final categories and their agreed descriptors following interview coding and analysis

4.5 Category level results and discussion

The next section describes the results of each category with some examples of items from the data. It also provides some discussion of the significance and implications of each category. It is not meant to give a complete overview of the categories, as the structure and content of the framework is expected to change with the subsequent steps of the refinement process. In other words, a comprehensive understanding of each category will be more appropriate once the final taxonomy has been developed, and will be aided by the selection of positive and negative exemplar behaviours.

Instead, areas of interest within the categories that are critical to the next step in the development process are discussed. These include areas where there appeared to be overlap between categories, or where the items identified clarified or challenged the understanding of the category, or of the scope of what can be conceptualised as a NTS.

4.5.1 Communication

Interview items from this category most commonly referred to communication between the junior doctor and nursing staff or more senior clinicians or (to a lesser extent) between fellow FY doctors.

There were items concerned with the effective sending and receiving of information, and with overcoming common barriers, including organisational and personal factors. These barriers often referred to the ability to be appropriately assertive in a hierarchical organisation.

A few examples of this category follow:

“if we had just been more clear (with) instructions, you know and ask to move the chair out the way or the bed out the way”(FY14)

“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” (FY2)

“I mean if I’d had someone to talk to, phone right away I probably would have phoned them quicker, but phoning the medical registrar is a real big hurdle as that is kind of the top person in the hospital at night, and there was no one else to phone so you have to in my head then, I’ve since adjusted that a little bit, but then there was a barrier” (FY3)

The last transcript quote here refers to the need to overcome barriers to communication hierarchy, and challenges the scope of what can be defined as NTS. Can and should junior doctors be expected to overcome this hierarchical barrier? Is this challenge insurmountable, and is this item a symptom of the organisational culture that is hindering the NTS of our junior doctors, rather than representing a skill that we must nurture? This question is not easy to answer. It could be that encouraging junior doctors to ‘speak up’ the hierarchical gradient is setting them up for failure, or it could be that this is a necessary approach to change the culture itself. Perhaps conceptualising this as a skill may help to promote a ‘bottom up’ approach to culture change. Evidence would suggest that junior doctors can be influential in cultural shift and be seen as ‘agents of change’ in this process (Ibrahim et al. 2013). In the aviation industry, considerable effort and training has been directed at getting junior co-pilots to ‘speak up’ to more senior pilots after accident investigations revealed that this hierarchical barrier has been linked with several major fatal accidents (Flin et al. 2008). These interventions make explicit the type of desirable behaviour required in speaking up, and have been adopted by other high reliability organisations, and some areas of healthcare with some success (Macready 1999).

4.5.2 Teamwork

Items in this category included those related to supporting others, co-ordinating activities, solving potential conflicts and effective exchanging of information within the team. In addition the importance of a good rapport with the members of the team and the positive effect this had was also acknowledged. Some examples follow:

“divvying up the tasks like you get access, I’ll get bloods, you do that you know so everybody knew what everybody else was doing.(FY26)”

“I guess already having a relationship with people helps you know because they are more willing to help you if you get on

with them and also it was not only my sickest patient on the ward but it was their sickest patient as well(FY4)”

“I think I got a nurse as well to just feel to make sure that they thought and people around said you know he definitely has a pulse..you just want reassurance that they definitely have got a pulse, they are breathing...it just gave me that reassurance that cause I was kind of doubting myself a little(FY19)”

“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.(FY4)”

Many of these items were similar to those that have been identified in the literature as successful components of teamwork and that have formed part of the successful team training programmes that were discussed in chapter 1(Armour Forse et al. 2011; Mazzocco et al. 2009). For example, the importance of a ‘shared mental model’ in successful teams has been well documented in the Team Steps programme and by the work of Mazzocco et al. (Mazzocco et al. 2009).

4.5.3 Leadership

Leadership items often referred to the need to be appropriately assertive and the difficulties in doing this as a junior doctor.

Examples include:

“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(FY20)”

“I don’t know why it bothers me so much, but don’t be afraid of coming across as bossy you know when you are asking nurses to do things in an acute situation, I mean I wouldn’t go around the ward barking orders normally (laughs) but if there is someone sick and you need things done then.....then you should just ask and you shouldn’t feel worried about asking people to do jobs for you(FY23)”

When junior doctors were asked who was in charge during a scenario, answers varied. They often described how this would change depending on who was there, and how the person in charge would shift as more senior people arrived on the scene. Despite this, the need for leadership during these scenarios was frequently acknowledged by the junior doctors and is well supported by the literature (Day et al. 2004; Baker et al. 2005). Whilst the junior doctors may lack the experience to take a leadership role, perhaps they can be involved in the process of explicitly recognising a need for leadership and identifying an appropriate person to provide this. As discussed in the previous chapter, there may be a benefit to view the skills of junior doctors under a framework of followership rather than leadership (Grint and Holt 2011).

4.5.4 Situation Awareness

Examples of information gathering, interpretation and anticipating future states were all found in the data. It included the gathering of information from various sources such as the observation chart, patient and nursing staff. An overview and understanding of the rate of deterioration seemed to be appreciated as important. There was also frequent reference to the ‘structured approach’ (A-E) being particularly important for gathering information effectively. This refers to the systematic assessment of the patient, starting from Airway and moving through to Breathing, Circulation, Disability and Exposure. A few examples included:

“looking at the OBS chart to see how things had been progressing throughout the day, and going back through sort of...back through the notes for that day as well, and erm, I think the main thing was that she had this abdominal pain and hadn’t been settling with this continuous dose....of opiates (long pause),.....and yeah, that’s what was really worrying. (Pause)and erm getting the history from the nurses that she was more alert and brighter sort of during the day and now she was more....she was quite obtunded and a bit drowsy, and not really speaking.....(FY1)”

“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.(FY25)”

“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(FY20)”

Many of these items fit with discussions of this category in the previous chapter, and the significant amount of literature regarding situation awareness. As discussed, it is likely that the stress, time criticality and lack of automaticity of these novice practitioners may reduce the amount of working memory available for the interpretative and projectory levels of situation awareness (Endsley 1995). Providing a framework for information gathering such as the ‘A-E assessment’ is a technique that is not unique to medicine. Within aviation training, a similar technique referred to as active scanning has been employed to improve situation awareness whereby a structured approach for gathering information from the complex array of instruments is used in an attempt to improve information gathering (Flin et al. 2008; FAA 2013).

4.5.5 Decision Making

Items included in this category contained decisions about diagnosis, investigations, treatment and perhaps most importantly about the escalation of care, or ‘calling for help’. It was noted by both coders that decisions were frequently binary. In other words, rather than considering the relative pros and cons of several different treatment options, the junior doctors were deciding on whether to give a drug or not, or whether to phone for help or not. The content of this judgement process and the factors that the junior doctors were balancing was extremely interesting, and did not always appear to relate to the patient’s condition or best interests.

Some examples of this category are:

(with reference to inserting a guedel in an unconscious patient with partially obstructed airway whilst waiting for the arrest team) “should I try it...I just kept focussing on we just just need to go for it basically.....and I thought well it’s something, putting a guedel in then I thought what’s the worst that can happen if the patient’s uncomfortable and if he kind of starts coughing or choking then I thought obviously maybe that’s a good sign as he is obviously more conscious than I thought(FY1)”

“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(FY4)”

“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.(FY7)”

“I knew you shouldn’t have this in your mind....but you think you can stabilise the patient....but you kind of want to make them a little bit better (laughs) before someone comes in(FY17)”

“if you have a resource then you’d be stupid not to use it, and if it’s because of your own arrogance essentially then that’s not the right reason(FY24)”

Whilst the primary aim of this research is to focus on the desirable behaviour or required skills for safe and effective performance, the underlying factors that influence these behaviours can also be seen within the data. Influences on decision making of junior doctors and factors that affect their behaviour have been studied elsewhere. Kennedy et al. describes how powerful these influences are on decision making and divides them into two main types; organisational and individual factors (Kennedy et al. 2009). Individual factors include the junior doctors’ desire to demonstrate their performance to colleagues and develop as an independent practitioner who is not seen as overly reliant on senior help. Organisational factors include the culture and hierarchical structure of the medical profession. Examples of both of these factors were noted by the researchers in this study during coding of the decision making category, particularly within decisions to escalate care. In a very similar way to the issue of ‘speaking up’ described under the communication section, it is difficult to know the extent to which performance here is purely a symptom of the organisational factors or can be viewed as a skill that the junior doctor can obtain. The decision of a junior doctor to escalate care at an early stage, is perhaps one of the most critical factors that can prevent avoidable patient mortality and morbidity (Mcquillan et al. 1998; Findlay et al. 2012). If we could promote this as a skill in a behavioural marker system that is observable and explicitly recognised by senior clinicians, then perhaps it would become a more desirable behaviour for junior

doctors. In other words, if ‘good performance’ of junior doctors was seen as early escalation of care rather than ‘struggling on’ without contacting a senior, then it could help to remove some of the negative impacts of external factors on behaviour.

4.5.6 Task Management

During the coding of the first interview it was noted by both researchers that there were items that related particularly to prioritisation, organisation of tasks and the identification of resources that appeared to be critical to the safe and effective performance of junior doctors. After discussion and reviewing of further interview data, it was agreed that the category of task management that has been successfully utilised in other behavioural marker systems would be appropriate to categorise the data (Fletcher et al. 2004; Yule, Flin, Paterson-Brown, Maran, et al. 2006; Mitchell 2011).

Phrases coded under task management included the prioritisation of tasks, and also the identification and utilisation of resources. Whilst resources included equipment, it most commonly referred to other members of the medical team that could be involved in helping with the scenario. Within prioritisation, the junior doctors often described using a structured A-E approach to prioritise and organise tasks.

Examples include:

“always remember being told when we were going through acute care situations that the ABCDE situation is very good but I remember having it drilled into you that you can’t just work through ABCDE and that if you find a problem with A you should do something about it before moving on(FY14)”

“But then I kept having to kind of like tell myself as well that when people come we can obviously talk about that but at the moment you just need to make sure the immediate problems like his BP and the reduced conscious level are dealt with(FY21)”

“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.(FY4)”

There are several reasons why this category could be particularly important, yet challenging for junior doctors. They are often the first doctor to arrive to these scenarios and may be faced with the initial challenge of managing many tasks with relatively few people. As a novice, it is likely that they will be unfamiliar with these tasks, that they may take longer to complete, and (as discussed already) that the tasks will require a considerable cognitive load that will prevent this ‘thinking space’ from being used for other purposes. It is therefore crucial that they can identify which tasks are most important, and find appropriate resources to help them manage a list that may not be possible for them to complete on their own. The structured ‘rule based’ approach to prioritisation using the A-E assessment may be crucial. Having a protocol for the order of tasks means that less thinking space is required for this process. As discussed previously, the high cognitive load of tasks, coupled with the adverse effects of fatigue, stress and unfamiliarity makes a junior doctor particularly fallible to the limited capacity of working memory.

4.5.7 Coping with Stress and Fatigue

For reasons discussed in chapter 3, this category was not initially included in the a priori template. However, after the analysis of two interviews the researchers felt that there were too many items that referred to the effects of stress and fatigue to be ignored. It was decided to add this category to the template, and that issues involving observability would be discussed further at a later stage in the research.

As you would expect with this cohort, there was frequent reference to the stress and anxiety related with these situations. The importance of recognising the stress and acting on it (frequently by getting help) was acknowledged. Additionally, using the A-E structure was also acknowledged as a coping mechanism:

“I guess by reassuring yourself by doing what you do know like stopping, reassessing, and you know keep working through that, probably helps to offload some of the panic.(FY3)”

“the more hurried you try to be the less slicker and more mistakes you make so I think you need to tell yourself you will do everything as quick as you can but if you stay calm it’s gonna help the patient in the long run you just need to stay

calm and if you stay calm it will help things get done more efficiently in the end(FY5)”

“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(FY17)”

“just get people to help you, because that’s the only thing you can do if you are in a panic(FY18)”

Whilst there was frequent reference to the stress and some suggestions of its negative effects, most of the behaviours that could be viewed as coping mechanisms to improve safe and effective care could be categorised under other categories. For example, the need to slow down or pause and the use of a structure could come under situation awareness, and the need to get help could come under decision making or task management. For this reason, and the fact that this category is typically very difficult to reliably observe, it may not be appropriate to include this category in a taxonomy that will form the structure of a behavioural marker system.

