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Surgical Nurses' Non-technical Skills: A Human Factors Approach

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Abstract

This research is the first to explore the social and cognitive non-technical skills (NTS) required of nurses practising in general surgical wards, the first to identify a taxonomy of NTS for general surgical nurses and the first to identify the differences in levels of performance of the NTS between experienced and less experienced nurses. There is increasing evidence that poor performance of these skills by health professionals at the 'sharp end' of healthcare is a significant factor contributing to preventable adverse patient events. The study was conducted in four general surgical wards in a metropolitan hospital in a large city in New Zealand using a Human Factors (HF) approach. Part A, the first stage of the study, involved non-participant observations of fifteen nurses and used an inductive process to identify a taxonomy of seven NTS required of the nurses in their roles in surgical wards. These skills are communication, teamwork, situation awareness, decision-making, leadership and management, planning, and patient advocacy. Part B, the second stage of the study, used applied cognitive task analysis (ACTA) to determine the key cognitive skills that nurses use in challenging situations and to determine the differences between experienced and less experienced nurses' practice. This involved a series of semi-structured interviews with six registered nurses. In conclusion, this research has developed a taxonomy of general surgical nurses' NTS, both social and cognitive, identified the cognitive demands and cognitive processes of nurses pertaining to challenging events, and has provided an understanding of the differences in decision-making between experienced and less experienced nurses. The study has also identified gaps in nursing practice and nursing knowledge that can compromise the safety and effectiveness of the healthcare provided to patients. The findings from this research have significant implications for professional nursing practice and nursing education and point to a requirement for NTS training to be introduced into the nursing education curriculum and to be part of continuing professional development for nurses working in clinical settings.

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Glossary

ACTA	Applied Cognitive Task Analysis
CDT	Cognitive Demands Table
COPD	Chronic Obstructive Pulmonary Disease
ED	Emergency Department
EWS	Early Warning Score
HDU	High Dependency Unit
HPCA	Health Practitioners Competence Assurance
ICU	Intensive Care Unit
IOM	Institute of Medicine
IV	Intravenous(ly)
MDT	Multidisciplinary Team
MET	Medical Emergency Team
MSU	Mid-stream urine
NCNZ	Nursing Council of New Zealand
NTS	Non-Technical Skill(**s**)
OR	Operating Room
PA	Patient Allocation
PACU	Post Anaesthetic Care Unit
PCA	Patient Controlled Analgesia
PCEA	Patient Controlled Epidural Analgesia
PDRP	Professional Development Recognition Programme
PICC	Peripherally Inserted Central Catheter
RN	Registered Nurse
RPD	Recognition-primed decision-making
SBAR	Situation Background Assessment Recommendation
SCN	Shared Care Nursing
UTI	Urinary tract infection

Chapter 1. Introduction

"… the very first requirement in a Hospital [is] that it should do the sick no harm" (Nightingale, 1863, p. iii).

The aims of this study were to identify the non-technical skills (NTS) required of general surgical nurses as members of multidisciplinary surgical ward teams and to identify the differences in levels of performance of those skills between experienced and less experienced nurses. It is important that key NTS are formally identified to encourage the development of teaching strategies that target the learning of those skills to enhance patient safety and reduce preventable errors in healthcare. A Human Factors (HF) approach was used for this study.

1.1. Human Factors

Human Factors is defined as "the study of the interrelationships between humans, the tools they use, and the environment in which they live and work" (Weinger, Pantiskas, Wiklund, & Carstensen, 1998, p. 1484). Human Factors research has its origins in the fields of industrial engineering and psychology, and studies human performance with the aim of creating safer systems and reducing conditions that lead to error or harm (Kohn, Corrigan, & Donaldson, 2000).

Aviation has long recognised the relationship between HF and safety and engaged in research to detect and correct errors. This has enabled the design of safer systems (Seamster, Redding, & Kaempf, 1997). Helmreich and Foushee (2010) argued that safety in the aviation industry can be attributed to long-standing HF training that has improved human performance. Human Factors is a concept that has recently been introduced into healthcare (Flin, 2010; Powell & Hill, 2006) on the recommendation of the Institute of Medicine's (IOM) report (Kohn et al., 2000).