4.5.8 Awareness of Limitations and Roles

After coding several transcripts the researchers agreed that this category previously identified in the literature review was also present within the interview data. Although awareness of limitations was sometimes a process related to other categories (e.g. decision making, situation awareness and task management), there were occasions when it did not appear to fit well into any of the other categories, but was related to safe and effective performance. The skill of recognising and often explicitly stating these limitations seemed to be frequently perceived as important:

“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(FY22)”

“but I felt that that was a situation that was too much to deal with with only 2 weeks of experience.(FY21)”

“because I have been trained to deal with this sort of situation I thought I should be making progress first, by myself.(FY27)”

“but if I can’t get IV access and I can’t get this that and the other....and I’ve tried so many times perhaps there is a limit to what I can do here(FY15)”

“perhaps I should have been a bit more open about it...not in my instruction, but actually I’m not sure what to do here, what would you do?(FY18)”

The need for an awareness of limitations or ‘self-awareness’ has been described in the literature on performance research, including NTS (Stewart 2008b; Bessone et al. 2008; Fletcher et al. 2002). Due to difficulties in the observation of this skill, other behavioural marker systems have chosen not to include this as a category or element of skill in a behavioural marker system (Fletcher et al. 2002). However, given that this skill is likely to be particularly important for the novice junior doctor, and also the suggestion in the data that the explicit statement of this limitation may be important, it could be feasible that this category is both observable and critical for junior doctors in this context.

4.5.9 Knowing your environment

There were a number of items that related to the importance of ‘knowing your environment’. Discussions between researchers revolved around the overlap between other categories, particularly task management, when thinking about the utilisation of resources. However, at times these items did not fit clearly into other categories, and therefore an inductively coded category under this title was formed.

Examples from the data include:

*“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)(FY2)”*

“to know what the on-call loop is and who to call in that instance, as looking back on it I didn’t(FY9)”

“when you start a job to definitely know who it is you should call for help(FY23)”

“I s-pose one of the things that I know now that I should have done was make myself a little bit better aware of the hierarchy there for me in terms of support,(FY14)”

“it was my first week, I can’t even remember if I knew how to bleep at that point(FY9)”

Some of these examples may provide evidence for organisational factors that could be improved in order to support junior doctors better. For example, it highlights the importance of providing this information clearly at induction. However, the complex support structures and differing routes of escalation of care that can be specialty or ward specific, may require the junior doctor to pro-actively seek out this information. Interestingly, although this category does not appear in behavioural marker systems for surgeons or anaesthetists, it has been used as one of the key points in anaesthesia crew resource management training as described by Gaba et al. (Gaba et al. 2001).

4.5.10 Accepting Responsibility

This category probably reflects the difficult transition from medical student to doctor. There was extensive discussion between researchers about the relevance of this category to NTS. At times it was felt that these items could be described as relating to professionalism and there was uncertainty if this should be conceptualised as a NTS. Perhaps some of these items reflected the attitudes of the junior doctors or the supervising team, rather than a behaviour that could be a marker of a ‘skill’. As they appeared to relate to behaviours that were linked with safe and effective performance they were included for now in the NTS categorisation. Further discussion of the scope of NTS and appropriateness of including these items will take place in the refinement process. Some examples include:

“I remember thinking if anything happens to this patient, it’s my fault (laughs nervously), I do remember thinking that. I don’t know why, I think it’s because you are there, and if you’ve done anything wrong initially or not dealt with the situation properly it will come back to you..... follow you back if anything goes wrong(FY3)”

“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.(FY19)”

“they called and they wanted the doctor to come, then doctor came, and now it’s doctors responsibility. Which...which is fair, because even though the nurses are providing the

clinical care I suppose, the doctor is to make decision and plans isn't it really?(FY27)"

4.6 Issues of Category Overlap

As discussed previously, the categories of NTS are inter-dependant and thus some overlap is unavoidable. However, the benefits of a degree of category exclusivity have also been described. It appears that if we can break this complex area down into robust categories, then it may help to improve the educational impact of the tool. For this reason, the researchers have picked out the main areas of category overlap to discuss further, so that it can help to guide the future stages of development of the behavioural marker system.

4.6.1 Communication and Teamwork/Leadership

It was noted during coding of the communication category that it had the greatest amount of overlap with others. There was considerable difficulty deciding on item coding between communication and other categories, particularly teamwork and leadership. To aid this process the researchers viewed communication as the skill in providing or receiving the content of information, rather than in the recognition of its need. In other words, items that referred to the skill of sharing understanding or co-ordinating activities were conceptualised as teamwork or leadership, but those that described the necessary content of this exchange were coded under communication. Some behavioural marker systems have chosen not to include communication. They view it as essential for successful observation of other skills, but not representing a useful category of skill in its own right. It may be that the significant overlap noted by researchers here would support a similar approach in this study.

4.6.2 Teamwork and Leadership

Overlap between these categories particularly apparent to the coders. This may explain why it has been combined in other behavioural marker systems such as anaesthetists (Fletcher et al. 2004). It appears and has been suggested that professions with stronger emphasis on leadership, such as surgery, may keep it as an independent category of NTS (Flin et al. 2008). As discussed previously, this is unlikely to be the case for junior doctors, although the importance of identifying a leader was acknowledged by the junior doctors.

4.7 Limitations

This study only gathered interview data from junior doctors. It may be missing important data from other members of the team that the junior doctors interact with, particularly nursing staff and senior colleagues. This may be particularly relevant for the social skills. However, this study was also aimed at identifying the cognitive skills of junior doctors, which can only really be elicited by the probing of junior doctors thought processes and decisions. In addition, the questioning of junior doctors themselves allows the researchers to view and understand the behaviours from their perspective. This has increased the awareness of the challenge of overcoming hierarchical and other barriers that have provided an interesting insight that may be less apparent from interviewing others. Whilst there would be some advantage of interviewing other candidates and triangulating the data, it was felt to be of greater benefit to interview more junior doctors for the reasons above and to ensure that the skills were relevant and achievable by the doctors themselves. In addition, it was already planned to involve the more senior colleagues in the later stages of the refinement process, which would in part compensate for the limitation here.

Whilst the study included a reasonable number of junior doctors who had graduated from different universities, they were all working in South East Scotland and they all volunteered to take part in the interview. This could limit the generalisability of the findings here to junior doctors on a larger scale. However, the sample did include junior doctors working in six different district general and teaching hospitals of varying sizes and locations. Despite the risk of volunteers being a self-selected group, they were remarkable in their honesty, and there was a range of different scenarios discussed, some of which went well and some that clearly did not. These open and honest accounts that included varying levels of performance would suggest that they did not self-select on the basis of ability. When asked why they agreed to take part, many expressed the wish to discuss these scenarios which they had not had the opportunity (or sometimes desire) to discuss with colleagues. It was felt that the researcher was a safe and trusted person who would be able to facilitate this discussion. Whilst this may self-select for candidates who are motivated to discuss a

case in detail, this may not be a bad point, especially when the interviews aimed at a deep exploration of behaviour.

It is accepted that the researchers were influenced in their coding by previous theory of NTS and the way they are categorised. However, as these systems of categorisation are based on extensive literature then this influence and its potential constraints on a more inductive approach can be justified. This system of categorisation has stood up to peer review, tests of validity and proven a useful construct in other areas of healthcare education. Using similar structures where appropriate is likely to be of benefit to the utility of the assessment tool, especially as these terms are becoming increasingly accepted by the medical community.

4.8 Conclusion

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.

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 if it is to be successful.

Chapter 5: Development of a prototype behavioural marker system

5.1 Introduction

This chapter describes the refinement process that was used to develop the prototype behavioural marker system. The main input for this process was the literature review and the interview study described in chapters 3 and 4. It used the knowledge and understanding of NTS and behavioural marker systems outlined in chapters 1 and 2 to help guide this process with the aim of producing valid, reliable and useful output.

The subsequent sections will describe a summary of the process that was used to reach the final prototype. It will not describe every small change to the taxonomy and selected exemplar behaviours, but it will give the reader an understanding of the method that was used, why this approach was selected and some examples of significant changes that were made.

The process of refinement is broadly similar to those described in the development of other behavioural marker systems (Fletcher et al. 2004; Yule, Flin, Paterson-Brown, Maran, et al. 2006; Mitchell 2011). However, the fine details of the method were also guided by other context specific and practical factors. Issues that affected design included the challenge of direct observation of acute care events in real clinical practice. This was not possible due to the infrequency and unpredictability of these scenarios, and also due to obvious patient safety issues with observing these scenarios without interfering. Additionally this behavioural marker system differs from those previously reported in that the subject population are novice junior doctors and not experienced senior practitioners. This influenced the method behind the development process, which is discussed in detail in this chapter.

5.2 Aims

The aim of this phase of the research project was to develop a prototype taxonomy and behavioural marker system for observing the performance of junior doctors or senior medical students managing acutely unwell patients.

5.3 Development Process

The main stages of the development process that will now be discussed are:

- Specifying design criteria
- Developing a prototype taxonomy
- Reviewing and refining this taxonomy
- Attaching exemplar behaviours
- Attaching an assessment scale

Each stage in this process is discussed sequentially in this chapter to ensure it is comprehensible and easy to follow. However, in reality this was an iterative process where there was considerable overlap between stages. For example, the process of attaching exemplar behaviours highlighted areas of weakness in the taxonomy that needed modification. In order to ensure that all changes to the tool could be explained and justified several key approaches were taken. Firstly, a tracking document was used where all modifications were recorded. Secondly, following the refinement workshops a report that summarised discussion along with modifications was sent to the panel in order to ensure mutual understanding and clarify any uncertainties. Thirdly, all workshops that involved refining the tool were recorded and reviewed to ensure accuracy of the reports and an accurate record of both the changes made, and the justification for these changes.

5.3.1 Design Specifications

Ultimately, the benefit of having design specifications was to ensure that the tool was an accurate representation of the skills required by junior doctors, but at the same time was usable and acceptable to the clinicians who would be required to adopt it. The design specifications from other successful behavioural marker systems were examined and included or adapted where appropriate (Fletcher et al. 2004; Yule, Flin, Paterson-Brown, Maran, et al. 2006; Mitchell 2011; Flowerdew et al. 2012).

Factors that influenced specifications were very similar to those previously documented and included the need for a tool to require minimal training and minimal cognitive load for the raters to complete. Six main design criteria were identified, and are described below, along with the justification for each point.

1. It should have a three level hierarchical structure, containing categories, and sub-categories (elements) with exemplar positive and negative behaviours (see examples in chapter 1).

Justification: This simple structure has proven to be an effective way at capturing the critical behaviours in other healthcare professionals. It has previously been viewed as an acceptable format, requiring minimal training to use with reliability. In addition, there may be some potential users of our tool that are familiar with this structure in assessing surgeons or anaesthetists and this could help to improve acceptance and minimise rater training requirements.

2. Focus on skills that are critical for junior doctors in real clinical events and are either directly observable or inferred from direct observation.

Justification: Whilst there may be some important skills that are non-observable, it was decided to focus on those that can be observed or inferred from direct observation of behaviour. There are several reasons why a tool that relies on rater observation was deemed to be appropriate. Firstly the practical considerations that it allows performance to be rated without questioning candidates decisions, thought processes and actions. This makes the tool more applicable for assessment and evaluation. Secondly, it allows more objective rater observations to be made, rather than subjective explanations from candidates. Subjective candidate explanations of performance are notoriously unreliable, and there is a tendency to relate them to personality traits, rather than skills. This phenomenon is discussed widely in psychology literature and termed as fundamental attributional error (Ross et al. 1975).

The term ‘clinical events’ was used and not simulated scenarios. Due to previously mentioned issues with infrequency and ethical considerations it was deemed to be unlikely that this tool would be used for direct observation of real clinical events. However, it was important that current limitations of simulation did not exclude critical behaviours. In other words, if there were areas of critical importance that affected safe and effective performance, but were not currently replicable in a simulator, these should not be excluded. This approach was taken to ensure we captured performance markers that reflected and impacted on real world

performance, not just the simulator. If there were areas that were not currently replicable in a simulator, it could lead to future modifications of how simulated scenarios and teaching were designed or at least a recognition that there were critical areas that a simulator could not replicate and had to be explored by other means. In addition, it would allow this tool to be adapted for other purposes in the future with greater ease. For example, if this framework was to be used for post event analysis of incidents or debriefing of real scenarios in clinical areas.