The HF approach operates on two levels: a systems level and an individual level (Fortune, Davis, Hanson, & Phillips, 2013). At the systems level the practice examines how people work in a specified system. It seeks to maximise safety in work systems through initiatives designed to counter human error. At the individual level, the approach is concerned with NTS which complement an individual's technical skills and are required for safe and

effective work performance (Flin, O'Connor, & Crichton, 2008). Problems at both levels can lead to an adverse event.

One HF model that explains the occurrence of an adverse event is James Reason's Swiss cheese model of system accidents (Reason, 2000). This model has highlighted how latent failures and active failures in a system contribute to adverse events when defences in a system fail. Reason's model asserts that in any system there are many levels of defence with 'holes' known as latent failures that lie dormant until they combine with an active failure to create an adverse event. Unlike holes in Swiss cheese these holes are constantly shifting location and can momentarily align to create an opportunity for an incident to occur. Active failures occur at the sharp end of a system as a consequence of the actions of frontline staff. Latent failures occur at the blunt end and are produced by factors such as poor system designs, procedures or management decisions. This study views nursing practice as being at the sharp end and attempts to understand the NTS that influence the clinical practice of general surgical nurses.

1.2. Non-technical Skills

Non-technical skills are defined by Flin et al. (2008) as "the cognitive, social and personal resource skills that complement technical skills, and contribute to safe and efficient task performance" (p. 1). The concept of NTS was initially applied to safety in the aviation domain for the training and assessment of the social and cognitive skills of flight deck crews (Flin, 2010) and has since been used in other safety-critical domains such as nuclear power plants (Crichton & Flin, 2004). Flin et al. (2008) identified seven generic NTS critical for safe performance in high risk industries. They are categorised as social or interpersonal skills for example communication, teamwork, and leadership; and cognitive or thinking skills which include situation awareness and decision-making. Two categories: managing stress, and coping with fatigue include both social and cognitive skills.

In healthcare NTS have been identified as an important aspect of clinical practice required to deliver safe and effective care. Investigations into adverse events have shown that the leading cause of clinical error can be attributed to human factors such as poor NTS, rather than deficiencies in technical competence (Kohn et al., 2000). As in aviation, health care organisations are beginning to examine the NTS required of health professionals for the

delivery of safe health care and NTS taxonomies are being developed for the purposes of training and evaluation of these skills.

In the context of surgical care, studies have explored NTS in operating room teams, and behavioural rating systems for the NTS required of anaesthetists (ANTS) (Fletcher et al., 2003), surgeons (NOTSS) (Yule, Flin, Paterson-Brown, Maran, & Rowley, 2006) and scrub nurses (SPLINTS) (Mitchell, 2011) have been identified. These studies show that the NTS required for safe performance are not the same for each professional group. Kodate, Ross, Anderson, and Flin (2012) assert that existing NTS taxonomies for any given occupation can be used as a basis for identifying NTS in other occupations. However existing taxonomies may contain some NTS categories not applicable for a different occupational role and thus will require further development with information obtained from the appropriate domain.

Within the surgical ward team, different health professionals work together to achieve a common goal. Therefore, it is important that the NTS required of individual team members be identified to enable them to work as part of an effective and efficient interprofessional team. In the surgical ward nurses are frontline providers of care, however the NTS required of them for safe patient care have not previously been identified.

During the course of their work nurses need to make decisions, often in challenging and pressured situations, requiring effective cognitive skills to ensure successful outcomes. Research in the nursing domain has shown that expert nurses make clinical judgements more effectively than their less experienced colleagues (Benner, 2001) who are more prone to make errors in their decisions. Consequently, it is important to explore the differences in the cognitive skills of experienced and less-experienced nurses to understand how they process information and respond in challenging situations. This will assist with comprehending how errors can occur but could be mitigated for the safety of the patients that are the nurses' responsibility.

Identifying NTS can be challenging. Unlike social skills which can be identified by direct observation, cognitive skills are tacit and therefore require the use of cognitive psychology techniques, such as cognitive task analysis to yield information about them (Schraagen, Chipman, & Shalin, 2000).