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

Justification: The potential for personality traits and values influencing performance behaviour cannot be denied. However, this tool is based on ‘skills’ and at its heart is the principle that it can be used for the educational benefit and the improvement of performance by medical students and junior doctors. It does not seek to weed out certain types of personalities, but is a tool that can target performance gaps that have the potential to be improved.

The effects of cultural values on the performance of junior doctors are well documented. Previous chapters (3 and 4) have discussed the difficulty in distinguishing between behaviours that represent a skill, and those that reflect the influence of an organisations culture or shared values. Whilst this differentiation may be murky, the underlying principle is that the tool represents skills that can be learnt and improved if it is to have educational benefit.

4. The system should be parsimonious and contain the least amount of categories and elements possible whilst still capturing the critical skills and behaviours

Justification: The cognitive load of the raters completing this assessment tool has to be taken into consideration. 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. There is a balance to be struck

here that requires expertise and judgement to reach a compromise between over simplification and being overly complex. An exact number of categories and elements has not been explicitly defined, but previous systems used in similar settings have contained between 4 to 5 categories, each with 3 to 4 elements. As this tool may be used in the live observation of simulation, where multiple tasks in the control room may be required by the rater simultaneously, this may be of considerable importance.

5. Categories and elements should have the maximum exclusivity as possible.

Justification: It is accepted that these skills overlap considerably and a degree of interdependence is unavoidable. However, it is preferable that each skill group behaves, to a certain degree, as a separate domain of ability (demonstrates good ‘internal structure’). This is partly because of the potential use of this tool in giving targeted feedback, and the way individual categories and elements can be scored differently. In other words, it may be possible to identify individual skill areas that need to be improved by a candidate.

6. The language of categories, behaviours and descriptors should be simple, concise and comprehensible to clinicians with minimal training.

Justification: This tool is intended for clinicians who train and supervise junior doctors. Not only are these clinicians busy and have limited time for training in the use of the marker system, but they may not be familiar with terminology and concepts that are frequently found within some NTS and psychology literature.

With these design criteria in place, a process of refinement was chosen that would align with the intended outcome and achieve these targets.

5.3.2 Preliminary Taxonomy Workshop

5.3.2.1 Objective

The objective of this preliminary workshop was to develop an initial taxonomy of categories and elements that would form a prototype for refinement and subsequent attachment of exemplar behaviours.

5.3.2.2 Participants

Participants for the workshop were selected based on the design criteria discussed above. A panel of six clinicians were selected who had experience of supervising and observing junior doctors and experience of using and developing behavioural marker systems. The panel included one emergency medicine consultant, one senior trainee in medicine, one senior trainee in surgery, two consultant anaesthetists and one senior anaesthetic trainee (the lead researcher). The two consultant anaesthetists were both involved in the development of previous successful behavioural marker systems and were also faculty of the Scottish Simulation Centre and experienced in training and supervising junior doctors and senior medical students. The senior trainees in medicine and surgery were selected on the basis that they had frequent contact with junior doctors in real acute clinical settings. They were both currently working as teaching or educational fellows and involved in observing simulated acute care training. The emergency medicine consultant was also the director of clinical skills at the University of Edinburgh and had experience with acute care training in the medical curriculum, acute care significant event analysis and research in the preparedness and behaviour of junior doctors in acute care. The lead researcher had experience in simulation training and had conducted the NTS literature review and all of the 29 CIT interviews with newly qualified doctors.

5.3.2.3 Process

The main data inputs for the workshop were derived from the literature review and interview analysis process. This included potential category and element labels, along with example behaviours that were selected by the two researchers involved in analysis. Items were selected by the researchers on the basis that they were the most critical for safe and effective behaviour, and repetition was avoided.

The workshop lasted a full day and was video recorded. It started with a review of the design principles and brief discussion about the principles and potential use of the behavioural marker system. Following this, several longer transcripts and audio clips of the critical incident scenarios were reviewed by the panel, so that there was a clear understanding about the origin of the data.

The majority of the day was spent discussing all of the categories in turn, and reviewing the items within them. Discussion was generated around the key points within the design specification described above. For example, there was considerable discussion about whether some items or categories truly represented ‘skills’ or would be more accurately seen as reflecting an organisations culture or the attitudes of junior doctors. There was also a lot of discussion around the overlap between categories, and how to capture the critical observable skills in an accurate but parsimonious format.

During this process a structure of key categories and elements was developed and refined. This was achieved by displaying this evolving structure during item review, and making consensus changes throughout the day on the basis of these discussions.

Following the workshop the lead researcher developed a summary of the output and agreed decisions about final structure of categories and elements. This was sent to each panel member in order to ensure accuracy and prevent any misunderstandings. In addition, the lead researcher reviewed the video recordings of the critical decisions made about structure of categories and elements with the aid of field notes that were taken at the time.

The summary document also served as a method for developing draft descriptors at category level. These were initially generated by the lead researcher guided by the recorded discussion by the panel and by previous descriptors used in similar or identical categories in other behavioural marker systems. These were included in the summary document sent to each panel member, who suggested appropriate tracked changes in line with the research aim and design criteria, until consensus was reached.

5.3.2.4 Output

The prototype taxonomy of skills and elements is displayed in table 7, along with the consensus descriptors.

Category and Descriptor/explanatory note	Elements
<p>Getting the Job Done The skills that Junior Doctors can use to organise tasks and achieve goals. This includes skills relating to planning and preparation, prioritisation and providing and maintaining standards. Planning and preparation also includes contingency planning; this will overlap to an extent with decision-making, especially options being generated, but in this category the emphasis on the planning that needs to be done to deal with a contingency. E.g. what is plan A? Am I prepared for that? If plan A is neither successful nor appropriate do I have plan B, plan C etc. and have I begun preparations for those.</p>	Prioritising (tasks and patients)
	Applying Rules
	Planning and Preparing
<p>Teamwork 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 particular, skills associated with the allocation of tasks . 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.</p>	Speaking up
	Establishing shared understanding
	Establishing a team
<p>Decision Making The process of reaching a judgement or choosing a course of action to meet the needs of a given situation. This includes the generation of different options, selecting an option and reviewing of decisions that have been made.</p>	Generating Options
	Balancing Options
	Reviewing of Decisions
<p>Escalating Care The skills that Junior Doctors can use to ensure that resources are utilised in a timely and efficient manor following the recognition and decision that escalation of care is required.</p>	Communicating Seriousness of Situation
	Identifying and utilising resources
<p>Situation Awareness 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 patient, charts, communication and behaviour of co-workers, etc. The cognitive load of interpreting the situation; that is, gathering and assimilating the necessary material often requires that the junior doctor temporarily ceases engagement in other activities.</p>	Gathering Information
	Pause to interpret information
	Projection to future states

Table 7: Prototype taxonomy of categories and elements

It can be seen that there were considerable changes made to the content and wording of categories during this process. It is not feasible or desirable to discuss each and every decision, but as discussed they were made on the basis of the design criteria, the data used and the experience of the panel in their supervision of junior doctors and in the use and development of behavioural marker systems. Elimination of categories was on the basis of observability, maintaining exclusivity, parsimony and on whether these areas truly represented 'skills'. For example, coping with stress and fatigue was removed as it was thought to be difficult to observe, and coping strategies overlapped with other categories to some extent. Items for managing stress included behaviours describing the use of a structured assessment in information gathering, or in pausing to put together findings, that could both be placed under situation awareness. Items under accepting limitations were felt to fall under situation awareness in some cases, or reflect attitudes rather than skills in others.

A consensus agreement was made to remove the category of communication, as this would frequently be the means by which all categories could be observed. In other words, 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).

Perhaps the most significant change was the addition of the escalating care category. There were many items within other categories that referred to the critical importance of early and effective escalation of care. The panel felt that these items were so critical to successful management, that a separate category representing these skills would improve the impact of this tool.

The next step in the development process would be the review and refinement of this prototype taxonomy.

5.3.3 Review of prototype taxonomy

The review of this prototype taxonomy involved two main stages. These were the observation of authentic recorded simulated scenarios, and the re-coding of interview

data. These two stages were chosen as they aligned with the research aims, the design criteria and the objectives outlined below.

5.3.3.1 Objectives

The objective of this review process was to identify any weaknesses in the current prototype. Specifically the potential weaknesses that were targeted resolved around three key areas:

- 1) Critical behaviours that do not fit into the existing framework. i.e. are there any categories or elements that appear to be missing?
- 2) Overlap between categories and elements. i.e. are the categories and elements mutually exclusive or not?
- 3) Potential problems with redundant elements: i.e. are there any categories or elements where it is not possible or difficult to identify any observable NTS in junior doctors.

5.3.3.2 Simulation observation

This was viewed as a scoping exercise to give some information on the observability of the behaviours. Its aim was to guide further stages in development, and not make any changes to the current template. This restriction was out of concern that the tool could reflect events that were present in simulation but less critical, or different in real clinical scenarios.

Six recorded videos of simulated acute care scenarios were reviewed by the lead researcher. These were recorded at a simulation induction training session at a district general hospital in Edinburgh. Scenarios lasted between 14 and 32 minutes. They involved one nurse (faculty plant) and two to three newly qualified Foundation Year 1 doctors managing three different acute care scenarios. These were reduced conscious level secondary to hypoglycaemia, sepsis and post-surgical haemorrhage. All recordings were made with written informed consent of all participants (see appendix 5 for consent forms). The researcher used the template shown in table 7 in an attempt to observe behaviours (both positive and negative) from each element.

Videos were reviewed by one researcher only, so it was not possible to make judgements on reliability issues at this stage. However, there was evidence of

observable behaviour at each element across all 6 scenarios, suggesting that observability may be achievable in these categories and elements. One issue that was noted during this process was related to the category of escalation of care. Clearly this appeared critical for successful performance, particularly in the patient bleeding post-operatively who required senior surgical input. However, there were frequently behaviours associated with teamwork (speaking up and establishing a shared understanding) and also evidence of the candidates' situation awareness that were evident at these moments and affected the ability to escalate care. For example, communicating the seriousness of the situation (an element of escalating care) involved establishing a shared understanding, and also relied on and demonstrated the candidates' situation awareness.

5.3.3.3 Re-coding interviews

It was imperative for the success of the marker system that critical behaviour relating to real clinical events were represented. For this reason the CIT interviews were an obvious choice for this process of review and refinement.

Six of the interview transcripts were chosen randomly. These then underwent deductive analysis by the two researchers using the prototype taxonomy. Individual phrases or items were coded independently by both researchers using NVivo 9 software. In all 249 items were coded into the template. There were several items that one or both coders felt reflected potentially critical NTS, but did not fit into these categories. These broadly appeared to fit into two main groups:

1) Situation Awareness with no pause

Some of these related to situation awareness, where no pause for interpreting information was performed. For example:

“I just knew by looking at her that she really wasn't well(FY4)”

Potential Significance: It was felt that seeing the situation awareness with pauses as the critical behaviour is important, with some good examples in the data. This kind of intuitive response was felt to be something we would find difficult to identify, improve on or should necessarily encourage. Other examples in the data suggested

that the pausing was a very important action and therefore worth focussing on. For these reasons, it was decided to view these items as non-critical behaviours at this stage.

2) Acceptance of limitations

There were some references that related to accepting that you are out of your depth. There are some examples that were coded into different categories, such as decision making, communicating seriousness and teamwork. In some cases it was not that clear which one they should fall into. For example:

“I think you have just got to accept that you are not managing(FY20)”

“this is difficult because you think you should be able to do this but you can’t, and you are not coping with what is in front of you.(FY14)”

“but if I can’t get IV access and I can’t get this that and the other....and I’ve tried so many times perhaps there is a limit to what I can do here(FY15)”

Potential Significance: It was felt that where this acceptance does not form part of decision making or communicating seriousness then it was probably evidence of situation awareness.