1.3. Patient Safety

Patient safety is defined as "… freedom from accidental injury" (Kohn et al., 2000, p.58) "due to medical care or from medical error" (Fortune et al., 2013, p. 2). Medical error refers to any mistake that contributes, or could contribute, to an unintended result occurring in the treatment of a patient. Such events in patient care can result from both clinical (technical) and human (non-technical) factors (Fortune et al., 2013). One of the core values of nursing practice is non-maleficence or 'do no harm' (New Zealand Nurses Organisation, 2010; Nursing Council of New Zealand [NCNZ], 2012b), yet harm to patients does occur (Rowe, 2012).

The delivery of high quality healthcare is paramount for patient safety. Preventable patient harm from substandard care resulting in disability and even death is a significant public health problem found globally in health systems today (Agency for Healthcare Research and Quality, 2013; Aranaz-Andres et al., 2009; Baker et al., 2004; Clarke, Furlong, Laing, Aldous, & Thomson, 2013; Forster et al., 2004; Hogan et al., 2012; Kable, Gibberd, & Spigelman, 2002; Morimoto et al., 2010; Soop, Fryksmark, Koster, & Haglund, 2009; Vincent, Neale, & Woloshynowych, 2001; Wilson et al., 1995; Zafarghandi, Mohaghegh, & Roudsari, 2003; Zhang et al., 2013). New Zealand is no exception with serious adverse events reported to have occurred in both the public and private sectors of the healthcare system (Health and Disability Commissioner, 2012; Health Quality and Safety Commission New Zealand, 2014; Rowe, 2012).

The Institute of Medicine's report (2000), "*To err is human: Building a safer health system*" (Kohn et al., 2000), identified that between 44,000 to 98,000 people die in the United States (US) each year from preventable adverse events due to human error in healthcare services. The report revealed that over 60 % of preventable adverse events in the inpatient setting were due to failure of health professionals' NTS, as opposed to their clinical skills. Since 2000 there has been an increasing awareness of the requirement for competence of health professionals' NTS in the delivery of safe patient care. It is now widely understood that poor performance of health professionals' NTS, rather than deficits in technical proficiency or technical knowledge, is the leading cause of preventable patient harm (Anderson, Davis, Hanna, & Vincent, 2013; Awad et al., 2005; Catchpole, 2013; ElBardissi, Wiegmann, Dearani, Daly, & Sundt, 2007; Flin, Winter, Sarac, & Raduma, 2009; Karsh, Holden, Alper, & Or, 2006; Leonard, Graham, & Bonacum, 2004; Merry,

2007; Moody, 2006; Norris, 2009; Phipps, Meakin, Beatty, Nsoedo, & Parker, 2008; Reid & Bromiley, 2012; Scanlon & Karsh, 2010).

Over the last decade HF approaches have been increasingly introduced into the healthcare arena in an effort to alleviate this problem. This issue has relevance for nursing practice because nurses provide the majority of care for patients as they are with the patients in hospitals 24 hours a day, seven days a week. Nurses are therefore in a prime position to prevent harm to patients and have real potential for improving both the quality of care and the quality of patient outcomes (Leape & Berwick, 2000; Rowe, 2012).

1.4. The Study

The study was conducted in four general surgical wards in a metropolitan hospital in a large city in New Zealand. It is the first research study to explore the NTS required of nurses in a general surgical ward setting.

My interest in this topic arose from my experience as a nurse clinician, an educator of baccalaureate nurses and my concern for patient safety. The latter is based on an awareness that preventable error can result from failures of health professionals' NTS, not just poor technical competence of frontline staff.

1.4.1. Research questions

The study was designed to answer the following questions: What non-technical skills are required of nurses when providing nursing care in a general surgical ward? What cognitive skills do nurses use in challenging situations in a general surgical ward? What are the differences in the levels of performance of NTS between experienced and less experienced nurses?

This study is the first to explore the social and cognitive NTS required of nurses practising in general surgical wards, the first to identify a taxonomy of NTS for general surgical nurses and the first to identify the differences in levels of performance of the NTS between experienced and less experienced nurses.

1.4.2. Research methods

A HF approach, using an exploratory research design based on observations of nurses' practice and Applied Cognitive Task Analysis (ACTA) (Militello & Hutton, 1998), was adopted for this research. Exploratory research designs are particularly suited to shedding light on the full nature of a phenomenon and its underlying processes when little is known about the topic of interest (Polit & Beck, 2008).