In this area there are also references that included overcoming the cultural barrier that ‘failure to cope’ is difficult, such as:

“I dunno.....think in medical school you are sort of raised to be quite confident person with skills and knowledge and you go for 5 years and you are sort of taught throughout school that you are top of the class in a way, as an entity and you ought to do this, you ought to know this.....and you’ve passed your medical exam for a reason and so if you can’t even do that then why are you there sort of thing, perhaps a sort of...I mean I’m certainly not a confident person when it comes to these sorts of things but perhaps we should be taught that this...medicine is not just a one person’s job, it’s a bit more deeper.....(FY18)”

Once again, this raised the issue about the scope of NTS, and if these behaviours could be viewed as a skill, or as purely the result of the prevailing culture within this context. This topic will be visited again in this chapter and in the final conclusions.

To investigate the category exclusivity, a matrix of coding similarities and differences was developed (see table 8). This allowed the critical areas of overlap to be explored, and items that were coded differently were reviewed and discussed between researchers.

	Decision making coded by MH	Escalating care coded by MH	Getting the Job Done coded by MH	Situation Awareness coded by MH	Teamwork coded by MH
Decision making by EM	12	7	5	3	3
Escalating care by EM	6	19	2	0	11
Getting the Job Done by EM	11	0	41	1	4
Situation Awareness by EM	8	2	8	30	0
Teamwork by EM	4	2	7	4	59

Table 8: showing number of items for each category coded by the two researchers (MH and EM). Red numbers indicate agreement, black indicate disagreement.

Inter-rater kappa coefficient was calculated at 0.55 (at category level) reflecting moderate rater agreement (Landis and Koch 1977). Through an exploration of the items coded differently and discussion between raters, some key areas of overlap and potential weaknesses were addressed. Below is a short summary of some examples along with potential significance that was inferred by the researchers.

5.3.4 Overlap between ‘Decision Making’ and ‘Getting the Job Done’

There was significant overlap between the decision making and ‘getting the job done’ category. Evidence of this is particularly noticeable between the ‘prioritisation’ element of getting the job done and balancing options of decision making. These overlaps sometimes involve the decision to call for help and

balancing that decision against other options such as investigations or (less frequently) management.

“well I knew that I wanted to phone, and I knew that I would need to do some jobs erm....but it was just basically, by myself. So errr errr I suppose....I suppose I could have organised the investigations before I phoned but I guess I was just a bit stressed about the whole situation I just wanted to get some advice(FY23)”

Significance: It was inferred that this could be a problem with defining and understanding the category, rather than the categories themselves. Decision making could be seen as the process of reaching, selecting and reviewing individual decisions, whilst prioritising is about ranking or sorting the decisions that have already been made. With this in mind, the above example would fit better under prioritisation rather than decision making.

5.3.5 Overlap between ‘Escalation of Care’ and ‘Decision Making’

Disagreement here often involved the decision to call for help, and the ‘identifying and utilising resources’ element of escalation of care.

“I knew the reg that was looking after her and he was fantastic, and so approachable, really friendly.and he was so supportive when we first started our jobs like he was like “guys if you ever need anything just give me a call” and I just like, and I think like when he’s on (shift) rather than anytime at all, and I thought I’m just going to call him because it’s his patient anyway(FY6)”

Significance: The issue in this area was felt to relate to the definition of the escalation of care category referring to behaviours that occur after the decision to gain help has been made. In this example it is difficult to know if the FY is balancing the decision to call or not to call around the ‘reg’ being ‘friendly’ or more about who (i.e. which resource) to call based around the same fact.

5.3.6 Overlap between ‘Situation Awareness’ and ‘Decision Making’

Overlap here often involves references that include the prelude to the decision. For example:

“I think we should have really realised by then that she was cold, clammy, she was shutting down, and she was shutting down quickly, and the reason we didn’t get any of those wasn’t because of skill, partially perhaps yes but it was more than that, she was shutting down and going to pass away, and for that you need someone with more experience.(FY12)”

Significance: It was felt that this was just an example when the reference itself crossed two categories, and should probably be broken down into two references. In other words, this overlap was not viewed as a significant concern in the taxonomy, and a strong degree of interdependence between situation awareness and decision making is unavoidable.

5.3.7 Overlap between the different elements of ‘Situation Awareness’

This category appeared reasonably robust with little differences between coders at a category level. There were however some difficulties in differentiating between the elements or stages of situation awareness.

“you know from that initial assessment when you look at someone and they look unwell, and you’ve already got someone who is not a very healthy patient and they kind of look obtunded in bed and have got the oxygen mask on and the drip running and you think “okay well, they are obviously not the most healthy of patients”, and then they just don’t look right.(FY21)”

Significance: It was felt that this was mainly a case of a reference spanning the two elements and intercoder disagreement probably reflects this fact. The key to getting this judgement right was to try and work out if failure or success was based on the gathering, interpreting or projecting phase.

5.3.8 Overlap between ‘Escalating Care’ and ‘Teamwork’

Most commonly the disagreement was with the ‘establishing a team’ element. A representative example was:

“Asking for help of people around you. Sometimes you feel a bit of an idiot as an FY1 asking the nurse to sort of help you out but I guess just don’t be afraid of whoever is there you know even if its the cleaner ask them, ask oh crap where’s the phone? Ask for help just don’t be on your own I guess is the main thing(FY17)”

Significance: It was felt that this represented a potential lack of accurate description and understanding of the categories. This overlap could be minimised by conceptualising Teamwork skills with allocation of roles, tasks, etc. whereas escalating care is about getting the team there in the first place. It was felt that this would still remain a potential for some overlap, but trying to keep to this definition may minimise it to acceptable levels.

5.3.9 Overlap between ‘Escalating Care’ and ‘Teamwork’ in the ‘speaking up’ element.

Although this was not that common, there are clearly times when speaking up is key to escalating care and ensuring resources are utilised in a timely manner:

“instead of the reg just saying he’ll be round, I probably just would have liked him there, there and then, and I should have been more assertive about it.(FY21)”

Significance: These kind of references were coded fairly reliably under teamwork and speaking up. It was felt that they were easy to identify at the element level. However, there was concern that speaking up in this context definitely fits into the escalating care category as it was defined by the descriptor. However, there were other occasions where speaking up seemed solely related to teamwork and did not involve escalating care.

5.3.9.1 Output

As detailed above, this process lead to a lot of discussion about the nature of the categories and elements within the taxonomy and areas of potential weakness. These

insights would prove very useful for subsequent steps in the process, in refining descriptors for the elements and categories, and even in the development of rater training.

A summary document of this refinement process was compiled and sent to the expert panel in order to help guide the next stages. No specific changes were made to the taxonomy, as it was felt that this process would be more accountable if consensus agreement was reached with the panel as part of the next workshop.

5.3.10 Behavioural marker system selection workshop

The final stage in the refinement process involved another workshop of subject matter experts.

5.3.10.1 Objective

The objective of this workshop was to make final changes to the taxonomy framework and attach positive and negative exemplar behaviours to each element and thus create a prototype tri-level behavioural marker system.

5.3.10.2 Participants

Participants differed slightly from the previous workshop. On this occasion the participants were one consultant anaesthetist, one senior medical trainee, two senior surgical trainees, and the lead researcher (a senior anaesthetic trainee). This change was due to unavoidable practical issues. However, the panel still included clinicians with experience of supervising, training and observing junior doctors and medical students and included members with experience in using and developing behavioural marker systems.

5.3.10.3 Process

Prior to the workshop the panel were sent preparatory documentation. They were reminded of the design criteria, and given the current prototype taxonomy as shown in table 7. Examples from the interview transcripts were given for each element, so that they could relate these skills to performance in real scenarios.

Each panel member was assigned three to four elements to review in more detail, and they were requested to write some positive and negative exemplar behaviours that could potentially be used in the marker system. Overlap between panel members and elements was designed to generate useful discussion during the workshop.

The workshop itself took place over a full day, and was recorded. Following a brief overview of the design criteria and update on the progress, each category and element was reviewed in turn. All exemplar behaviours that had been generated by the panel were displayed next to their element. A system of laminated labels and large poster boards was used to facilitate the process of exemplar behaviour selection and any further refinements to the taxonomy structure that were deemed appropriate. Consensus opinion was established for the selection of behaviours, the structure of categories and elements, and for category and element descriptors.

Following the workshop, a summary document was provided to all panel members, and included the three additional members from the first workshop. It detailed the key changes that had been made during the workshop, and the final version of the prototype marker system, along with category and element level descriptors. Some minor changes to descriptors and wording were suggested and agreed upon during this stage.

5.3.10.4 Output

The output from this stage in the refinement process was the prototype behavioural marker system, that was now suitable for piloting. The most significant change to the structure was the removal of the escalation of care category. This was due to the fact that whilst escalation of care was seen as perhaps the most critical action for junior doctors, it was viewed that failure or success in this area was a result of performance across all other categories. In other words, if a junior doctor was not successful in getting senior support, this could be due to a lack of situation awareness, poor decision making, poor task management or poor teamwork skills. There was some discussion about how the remaining four categories could be thought of as pillars that supported the effective and timely escalation of care. It was acknowledged that

the importance of escalation of care must remain within the structure or conceptualisation of this framework.

Some more minor changes were made to the other categories in order to ensure that all critical skills in the escalating care category were encapsulated in the framework. This included ensuring that decision making clearly involved the decision to escalate care, as well as those related to investigation, treatment and diagnosis. Additionally the category ‘getting the job done’ was changed to ‘task management’ as it was felt that this fitted in better with the style of other categories and with the names given to categories in other behavioural marker systems.

5.3.11 Attaching an assessment scale

The final stage in the development process was agreeing and attaching an assessment scale to each element and category. Various types of assessment scale can be used for this process. In general ‘anchored’ numerical scales are accepted as being appropriate and facilitate easier understanding of the rating scale by the rater. In this method a numbered scale is used and ‘anchored’ to written descriptions of points along the scale. If the anchoring scale is written clearly and represents concepts that the rater is familiar with, then this can have a significant improvement on reliability. The next issue to be discussed is how many points in the scale should there be, and what should the descriptions contain. A larger number of points in the scale helps raters to differentiate candidates of more similar abilities. However, it also makes the task potentially more challenging for the rater and risks some parts of the scale being redundant. If the scale is too small, it makes it harder for the rater to split abilities, and risks the feedback on performance is too generalisable. Another controversial issue is if there should be a neutral or mid-point score. There is a tendency for raters to gravitate towards neutral scoring, particularly when rating the marginally underperforming candidates.

A few pragmatic expectations or assumptions about the tool guided the decisions about the assessment scale. This included the fact that rater training would be limited by financial and time restrictions, and that this tool would be most likely used for formative assessment to aid targeted feedback. It was also based on the literature

from other behavioural marker systems, particularly the ANTS system, where several scales were piloted. The final scale that was agreed was a four point anchored system as shown in table 9. It was decided to use a ‘not applicable’ option to the scale as there may be some scenarios where these skills were not required and therefore could not hope to be observed. A cautionary note was added that raters must be informed that an absence of observation of a skill, could actually signify poor performance where this skill is required, and should not be scored not applicable, but instead be labelled ‘poor’ under these circumstances.

The final decision was that the category level score did not have to be dependent on the averaging of the element level scoring. In other words, raters were expected to consider how the candidate had performed in each element, but were then free to attach the most appropriate score to the category. This was because there was no attempt to weight the significance of elements in the refinement process, and it was accepted that on some occasions a scenario or candidate behaviour may dictate that a score in one element is more indicative of overall performance in that category than the other elements.

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

Table 9: Anchored rating scale for categories and elements

5.4 Results: The prototype behavioural marker system

The final prototype behavioural marker system contained four categories, each with three to four elements, and each element containing a number of exemplar behaviours. It should be noted that the exemplar behaviours are not all-inclusive, but

are just given to guide the clinician raters to the type of behaviours and the nature of the skill that they are rating.

As discussed previously, it was felt that successful escalation of care was imperative in the performance of junior doctors, but that its success was dependent on the performance from all of the other four skill categories. As such, it was decided to present this model as a diagrammatic construct to demonstrate this relationship to the reader. This diagram is shown in figure 5, where the four categories are schematically represented as pillars, supporting escalation of care.