The ACTA method (Militello, Hutton, Pliske, Knight, & Klein, 1997) was originally designed as part of a naval research programme as traditional cognitive task analysis techniques were impractical for use in applied work settings such as Navy Instructional Systems. Since then the methodology has been refined (Militello & Hutton, 1998) and, due to its generic approach, applied successfully in other domains such as aviation (Ebbatson, 2009). The ACTA method typically begins with an observation of individuals' performance in the work place. This is followed by a series of interviews designed to gain information about the cognitive strategies individuals use to accomplish their work tasks. Three semi-structured interviews designed to explore different aspects of cognitive skills, were used to collect the data. To assist with the facilitation of data extraction, a 'toolkit' containing specified cognitive probes and questions was utilised. The outputs from ACTA are typically used to aid instructional systems' design (Militello & Hutton, 1998).

This study was conducted in two parts. Part A was the first stage in the study and utilised non-participant observations involving 15 registered nurses (RNs) as participants. The reason for conducting the initial non-participant observations was to observe the NTS required of the nurses in their everyday practice in the surgical ward. Part B was the second stage of the study and the ACTA method was used to determine the key cognitive skills nurses use in challenging situations and to determine the differences between experienced and less experienced nurses' practice. For this part of the study six RNs were recruited and individually interviewed three times. The combination of observation and interview data increased the depth of information collected and provided a much deeper understanding of the research topic than one data collection method alone could have provided.

Analysis of the observational data was guided by the generic NTS categories required for safe and efficient performance in safety critical work settings (Flin et al., 2008). Analysis of the interviews was undertaken using ACTA methods (Militello & Hutton, 1998).

The observational study identified the social and cognitive NTS nurses used every day in their clinical practice. The ACTA provided a comprehensive picture of the cognitive demands that guide nurses' actions and was useful for gaining an understanding of the cognitive skills they used to make difficult decisions and judgements in complex situations.

1.5. The General Surgical Setting

In New Zealand, patients undergoing surgical procedures are nursed in surgical wards which may be general surgical wards or specialty surgical wards such as orthopaedic or cardiac surgery wards. General surgical wards are not specific to a surgical specialty and are comprised of a mix of patients who require different surgical procedures.

The general surgical ward team consists of a number of health professionals with different skills who interact to provide patient care. Within this multidisciplinary surgical team, it is assumed that the role expectations and responsibilities of each professional group are clearly defined and understood by the team members. However, a pilot study carried out in a New Zealand tertiary healthcare setting to explore team performance in a perioperative environment established that team members were unclear about the role and responsibilities of each occupational group (Callaghan, Roskvist, & Hunt, 2008). White (2012) suggested a lack of role clarity and poor team dynamics may result in unintended injury to patients. Therefore, given the current lack of understanding of the role expectations and responsibilities of each professional group in the surgical team it is important that clarification of each team member's role is established for the safety of surgical patients.

The main responsibility of nurses working on surgical wards is the provision of safe care to surgical patients who have varying levels of acuity. Following the introduction of the Health Practitioners Competence Assurance (HPCA) Act of 2003, nurses became accountable for the health services they provide. In an increasingly complex and uncertain environment, nurses are required to respond appropriately to the many demands placed on

them from patients in their care, their families/*whānau[1]*, and other team members. When providing care nurses are required to maintain legal, ethical and professional standards. In challenging situations, it is argued that nurses who have well developed NTS are more likely to keep patients safe and minimise the potential for harm (Reader, Flin, Lauche, & Cuthbertson, 2006).

1.6. Nursing Education

Entry to the Register of Registered Nurses in New Zealand is through successful completion of a three year NCNZ accredited baccalaureate programme and obtaining a pass grade in the national state examination administered by the NCNZ. As well, all candidates for registration must meet the competencies for the RN scope of practice (NCNZ, 2012a)[2]. The RN scope of practice, which is based on consultation with experts rather than research-based evidence, consists of four domains of competence: professional responsibility, management of nursing care, interpersonal relationships, and interprofessional healthcare and quality improvement. Evidence of safety to practise as a registered nurse is demonstrated when all competencies within the four domains are met.

Although some competencies refer to cognitive skills such as decision-making and social skills such as communication and teamwork, the associated generic performance indicators do not include behavioural markers for good and poor practice. Instead competence within each of the four domains is for the assessors to determine. This is problematic as there is

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[1] W*hānau:* Is a noun which refers to extended family or the family group in Māori society. It is sometimes used to include friends who may not have any kinship ties to other members (Moorfield, 2011).

[2] Registered nurse scope of practice: "Registered nurses utilise nursing knowledge and complex nursing judgment to assess health needs and provide care, and to advise and support people to manage their health. They practise independently and in collaboration with other health professionals, perform general nursing functions and delegate to and direct enrolled nurses, healthcare assistants and others. They provide comprehensive assessments to develop, implement, and evaluate an integrated plan of health care, and provide interventions that require substantial scientific and professional knowledge, skills and clinical decision-making. This occurs in a range of settings in partnership with individuals, families, *whānau* and communities. Registered nurses may practise in a variety of clinical contexts depending on their educational preparation and practice experience. Registered nurses may also use this expertise to manage, teach, evaluate and research nursing practice. Registered nurses are accountable for ensuring all health services they provide are consistent with their education and assessed competence, meet legislative requirements and are supported by appropriate standards. There will be conditions placed in the scope of practice of some registered nurses according to their qualifications or experience limiting them to a specific area of practice" (NCNZ, 2012a, p. 3)

currently no evidence-based definition of nursing competence and little formal instruction of NTS in nursing education. Instead nurses usually acquire these skills from role models in clinical practice (Adlam, Dotchin, & Hayward, 2009; Haggerty, Holloway, & Wilson, 2013; Vallant & Neville, 2006).

1.7. The Health Practitioners Competence Assurance Act of 2003

As mentioned above, nurses in New Zealand are regulated by the HPCA Act of 2003. This Act requires the NCNZ, as the regulatory and disciplinary authority of the profession of nursing, to specify scopes of practice and the requisite qualifications for each scope (s.12). The NCNZ is also required to monitor and accredit educational institutions that provide education for nursing qualifications. The Act does not, however, clearly define competence, instead the conceptualisation and interpretation is left to the regulatory bodies covered by the Act. The NCNZ (2011) has defined competence as "the combination of knowledge, skills, attitudes, values and abilities that underpin effective performance as a nurse" (p.4). The competency standards developed by NCNZ reflect this definition.

1.8. Nursing Council of New Zealand

Under the HPCA Act of 2003 the NCNZ is charged with monitoring nurses' ongoing competence and fitness to practise to ensure the safety of the public. This is achieved through the Continuing Competence Framework (NCNZ, 2007) which requires each nurse to make a self-declaration of competence on an annual basis and to maintain a professional portfolio for assessment by an approved professional development and recognition programme (PDRP) or NCNZ recertification audit (NCNZ, 2013). Competence is demonstrated by the provision of evidence of: ongoing professional practice, ongoing professional development, and meeting the NCNZ's competencies for the scope of practice for a RN (Nursing Council of New Zealand, 2012a). An additional role of the NCNZ is to investigate reports of concerns about nurses' health, conduct or competence.

1.9. Structure of the Thesis

The thesis is structured as follows:

Chapter One: Introduction. This chapter introduces the research topic, identifies the research aims and research questions and provides the context for the research.

Chapter Two: Literature review. Chapter Two provides a critical review of existing literature pertaining to general surgical nurses' NTS.

Chapter Three: Methods. Chapter Three discusses the research strategy for this study. It discusses why a HF approach was used and provides an outline of the two parts of the study and the methods used to collect and analyse the data. Ethical considerations are discussed as well as the techniques used to establish trustworthiness of the study's data.

Chapter Four: Observation study. Chapter Four presents the first part of the study and includes the findings from the analysis of the data generated by non-participant observation of fifteen nurses in four general surgical wards.

Chapter Five: Task diagram interview. Chapter Five introduces the second part of the study and commences with an overview of the ACTA framework. It is the first of four chapters that illustrate nurses' cognitive processes during challenging situations. It presents the analysis of the data generated from the first of three interviews and provides direction for the more detailed interviews presented in the following two chapters.