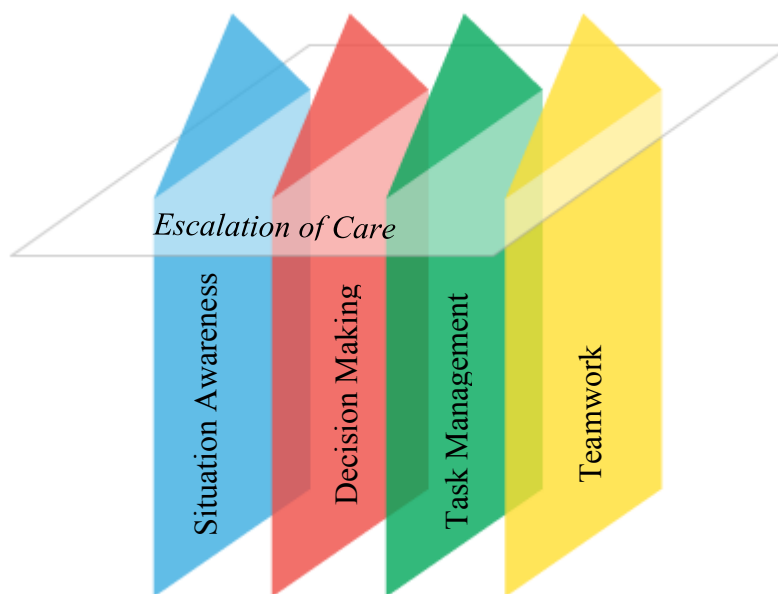


Figure 5: Schematic representation of the four categories of skills representing pillars that support the effective escalation of care

The next section of this thesis provides the final results of this development process. It provides the category descriptors, each element within these categories, and the exemplar behaviours that were selected for each element.

A handbook demonstrating these categories and elements was developed and is provided in appendix 9. It provides a rating table to allow raters to mark candidates in the different categories and elements. Evidence suggests that considerable rater training is required to allow NTS to be reliably assessed (Flin et al. 2008). It is

therefore not recommended that this handbook be used as a stand-alone resource, and further discussion of rater training is provided in the subsequent chapter.

Situation Awareness

Descriptor agreed for the category of situation awareness:

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. The cognitive load of interpreting the situation: that is, gathering and assimilating the necessary material, often requires that the junior doctor temporarily ceases engagement in other activities.

Element and descriptor	Positive Exemplar Behaviours	Negative Exemplar Behaviours
<p>Gathering Information</p> <p><i>Gathering information about the patient’s current condition, their background and rate of deterioration from available sources. The ‘available sources’ includes all those mentioned above.</i></p>	<ul style="list-style-type: none"> • Applies a structured A-E approach to assessment • Verifies/cross checks information with nurse or patient • Requests further history/information from available sources to identify problem • Closely monitors physiology, condition of patient and trends to detect deterioration early • Obtains information from multiple sources including patient, ward staff, monitors, charts and notes on patient condition 	<ul style="list-style-type: none"> • Takes a lengthy non-focussed history, despite clinical signs suggesting urgent management required • Misses critical information by using an unstructured and disorganised approach to information gathering • Overlooks critical information available on notes or charts • Does not notice changes in patient condition • Fails to review new information required to update clinical picture
<p>Recognising and Understanding</p> <p><i>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.</i></p>	<ul style="list-style-type: none"> • Stops tasks temporarily to put together information in order to recognise severity of situation • Summarises key findings and significance to other health care professionals • Increases frequency of observation review in response to patient condition • Verbalises or documents the significance of trends in patient condition 	<ul style="list-style-type: none"> • Does not recognise rate of deterioration of patient condition • Remains task focussed without assimilating current status of patient • Overlooks critical information about patients’ condition despite having previously observed it • Fails to allocate attention to critical events when patient deteriorating • Interprets patient condition incorrectly by failing to put together information from different sources
<p>Projection to future states</p> <p><i>Thinking ahead to predict what might happen and consequences of actions, interventions, non-interventions.</i></p>	<ul style="list-style-type: none"> • Communicates the expected course of the clinical condition to other health care professionals • Recognises that patient may need higher level of care • Communicates likely effects of interventions based on current understanding of patient condition • Calls 2222 for peri-arrest patient where deterioration is anticipated 	<ul style="list-style-type: none"> • Does not communicate with other health care professionals 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

Decision Making

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.

Element and descriptor	Positive Exemplar Behaviours	Negative Exemplar Behaviours
<p>Generating Options</p> <p><i>Generating differential diagnosis or potential courses of actions to be considered.</i></p>	<ul style="list-style-type: none"> • Verbalises or documents differential diagnosis • Invites other team members to help generate options • Generates treatment or action plans that are based on potential diagnoses • Identifies promptly that additional medical support may be required as part of action plan 	<ul style="list-style-type: none"> • Fixates on one particular diagnosis • Does not consider possible alternative strategies • Has no 'plan B' or inappropriate plan B • Fails to consider contacting senior support within action plan
<p>Balancing Options</p> <p><i>Weighing up different options (including treatment, investigations and escalation of care) and balancing risks and benefits based primarily on patient interests and taking into account own skills, knowledge and experience.</i></p>	<ul style="list-style-type: none"> • Takes into account own skills and limitations when choosing an action plan, making patient safety the priority • Identifies risks and benefits of potential action plans • Assesses the time criticality of the patient's condition when considering which options are possible • Initiates further investigations to help delineate diagnosis • Considers patient's wishes in decision making 	<ul style="list-style-type: none"> • Does not base management plan on patient diagnosis or current condition of patient • Performs unnecessary investigations • Allows personal agenda to influence decision • Fails to consider views of other team members when making decisions • Operates beyond level of experience without escalating care
<p>Reviewing of Decisions</p> <p><i>Reviewing the suitability of the option or course of action that has been selected by re-assessing the situation. The 'option' to be reviewed could be a diagnosis, an investigation, treatment or a decision to escalate care.</i></p>	<ul style="list-style-type: none"> • Adopts an alternative strategy when patient is not responding as anticipated • Reviews plan when condition changes 	<ul style="list-style-type: none"> • 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

Task Management

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.

Element and descriptor	Positive Exemplar Behaviours	Negative Exemplar Behaviours
<p>Prioritising (tasks and patients)</p> <p><i>Prioritising tasks and patients according to importance and avoiding being distracted by less important or irrelevant matters.</i></p>	<ul style="list-style-type: none"> • Maintains and reviews task list frequently • Allocates attention to sickest patients first • Makes priorities clear to other members of team • Uses A to E approach to prioritise interventions in unwell patients • Requests investigations and makes referrals early to accommodate inherent system delays • Recognises when input no longer required 	<ul style="list-style-type: none"> • Does tasks in inflexible or haphazard order • Does not seek information on clinical condition or required urgency of allocated tasks • Delays doing unfamiliar, difficult or unpleasant tasks • Accommodates staff/administration demands over needs of patients • Concentrates on individual tasks without attempting to relate one task to another
<p>Maintaining Accepted Standards</p> <p><i>Using guidelines and adhering to accepted principles and codes of practice in the management of patients and tasks.</i></p>	<ul style="list-style-type: none"> • Utilises algorithms in emergency situations • Uses appropriate guidelines to inform patient management decisions • Uses checklists to support tasks • Maintains accurate, legible contemporaneous written documentation • Refers to local policy and utilises standardised documentation where available • Adheres to infection control measures 	<ul style="list-style-type: none"> • Does not check results of ordered tests • Dismisses need for use of guidelines • Fails to adhere to accepted standards of practice • Ignores available protocols to take unnecessary short cuts
<p>Being Prepared</p> <p><i>Planning and preparing for scenarios and eventualities where possible. This includes familiarising self with the ward environment and preparations before or during a shift that may help if an acutely unwell patient is encountered.</i></p>	<ul style="list-style-type: none"> • Actively seeks out information of support structures and hospital systems • Ensures has ability to access results/IT systems • Assembles all equipment required before beginning a task • Is aware at any point of day or night who their senior is and how to contact them 	<ul style="list-style-type: none"> • 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 that may be required
<p>Identifying and Utilising Resources</p> <p><i>Selecting the most suitable resource for the situation based on the requirements of the team and patient. Resources include people, expertise and equipment.</i></p>	<ul style="list-style-type: none"> • Selects appropriate person to escalate care based on patient and team requirements • Uses 2222 to get people and expertise when needed urgently • Contacts available allied healthcare professionals, portering services or other resources to help when required 	<ul style="list-style-type: none"> • 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 available resources leading to task overload

Teamwork

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.

Element and descriptor	Positive Exemplar Behaviours	Negative Exemplar Behaviours
<p>Speaking up</p> <p><i>Using the required level of confidence and assertiveness to express a point or clarify a situation in order to achieve goals.</i></p>	<ul style="list-style-type: none"> • Asks for clarification of requests or situations to aide understanding • Clearly and succinctly explains the reasons for concerns • Communicates abnormal results to team without being asked • Adapts tone and content of communication to express important points clearly when not heard or understood • Clearly asks seniors to attend when required and gives a timeframe within which this is required 	<ul style="list-style-type: none"> • Does not convey critical information unless asked • Fails to express concern even when patient safety is at risk • Accepts that help is not available despite deciding it is required • Fails to speak up when unclear about patient condition or lacks experience to manage situation • Accepts tasks that are not appropriate given level of experience without expressing concern
<p>Establishing shared understanding</p> <p><i>Seeks and gives enough information to ensure a shared understanding of the situation among team members.</i></p>	<ul style="list-style-type: none"> • Regularly updates team on current progress and checks level of understanding • Uses closed loop communication to clarify and verify task completion • Invites information or recommendations from staff more familiar with patient or situation • Clarifies objectives and goals of management • Provides clear, structured handover and summary of progress to senior help 	<ul style="list-style-type: none"> • Does not inform team about current understandings or level of concern • Gives incomplete or irrelevant information • Relays information whilst other team members are distracted • Does not include all relevant team members in communicating management plans • Fails to recognise differences in understanding amongst the team
<p>Establishing a team</p> <p><i>Taking into account different team members skills and abilities to establish roles and allocate tasks between team members and self in order to enhance team performance.</i></p>	<ul style="list-style-type: none"> • 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 • Demonstrates ability to relinquish or maintain leadership role when appropriate team or senior in attendance 	<ul style="list-style-type: none"> • Fails to clarify own or team members roles • Vocalises necessary tasks but fails to delegate to specific team members • Overloads self or other team members with tasks

5.5 Discussion

The refinement process has used an iterative design and facilitated discussion to improve the understanding of the critical NTS required in this domain and to develop a prototype behavioural marker system. This method was also used to develop the guiding principles for the process itself, some of which offered conflicting arguments and required compromise. For example, the need to be parsimonious to gain usability and acceptability, but at the same time contain the detail to maintain the validity and internal structure of the tool. This process has remained true to the theoretical perspectives and acknowledgements of influences stated at the start of chapter 2. The construction of the framework has come through the discussion between the panel members. By selecting a mixed panel of individuals who all have experience of supervising junior doctors, and a varying degree of expertise in NTS, it is hoped that this tool will be both valid, and also easy to grasp conceptually for those with less experience in NTS.

Through returning to the original data and a detailed review of the category and element level decisions it is believed that this tool has been put together in a rigorous manner that will improve its validity and educational impact. This process has also highlighted potential areas of overlap between categories and the discussion of how to differentiate these skills will be useful in the future for designing rater training.

Several particularly interesting areas of discussion surrounded the impact of cultural, organisational factors and attitudes on behaviours and thus the scope of the behavioural marker system. Statement 3 of the design specification at the start of this chapter explained how the marker system should represent skills, not behaviours ‘influenced by external factors’. This remained a grey area of much debate throughout the process. There were several areas where it was conceded that this behavioural marker system should and could encourage the ‘right’ types of behaviours for junior doctors, even though they are currently influenced by factors such as hierarchy and culture. This was particularly notable with the speaking up element and exemplar behaviours that have been included under teamwork. It is hoped that if this tool is embraced by clinicians, particularly those in ‘senior’

positions, then their endorsement could act to change some of the existing culture and change these behaviours from a symptom of the culture, to a skill that can be trained and improved. A similar phenomenon has been documented in aviation, the oil industry and in some areas of healthcare, where this explicit acceptance of speaking up has been adopted (Armour Forse et al. 2011; Moray 2000).