Chapter Six: Knowledge audit interview. Chapter Six presents the findings from the knowledge audit interviews which are the second phase of the ACTA. The first part of the chapter presents the findings of six individual knowledge audits which identified the cognitive demands the nurses faced in challenging situations. The second part of the chapter presents a master knowledge audit which is an amalgamation of the findings of the six individual knowledge audit interviews.

Chapter Seven: Simulation interview. Chapter Seven presents the analyses and findings from the data generated by the six simulation interviews. It provides access to the thought processes of experienced nurses and the decisions they make when a patient "doesn't look right" following surgery. It also identifies the potential errors less experienced nurses would be likely to make when dealing with the same situation.

Chapter Eight: Cognitive demands table. Chapter Eight presents the findings from the cognitive demands table which integrates the data obtained from the task diagram, knowledge audit and simulation interviews. This chapter also presents the cognitive demands associated with the NTS identified in the observational study. It discusses the

cognitive skills used to respond to the cognitive demands and the differences in performance of those skills for experienced and less experienced nurses.

Chapter Nine: Discussion. Chapter Nine presents the original contributions to knowledge made by this study and discusses the implications for clinical practice and education. The findings from both parts of the study are discussed in relation to the existing literature and the research questions. It concludes with a discussion of the strengths and limitations of the approach used.

Chapter Ten: Conclusion. Chapter Ten concludes the study and presents recommendations for future research, education and practice.

Chapter 2. Literature Review

This chapter reviews literature that addresses cognitive and social NTS used by nurses in general surgical wards. The chapter describes the strategy undertaken for the literature review and examines the current body of knowledge relating to nurses' NTS. The literature is discussed using Flin et al.'s (2008) seven NTS categories: situation awareness, decision-making, communication, teamwork, leadership, managing stress, and coping with fatigue.

2.1. Search Strategy

Thus an extensive literature search was focussed on these seven fundamental NTS categories noted by Flin et al. (2008). The search was limited to articles in English and initially those published from 2000 to 2010. They were sourced from the following databases: CINAHL Plus, ERIC, SCOPUS, PsychINFO, Medline and ProQuest Dissertations & Theses Global. The search terms used were "non-technical skills", "nontechnical skills", Managing stress OR coping with stress, (MH "Communication Skills") "communicat*"(MH "Communication+")(MH "Decision-making") "planning" ("situation awareness") or (MH "Cognition") ("teamwork") or (MH "Teamwork") ("leadership") or (MH "Leadership") ("social skills") or (MH "Social Skills") ("cognitive skills") or (MH "Cognition") "surgical ward*" ("nursing units" or (MH "Nursing Units") "surgical unit*" "day stay surg*" "ambulatory surg*" (MH "Nurses") OR nurse or nurses or nursing (MH "Social Skills") (MH "Teamwork") Leader* "surgical ward" Surgical wards (MH "Nursing Units") Surgical unit* Day stay surg* (MH "Nurses+") (MH "Decision, Making+") "situation awareness" (MH "Quality of Healthcare+) (MH "Protocols+") Planning Nurs* Not (icu or intensive care unit* or critical care unit* or pediatric * or paediatric* or palliative care) Not (nurse leader or nurse manager or pacu or theatre or operating room) Not (mental health or psychiatric* or manager* or critical care).

2.2. Search Outcome

Initially 564 publications were identified in the search. Of those 150 reported research relating to the surgical setting and their abstracts were studied to determine the relevance of the papers. Most of the literature was related to studies conducted in specialist surgical units such as cardiothoracic, neurology and orthopaedics and these publications were

excluded as insights from specialist units may not be transferrable to understanding the NTS required of nurses in general surgical wards. This exclusion resulted in 41 possible articles. These were read to identify only those that included data specific to RNs working in general surgical wards. Of these 41 articles, only one study was conducted in a general surgical ward and referred to communication of "frontline staff". Therefore, the search was repeated on 15 March, 2013 to ensure all extant literature pertaining to general surgical nursing was accessed. Initially 932 articles were identified in this search. One hundred and forty-four potential articles were saved. Articles were retained if the title included the words surgical, surgery, or nurse; or pertained to any surgical procedure, surgical patient, or surgical specialty such as orthopaedics; or mentioned any generic NTS, or any NTS which had been identified by analysis of the data from the study, or any other word indicating a HF orientation. While some titles appeared with words or terms that had been excluded from the initial search it was decided in this instance to retain these articles for further review. It was perceived they could potentially contain relevant information since they had been included in the hits from the search. If not, they could be easily discarded.