The behavioural marker system represents a framework of skills and behaviours used by front line junior doctors. As discussed above, it could itself act as a tool to encourage safe and effective performance in junior doctors. It can also be used as a conceptual model to develop other tools and training, or to explain their effectiveness. For example, structured communication tools such as SBAR (Situation, Background, Assessment and Recommendation) or the Early Warning Scores linked to patient observation charts have had a significant impact in improving performance by front line staff (Beckett and Kipnis 2009; Alam et al. 2014). This improvement can be explained by using the conceptual model of NTS to appreciate which category of performance behaviours may have been improved. Figure 6 provides an example of several of these tools and which categories of behaviours are likely to be affected.

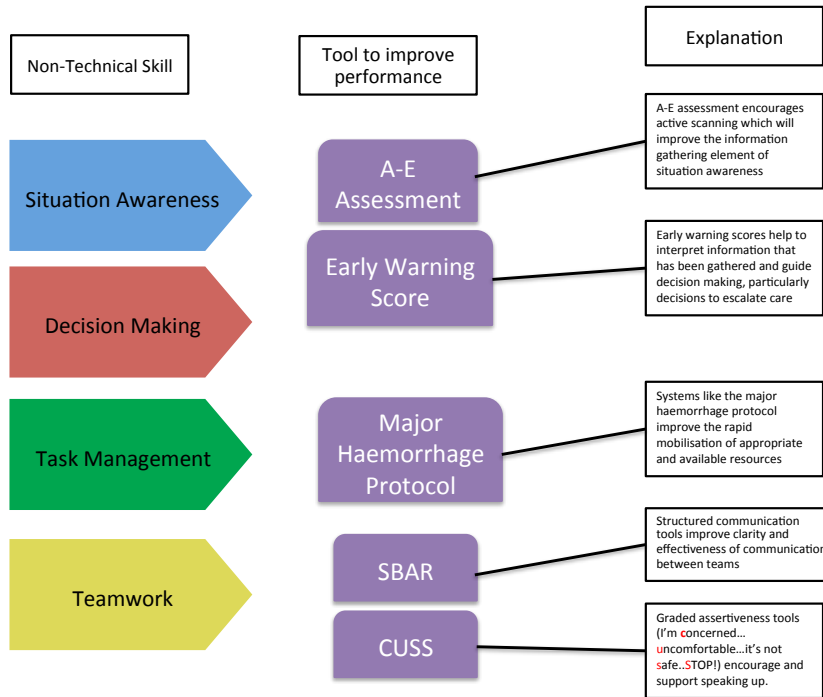


Figure 6: Examples of tools that have been introduced to improve safety in healthcare settings and the underpinning skill categories that may explain their apparent effectiveness.

Another area of interest and importance was the conceptualisation of escalation of care as being supported by the four pillars of NTS categories. This concept that the critical importance of escalating care can fail due to failure in any one of these four skill groups is critical. It explains to some degree why this can be so challenging, and lead to the astonishingly high levels of avoidable error described in chapter 1. Not only does a junior doctor have to recognise that a patient is critically unwell (situation awareness) she then has to decide to escalate care (decision making) and overcome some cultural barriers that prevent this. She then has to select the correct person to contact and means to contact them (task management) and finally convey the information in the right manor and possibly speak up (teamwork) in order to be successful. This suddenly becomes a fragile process that can break down at any point, resulting in failure and significant adverse events for patients. Perhaps this

could explain why 38% of patients suffering a cardiac arrest in hospitals are categorised as avoidable (Findlay et al. 2012).

5.6 Limitations

This socially constructed reality is one of many ways that the data could be displayed and the final behavioural marker system could appear. It is accepted that this output is limited by the very fact that an assessment tool's utility has competing demands that force compromise. As Van der Vleuten explains in his explanation of the utility equation: 'perfect utility is a utopia' (van der Vleuten and Schuwirth 2005).

However, it is hoped that the current framework strikes that balance in a way that will have a positive impact on the performance of junior doctors and the safety of patients in their care.

One bias that has clearly influenced the system is the categorisation and conceptualisation of NTS from previous research in the field, particularly the tri-level format of tools such as ANTS, NOTSS and SPLINTS (Fletcher et al. 2004; Mitchell et al. 2012; Yule, Flin, Paterson-Brown, Maran, et al. 2006). Justification for this influence is the successful validation of these tools in the literature and the adoption of these tools by clinicians on an international scale.

The construction of this behavioural marker system has not taken into account data from other members of the healthcare team, most notably nursing staff. There are several reasons for this notable limitation. Firstly the pragmatic explanations of time and resources with competing interests. Secondly, the purpose of the refinement process was to develop the tools validity, but also to ensure acceptability and usability from the clinical supervisors of the junior doctors. Within the current training programme these supervisors are by and large senior clinicians. It was therefore imperative to have senior clinicians from medicine and surgery involved with the refinement process to help steer the framework towards a usable tool that they and their colleagues would value. It is also acknowledged that this is a prototype. If further data from nursing staff is collected, then this prototype could act as a framework for analysis and undergo further refinement if it were to improve its utility.

This behavioural marker system is currently limited to observable behaviours. There is the potential that some important or critical behaviours cannot be observed. Indeed the cognitive skills in this tool are not observed, but rather inferred from other behaviour and actions. However, observability ensures a degree of objectivity that is required in assessment, and also avoids the trapping of fundamental distributional error that have been discussed previously.

A final comment is that this project has not involved any observational data from the management of acute care in the 'real world'. This is due to the practical and ethical difficulties in observing these infrequent and high stakes events without intervening. It is therefore true that the data is fallible to issues such as recall bias of the junior doctor volunteers. Given the graphic and honest accounts of the individuals who appear to have vivid memories of these scenarios, it is hoped that this will not have a significant negative impact on the findings.

5.7 Conclusions

This process has developed a prototype behavioural marker system for junior doctors in acute care. Whilst there are some limitations, it is hoped that this will be a valid, acceptable, usable and useful tool in improving the training of junior doctors and senior medical students.

It is the belief that this aim will be achieved due to the alignment of aims, theoretical perspectives and methods that have been deployed. In the spirit of constructivism, these methods have not only developed the research and advancement of understanding on the topic, but have also affected the views and behaviours of both the lead researcher and others in the research team. Improved understanding of the NTS and the challenges and influences of junior doctors in these time critical scenarios have changed the way that the author thinks and behaves in these scenarios towards these doctors. It is hoped that in some way this research can illuminate this issue to other clinicians and have a similar effect on their understanding and behaviour.

Chapter 6: Conclusions

This final chapter consists of a brief summary of the research process and outcomes. This is followed by its potential implications. It includes a description of how this research is currently being implemented into medical training and clinical practice. Some limitations are discussed, and recommendations for future research in this topic.

6.1 Summary of Research

This thesis has discussed the need to improve the management of acutely unwell patients by junior doctors. It has explored the concepts and current understanding of NTS and why this approach may benefit performance in this domain. Through the use of human factors research methodology it has identified the critical behaviours required by junior doctors and linked them to observable behaviours.

It is the first behavioural marker system that has been developed specifically for novice practitioners. During its development it highlighted several issues that may be particularly pertinent to the NTS of less experienced practitioners. Firstly, the cognitive challenges of novices and secondly the impact of cultural factors on performance. A summary of these two critical factors is discussed below.

6.1.1 Cognitive Challenges for Novices

Through the data gathered from the literature review, and the critical incident technique interviews we have seen how current theories of cognitive architecture and the limited capacity of working memory play out in clinical practice. It appears that these novice practitioners are particularly vulnerable to both increased demand on working memory and reduced capacity.

Reduced capacity is due to factors such as stress, unfamiliarity and excessive workload that all impact negatively on the limited reserves of working memory (Baddeley 1992). Additionally, the concept of automaticity is discussed in NTS literature (Flin et al. 2008). This describes how unfamiliar technical tasks by less

experienced practitioners can lead to less available space in working memory for NTS. For example, the act of getting blood, or inserting an intravenous cannula takes up less working memory for experienced doctors than for novice junior doctors (Smith et al. 2012).

Increased demand comes mainly through limited experience. The types of short cuts that are available for more experienced practitioners to improve situation awareness and decision making are less available to novice practitioners. These processes include concepts such as pattern recognition (Endsley 1995) and intuitive decision-making (Croskerry 2005). Whilst these strategies can lead to problems such as search satisfying and fixation errors, they undoubtedly have less demand on working memory and play an important role in how expert clinicians function in complex and demanding environments.

The novice junior doctor has to do two key things. Firstly, they must try and free up enough working memory to be able to gather, process, project and make decisions. Secondly, they (and clinicians supervising them) must accept that sometimes they lack the necessary experience and ability to have adequate situation awareness and decision making to proceed without support.

The importance of these factors are captured in the behavioural marker system in a few of the elements and exemplar behaviours. For example, within situation awareness, the use of a structured assessment, and the need to temporarily cease other activities are examples of trying to free up working memory and improve situation awareness. There are also attempts to acknowledge and except the unavoidable poor situation awareness that these practitioners are prone to. These include behaviours in decision making such as accepting own limitations, not operating beyond level of experience, involving others in decision making and (perhaps most importantly) escalating care early. Of course there are factors other than situation awareness that will impact on a junior doctors ability to escalate care early and not operate beyond their level of experience. These include environmental and cultural influences on behaviour and leads to the second of the critical factors that had to be considered whilst developing this marker system.

6.1.2 Impact of Cultural Factors

The aim of this research was to identify the desirable skills and performance behaviours of junior doctors, not to study the factors that influence them. However, when discussing performance behaviours it was unavoidable that influences on behaviours were captured. In fact, failing to acknowledge these impacts could have a negative effect on the validity and utility that this tool would yield.

Perhaps the most common factors affecting these novices, was the influence of perceived hierarchy on critical behaviours, such as timely escalation of care and speaking up. This is not surprising given that these doctors are the most 'junior' of all the medical practitioners involved in the patients' care. The key discussion relevant to this thesis is whether we should interpret performance in these areas within this behavioural marker system. Should behaviour influenced so strongly by external influences, rather than the 'skill' of the individual practitioner, be included as representing a NTS? It leads us to examine and explore the definition and theory that underpins the concept of NTS.

Through discussion and examination of the available literature we have taken the stance that these behaviours should be included in this behavioural marker system. This stance can be justified in aligning with the requirements and aims of this research project. In order to improve performance, it must focus on the most critical NTS required for safe and effective care. Whilst there is evidence that some of these behaviours are influenced by culture, there is also evidence from other industries that this culture can change (Armour Forse et al. 2011; Moray 2000). This is particularly evident within the aviation industry where an improvement in the safety culture that includes the ability to speak up against the gradient of perceived hierarchy is reported (Kanki et al. 2010). It appears that some of this culture has improved through explicitly accepting and acknowledging that these types of behaviours should be encouraged, and implementing this into training. It is the aspiration of this research that a similar phenomenon may be possible within healthcare. In other words, this tool explicitly states the importance and requirements for junior doctors to speak up, and if this can be accepted by the medical community, it could have a

directly positive effect on cultural influences and performance as a whole. Whilst there is no certainty that this will occur, it is reassuring that these changes appear to have been influenced by similar processes in other industries.

6.2 Implications of this Research

There are a number of implications for this research and ways in which this tool can be implemented to improve the clinical practice of junior doctors. They are similar to those suggested by the current literature on NTS and behavioural marker systems, but some are more specific or more pertinent to junior doctors and acute care. There are two factors to be considered here. Firstly the environment that this tool can be used within, and secondly the benefits that this tool has in allowing us to observe and assess NTS in this domain.

6.2.1 Environments to be used

As discussed previously, it is expected that this tool, as it stands, will be mainly used in simulated clinical scenarios. There is increasing use of *in situ* simulation, where manikin or patient actors are used to simulate scenarios in real clinical environments (Theilen et al. 2013). This allows some of the complexity and environmental factors to remain present, that may be difficult to capture in an off site simulation centre.

In its present form it would be more challenging to use this tool to observe and assess NTS in real clinical emergencies. This is because of the obvious difficulties in capturing these critical and infrequent events, and observing performance without intervening. In other high reliability organisations, and increasingly now in healthcare there is interest and acceptance in recording real clinical events. If this practice is conducted sensitively and appropriately it has been shown to provide invaluable information to guide performance improvements (Noland and Treadwell 1996; Santora et al. 1996). If this phenomenon continues to be accepted and supported then this tool could provide a method to observe these NTS within real clinical emergencies.

Other anticipated or possible ways this could be used to train and improve performance in this domain involve post event analysis and discussion by workplace

assessment, or critical incident analysis. Currently workplace assessment forms a large part of trainee assessment and validation processes within postgraduate training in the UK. This includes the summative and formative assessment of UK Foundation doctors. This tool could be used as a framework to help guide the structure of workplace based assessments such as a 'case based discussion' where a trainee analyses a previous patient interaction with a more senior colleague, using notes and recall. A similar process could be used to structure significant incident analysis in the event of an acutely unwell patient deteriorating and suffering an avoidable cardiac arrest admission to an intensive care ward.

Finally there is the possibility that some of these skills may stretch beyond the realm of the acutely unwell patient. There is a developing understanding of the importance of NTS in areas such as prescribing and particularly in the successful management of tasks during ward rounds. There is currently limited literature on the skills required for junior doctors to conduct ward rounds safely and effectively, despite this being a key part of their job, and some evidence to suggest that failures in NTS in this process lead to significant avoidable errors (Hogan et al. 2012). Whilst this would undoubtedly require an adaption of the tool, it is currently being used as a starting framework to guide training and assessment in this area (as described in the subsequent section).

6.2.2 Implications of the Behavioural Marker System

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. These will be discussed in more detail below:

6.2.2.1 Designing Training and Curriculums

Behavioural marker systems have been used successfully to design training programmes in other industries and areas of healthcare, particularly in the use of CRM. This includes setting learning objectives, training programmes and designing clinical scenarios for simulation or discussion. In essence, the framework identifies the critical skills and allows alignment of objectives, learning and assessment.

The World Health Organisations patient safety curriculum describes the requirement for students to learn and understand the concept and importance of NTS terms (WHO 2009). This has led to it now featuring increasingly in undergraduate medical curricula. Some of these curricula discuss the concepts of NTS, but evidence and educational theory suggests the importance of embedding this learning in real clinical scenarios. This allows students to see the direct importance and relevance of this topic to their own performance as junior doctors. This behavioural marker system allows students to clearly see the link between real clinical performance behaviour and the concepts and categories of NTS. As discussed below, it is already being used for this purpose at a local level.

6.2.2.2 Evaluating Training

Following the collection of further validity evidence for this tool, it is anticipated that it can be used to evaluate training methods and how they impact on the NTS of their candidates. The success of this use is well documented in other domains, including healthcare. It can allow a measure of quality control of local educational interventions, or between different organisations and educational techniques.

6.2.2.3 Structuring Feedback

There is a great deal of literature and research discussing the importance and nature of good feedback. The need for it to be timely, specific and targeted are now widely accepted. In addition it should deal with issues or behaviours that are amenable to improvement (Ende 1983). With these qualities in mind, the value of using this structure as a means to deliver effective feedback are clear. By dividing these skills into different categories and subcategories it can deliver specific and targeted feedback based on first hand direct observations. With training and increased use, it can also provide a common language to discuss these critical skills. This structure could and has been used to improve feedback during simulated debriefing sessions, to aid peer led feedback, and even to assist with self-rating and reflection.

6.2.2.4 Assessing Individuals

Depending on reliability and validity data, this tool could be used in formative and potentially summative assessment process. Other behavioural marker systems have

shown utility in this regard, in particular those used by aviation in licensure programmes (Flin et al. 2003). As discussed, for high stakes examinations this would require rigorous validity data before this could be fully justified. Within anaesthetics there has been examples of NTS assessment contributing to postgraduate selection programmes (Matveevskii and Gravenstein 2008). This could be an attractive option for selecting Foundation programme or other postgraduate training programmes. Although there would be some cost implications that would require further analysis, it may well prove feasible and worthwhile. Many deaneries in the UK now have simulation facilities available, and recording standardised scenarios could allow candidates to be compared and scoring to be confirmed by several raters who would not have to be in attendance.

6.2.2.5 Research

Finally this assessment tool could offer many valuable implications for research. There is a growing interest into the ways in which NTS can be taught and includes the importance of debriefing and feedback in the process of learning. Following adequate validity data, it is anticipated that this tool could be used to research the importance of different educational principles and technique, and also the influence of other factors on the performance of NTS. This could include environmental factors, or factors such as the technical ability or perhaps controversially the personality of the candidate itself. The latter may provide some interest in furthering our understanding of the nature and usefulness of NTS assessment in general. It is important to ensure we are not biasing individuals based on personality, but instead are assessing skills that can be trained and improved.

6.3 Current Implementation of this Tool

Whilst required validity evidence has limited some of these uses described above, this tool has already 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 (see appendix 9 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.

6.4 Limitations of the Research

Limitations of each phase of the research have been discussed in the individual sections of the thesis. In this section we will discuss several key limitations and their potential implications. The first relates to the method of data collection.

The largest source of data collection came from the critical incident techniques with junior doctors. The subject matter expert focus groups allowed the input of clinical supervisors to triangulate and add to the validity of the final marker system.

However, further sources of data could be used to improve and refine the marker system further. These sources include those of nursing staff, and those of the patient. Whilst these sources were considered in the design process, they were not included for several practical and justifiable reasons. By focussing on the junior doctor we

were able to collect more interviews from this key source and ensure we were able to use an iterative process to analyse the data several times in order to confirm any changes to the refinement process. This was seen as the most critical source as we are investigating cognitive processes. At this stage of the research it was felt that the best way to understand the cognitive processes of the junior doctors, is to ask them in depth questions directly, and not through second hand accounts from others about what they may be thinking, or trying to communicate. Perhaps involving nurses or patients in the refinement process could have been useful and valid, particularly for the critical social skills. However, it was decided to use clinicians with experience of supervising and training junior doctors. At present they have a greater influence and involvement on the training of junior doctors and therefore involving them in this process added to the likelihood that this tool would be accepted and usable for clinicians and therefore integrated into training. This limitation is accepted, and we have therefore referred to this tool as a prototype behavioural marker system. It can and should be refined with further data and over time, as have other behavioural marker systems in other industries.

The final limitation to discuss in this section is the lack of current validity evidence, particularly for reliability of this assessment tool. Validity can be defined as the way in which an assessment tool actually measures what it is supposed to measure. Whilst some evidence for validity can be claimed by the systematic and rigorous approach to methodology, further evidence is required particularly if this tool is to be used for assessment and research. Even simply used for training, it could be argued that the measurement of the tools internal validity and inter rater reliability is required. This would provide evidence that the different categories truly represent different domains of skills and abilities, and that these can be differentiated and observed in similar ways by different individuals. This evidence would allow us to be more confident that this tool provides a useful format for structuring feedback. Unfortunately due to practical considerations and a focus on the rigour of collecting and analysing interview data and refining the marker system, this was not possible within the time scale of this project. However, the marker system is now in a format that others can

use to collect this invaluable data and report it without the bias of being involved in the development process.

6.5 Recommended areas for future research

As discussed the main areas for on-going research would be the collection of further validity and reliability data to support the use of this tool in training and assessment.

Assuming that this tool demonstrates validity and reliability, it would then prove useful for many areas of future research as discussed in the previous sections. Within the context of junior doctors, given the findings discussed above, and current understanding of NTS in the literature, it would be particularly useful to study the influence of environmental and context specific factors on the performance of NTS. In addition the development and improvement of cognitive skills with experience and their link with technical ability would also be of interest.

6.6 Final Conclusions

Through human factors research methodology, 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 and their relative inexperience. This supports the current understanding and theory of workplace based learning and communities of practise, in the way that learning and behaviour are inextricably linked to the environments that they take place in (Lave and Wenger 1991). It also conveys a similar message to the literature on the hidden curriculum, whereby there is much about what is learned in clinical environments that is not explicitly taught (Lempp and Seale 2004). This may include how to behave with colleagues, and when to escalate care.

This behavioural marker system, with its exemplar behaviours can be viewed as a way of being more explicit about what we expect 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 people and environment 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.

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Appendix 1: Search terms for literature review

Terms for junior doctor AND terms for non-technical skill AND terms for acutely unwell patients were combined. The following represent the searches from each of these three categories:

Category 1: Non-Technical Skills

1. communicat*.tw.
2. (non?technical adj2 skill*).tw.
3. non technical skill*.tw.
4. planning*.tw.
5. team*.tw.
6. leadership*.tw.
7. anticipat*.tw.
8. situation*.tw.
9. trust*.tw.
10. relationship*.tw.
11. decision*.tw.
12. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11

Category 2: Junior Doctor

1. FY1*.tw.
2. FY2*.tw.
3. "foundation year*".tw.
4. (foundation adj2 (train* or doctor*)).tw.
5. (house adj1 (officer* or doctor* or man*)).tw.
6. (medic* adj2 graduat*).tw.
7. (medic* adj2 graduat*).tw.
8. (medic* adj1 graduat*).tw.
9. (junior adj2 doctor*).tw.
10. PRHO.tw.
11. internship*.tw.
12. "internship and residency"/
13. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12

Category 3: Acute Care

1. death, sudden/ or death, sudden, cardiac/ or acute disease/ or critical illness/ or emergencies/
2. Acute Disease/ or acute care.mp.
3. acute medicine.mp.
4. (acut* adj2 unwell*).tw.
5. (acut* adj2 ill).tw.
6. acut*.tw.
7. critic*.tw.
8. 1 or 2 or 3 or 4 or 5 or 6 or 7

Appendix 2: Descriptors for coding literature review

Coding Protocol

Protocol for coding the studies included in the literature review. The aim of this process is to try and identify the non-technical skills junior doctors use in the management of acutely unwell patients. For the purpose of this work, non-technical skills (NTS) are defined as:

‘Cognitive, social and personal resource skills that complement technical skills and contribute to safe and efficient performance’

It is the individual skills of the junior doctor that we are focussing on in this project. The initial aim of the coding is to identify the categories of NTS that are used by junior doctors in this context.

Category identification

This process will use NVivo software and a template analysis methodology. In this process pre-defined template for coding has been constructed. The following short descriptors should act a guide for coding phrases and sections from the literature.

Situation Awareness:

‘The gathering of information in the current situation, the comprehension of their meaning and the projection of their status in the near future.’

Decision Making:

‘The process of reaching a judgement or choosing a course of action to meet the needs of a given situation.’

Communication:

‘Exchange of information, feedback, ideas or feelings’

Teamworking:

‘The skill of working with others in a team context’

Leadership:

‘The behaviours and strategies adopted by the team leader that influence how and whether the team achieves its objective’

Appendix 3: Quality Scoring of Literature Review Papers

Tables demonstrating quality indicators as described by Buckley et al. and how each paper was scored by both researchers. One point was awarded for each quality indicator.

Quality indicator	Detail
Research question	Is/are the research question(s) clearly stated?
Study subjects	Is the study group appropriate (size, characteristics, selection)?
Data collection methods	Are the methods reliable and valid?
Completeness of data	What is the drop out / attrition / response rate?
Control for confounding	Have confounding variables been removed / minimised / accounted for?
Analysis of results	Are the methods of analysis appropriate?
Conclusions	Can the data justify the conclusions?
Reproducibility	Could the study be repeated by another group?
Prospective	Is the study prospective (forward looking) as opposed to retrospective?
Ethical issues	Were ethical issues addressed adequately?
Triangulation	Are the results supported by data from other studies?

Paper	Quality score from EM	Quality score from MH
O'Brien et al. 2001	7	8
Kennedy et al. 2009	8	9
Kennedy & Regehr 2009	9	9
Stewart 2008a	9	8
Tallentire et al. 2011	9	9
Tallentire et al. 2012a	9	9
Wu et al. 2003	7	7

Appendix 4: Confirmation of Ethics Approval

South East Scotland Research Ethics Service

Waverley Gate
2-4 Waterloo Place
Edinburgh
EH1 3EG



Name: Edward Mellanby
Address: Centre for Medical Education
University of Edinburgh
Chancellor's Building
49 Little France Crescent
Edinburgh
EH16 4SB

Date: 16/04/2012
Your Ref:
Our Ref: NR/1201AB1
Enquiries to: Alex Bailey
Direct Line: 0131 465 5679
Email: alex.bailey@nhslothian.scot.nhs.uk

Dear Edward,

Project Title: Defining the Non-Technical Skills Required by Newly Qualified Doctors in Managing Acutely Unwell Patients

You have sought advice from the South East Scotland Research Ethics Service on the above project. This has been considered by the Scientific Officer and you are advised that, based on the submitted documentation (email correspondence, Projsummary.doc and Interview schedule.doc), it does not need NHS ethical review under the terms of the Governance Arrangements for Research Ethics Committees (A Harmonised Edition). The advice is based on the following:

- *The project is an opinion survey seeking the views of NHS staff on service delivery*

If this project is being conducted within the NHS you should inform the relevant local Quality Improvement Team(s).

This letter should not be interpreted as giving a form of ethical approval or any endorsement of the project, but it may be provided to a journal or other body as evidence that ethical approval is not required under NHS research governance arrangements. However, if you, your sponsor/funder or any NHS organisation feels that the project should be managed as research and/or that ethical review by a NHS REC is essential, please write setting out your reasons and we will be pleased to consider further. You should retain a copy of this letter with your project file as evidence that you have sought advice from the South East Scotland Research Ethics Service.

Yours sincerely,

A handwritten signature in black ink that reads 'Alex Bailey'.

Alex Bailey
Scientific Officer
South East Scotland Research Ethics Service

Appendix 5: Interview Consent Form



Consent form for FY1 Interviews The University of Edinburgh Centre for Medical Education

Project Title: Defining the Non-Technical Skills Required by Newly Qualified Doctors in Managing Acutely Unwell Patients

Date: _____

Researcher: _____

Participant name: _____

&Contact details: _____

Please read carefully and sign below.

- I agree to participate in an interview undertaken by the The University of Edinburgh Centre for Medical Education and their research collaborators
- I have been given a full explanation of the nature, purpose and likely duration of the interview, and have been given the opportunity to ask questions about these.
- I have been assured that my participation is entirely voluntary and I understand that I am free to withdraw my participation at any time without needing to justify my decision. I can also ask afterwards for specific comments not to be used in the research
- I do not in any way feel pressured into participating in this research, and will try to respond openly and honestly to the questions.
- I understand that notes will be taken and the interview will be audio-recorded and transcribed. These will be kept strictly confidential, anonymised and will only be accessible to the research team. They will be destroyed when no longer required for the research.
- I understand that anonymous data from this interview may be published as research findings, including anonymised quotes in journal articles, book chapters, on the world wide web or in a thesis/dissertation. I am aware that I can see any such material before publication upon request.

Signature.....Date.....

Appendix 6: Interview project information sheet



Defining the Non-Technical Skills Required by Newly Qualified Doctors in Managing Acutely Unwell Patients

Participant Information Sheet

Thank you for your interest in taking part in this research project! Before you decide to participate it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully. Contact me (details below) if anything is not clear or you would like any further information.

What is the research is for?

We are aiming to produce some research to improve our understanding of the skills that are required of junior doctors in managing acutely unwell patients. We are particularly interested in the non-technical skills (e.g. things like teamworking and the way we think in these situations).

Who is doing this research?

This research is part of my work as an Education Fellow at the University of Edinburgh. It is being supervised by Dr. Janet Skinner (Consultant in Accident and Emergency and Director of Clinical Skills at the University of Edinburgh) and Dr. Nikki Maran (Consultant Anaesthetist, and Associate Medical Director of Patient Safety for Lothian) and has been funded by the Clinical Skills Managed Educational Network and the Institute of Academic Development at the University of Edinburgh.

What is required of you?

You are being asked to take part in a one-to-one interview lasting roughly 45 minutes at a time and place convenient for you. The interview will be based around a time when you have managed an acutely unwell patient as an FY1. It could be a time when things went well or not so well and should not be a case that you have used previously as part of a 'Case Based Discussion'.

Is what I say confidential?

Yes, your comments are strictly confidential. The transcriptions will be made anonymous and will not be shared with any other parties outside the research team. All recordings and notes will be destroyed when they are no longer needed for this research project.

Contact Details:

e-mail: Edward.mellanby@ed.ac.uk

Phone: 07916299445

Address: Edward Mellanby, Centre for Medical Education, Chancellor's Building,
49 Little France Crescent, Edinburgh. EH16 4SB

Appendix 7: Interview Schedule

Schedule overview

Brief

- Reiterate points what the project is about
- Give information leaflet
- Get written consent
- Re-iterate ground rules (confidentiality, no judgement will be made, can stop at any time, will be anonymous, try and stay clear of identifiable patient and staff details)

Interview

- Walk through event with little in the way of interruptions
- Use 'prompt' to clarify for more detail where required
- Use 'probes' to address any areas not covered

Conclusion

- Concluding questions
- Thank them for time and give them a signed letter of thanks.

Interview Schedule

1. Recall question

You were asked to recall a time when you have been involved in the management of an acutely unwell patient. This could be a time when things went well or didn't go so well, but is something that you remember clearly and that was challenging to deal with at the time. Please choose an example that you have not used as a case based discussion in the past.

Can you tell me about this in as much detail as possible? I am particularly interested in the non-technical details.

2. Prompts

What was it about this case that was particularly challenging?

Can you give me a bit more detail about that?

You said...what did you mean by that?

Tell me what you were thinking at that time?

3. Areas to be covered and suggested questions/probes:

Situation/Context of event

When did this happen?

What time of day was it?

What type of ward was it?

Who else was there?

What was the general workload like at the time?

How were you feeling at the time? (e.g. tired, rushed, etc)

Situation Awareness

What did you think was going on at the time?

What did you think was going to happen next?

How did you keep track of what was going on and where things were heading?

Decision making

Which options did you consider at the time?

What factors affected your decision?

How did you feel about this decision?

Task Management

What were the priorities?

What resources do you think would of helped you?

How did you use the resources around you to accomplish your goals?

Communication and teamwork

Who did you need to communicate with?

What was required for the team to work effectively together?

Leadership

Who did you think was in charge?

Did that apply for the whole case?

Stress/Fatigue

How were you feeling at the time?

4. Conclusion Questions

Were you taught any non-technical skills at medical school?

If so, where?

If you were to give some advise to a new FY1 for handling this type of situation, what would the main points be?

Thank you very much for your time, etc.

Appendix 8: Interview Coding Protocol and Example

Coding Protocol

Protocol for coding the critical incident technique interviews with the junior doctors. The aim of this process is to try and identify the non-technical skills junior doctors use in the management of acutely unwell patients. For the purpose of this work, non-technical skills (NTS) are defined as:

‘Cognitive, social and personal resource skills that complement technical skills and contribute to safe and efficient performance’

It is the individual skills of the junior doctor that we are focussing on in this project. The initial aim of the coding is to identify the categories of NTS that are used by junior doctors in this context.

Category identification

This process will use NVivo software and a template analysis methodology. In this process pre-defined template for coding has been constructed. This template is based on our current understanding of NTS in other high-risk industries. There are 7 categories to code the data into, and the definitions used for this project are as follows:

Situation Awareness:

‘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 patient, charts, communication and behaviour of co-workers, etc.

Decision Making:

‘The process of reaching a judgement or choosing a course of action to meet the needs of a given situation.’

It should include the generation of different options, the selection of an option and the reviewing of decisions that have been made.

Communication:

‘Exchange of information, feedback, ideas or feelings’

It should include the sending and receiving of information, and identifying and addressing barriers to effective communication.

Teamworking:

‘The skill of working with others in a team context’

This category includes skills required for working effectively in a group. It may include supporting others, resolving conflict and co-ordinating activities.

Leadership:

‘The behaviours and strategies adopted by the team leader that influence how and whether the team achieves its objective’

This may include skills relating to leading, asserting one’s position, directing others, allocating tasks and organising team structure.

Task Management:

‘The skill of management of resources and organisation of tasks to achieve goals’

This may include skills relating to planning and preparation, prioritisation, providing and maintaining standards and the identification and utilisation of resources.

Coping with Stress and Fatigue:

‘Coping with pressure, managing stress and fatigue’

This may include skills relating to the identification of symptoms of stress and fatigue, recognising their significance and adopting coping strategies.

Key Points

There is considerable overlap between the categories. Try and code each phrase to the most appropriate category that you think it fits best to. Please remain open to the possibility that new categories may exist. If you identify a phrase that relates to safe and effective performance, but does not fit into the current categories then please code into ‘other’ category for further discussion.

Example of Transcript Coding

Below is a brief example of an interview transcript and how it was coded using the final template at category level. It is provided to give an understanding to the reader of the level of detail that each item was coded at:

*"I got called to see her again and she was extremely breathless and her SATS had fallen quickly down.....and I remember thinking there's nobody here, it's just me and a nurse (laughs) and I just thought I need to start my A, B, C's, and I remember her saying to me "I can't breathe, I can't breathe" and it was horrible because I was like "but you've got oxygen on you, what else can I do" (said in a jokey helpless way), and it was high-flow oxygen and she could maintain her own airway and so I was happy with that, but what made me more scared was when you go back and reassess and the patients not improving after everything that you've done. Erm I didn't know who to call because it was my first week, I can't even remember if I knew how to bleep at that point, and I think I did the mistake of not calling the on-call person, but I actually called her reg who was in a clinic at a different.....this was at the*** and he was at the *** (different hospital), and I remember phoning him instead of the on-call which I felt really stupid....you know hindsight....it was a stupid thing I should have phoned the oncall person, but I called him and asked him if he could just have a look at the chest XRAY from where you're sitting... while I was on the phone she was getting sicker and sicker and I just remember turning to the nurse and saying "she needs to go to CCU"*

.....the nurse was fantastic, like very experienced in taking bloods and stuff and I remember he was able to do that, and put the oxygen on while I told him to take bloods and ECG, I'll order the chest xray and order the portable one....and phone the reg at the same time.

Key to coding of items:

Situation awareness

Decision making

Task management

Teamwork

FoNTS

Foundation

Non-Technical

Skills



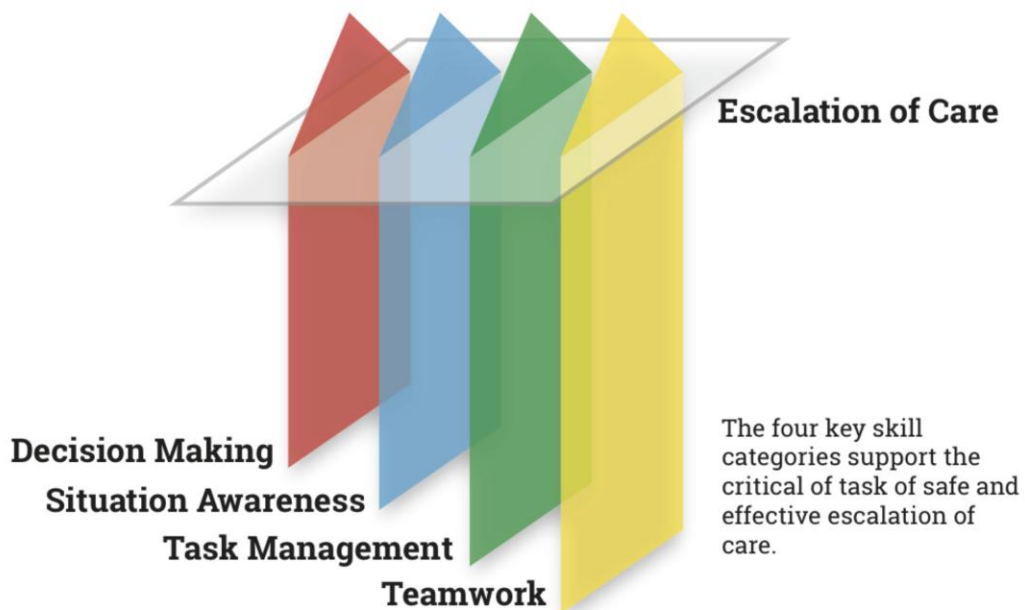
System Handbook



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

For further information about the FoNTS project:

Contact Edward Mellanby by email:

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

Skills Category:

Teamwork



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 aid 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

Establish roles and allocate tasks between team members and self in order to enhance team performance.

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

Skills Category:

Task Management



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

Category	Category Rating	Element	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