Because very little literature pertaining to NTS in general surgical nursing was retrieved, it was decided to also include any literature with 'medical-surgical' or 'medical and surgical' in the title. It was realised that globally, medical-surgical wards are the most predominant configuration for the delivery of surgical services in hospitals. In contrast, general surgical wards were most commonly found in New Zealand and Australian healthcare services. The second search resulted in 10 articles which were included in the review.

Due to the paucity of literature relating to the research topic the search terms were extended to include non-technical skills and health professionals and, non-technical skills and patient safety. Thus a final search was conducted in January 2016 to update the literature review resulting in a total of 31 articles that met the criteria.

Within the literature located, communication skills and teamwork skills were the most frequently investigated NTS involving general surgical ward nurses. There were few papers that specifically explored decision-making, leadership, and managing stress. No studies pertaining to the NTS of situation awareness and coping with fatigue were found in the literature searched.

2.3. Non-technical Skills and General Surgical Nurses

2.3.1. Communication

Communication is a critically important NTS as poor transfer of information, either verbally or non-verbally has been identified as one of the leading causes of preventable errors in healthcare by The Joint Commission for Accreditation of Healthcare Organisations (JCAHO) (2015). Effective communication is the foundation of a safety culture that embraces the safe and efficient functioning of healthcare teams (Awad et al., 2005; Catchpole et al., 2007; Chapman, 2009; Cohen et al., 2004; Leonard et al., 2004; Reid & Bromiley, 2012; Rosenstein & O'Daniel, 2008). Much of nursing work involves communicating with patients and their family/*whānau* medical colleagues and allied health professionals.

In the literature searched, communication was the most frequently explored NTS pertaining to patient care in a surgical ward setting. The focus of these publications was verbal and non-verbal communication including non-verbal behaviours (Frankel et al., 2012), communicating with doctors (Andrews & Waterman, 2005; Donohue & Endacott, 2010), nursing handover (Carroll, Williams, & Gallivan, 2012; Chung, Davis, Moughrabi, & Gawlinski, 2011; Cornell & Gervis, 2013; De Meester, Verspuy, Monsieurs, & Van Bogaert, 2013; Dowding, 2001; Evans, Grunawalt, McClish, Wood, & Friese, 2012; Lee, Cumin, Devcich, & Boyd, 2015; Radtke, 2013; Riesenberg, Leitzsch, & Cunningham, 2010), the impact of different models of care on communication (Fernandez, Tran, Johnson, & Jones, 2010), factors that impair communication (Dayton & Henriksen, 2007; Johnson et al., 2014; Redding & Robinson, 2009; Staggers & Jennings, 2009), and communication technologies (Breslin, Greskovich, & Turisco, 2004; Guarascio-Howard, 2011; Vandenkerkhof, Hall, Wilson, Gay, & Duhn, 2009).

In the surgical ward, nursing communication typically occurs during routine care or during pressured situations such as emergencies. In both situations it is subject to many distractions, inefficiencies and variability which have implications for patient safety as these factors are potential sources of error (Keenan, Yakel, Dunn Lopez, Tschannen, & Ford, 2013).

Nurses' ability to communicate effectively with other team members is central to patient safety (Nadzam, 2009). Using a grounded theory approach to explore the practical

problems medical and surgical nurses face in detecting physiological deterioration Andrews and Waterman (2005) found in their UK study of 44 nurses, doctors and support workers that nurses often picked up physiological deterioration with subtle cues which they then had difficulty getting a response from doctors. Nurses observed that the most effective way of communicating information to doctors when a patient required a medical review was to use 'convincing' and objective information. However, nurses in the study had little experience of using medical language and were not confident with articulating the evidence to get doctors to respond. Instead they used predominantly social language to articulate their concerns. What emerged from the data was that for nurses to successfully refer a patient they must present their clinical findings and their worries more convincingly and in a way that doctors understood. Andrews and Waterman concluded that being able to discuss biological knowledge such as anatomy, pharmacology, microbiology and pathology is central to effective communication between nurses and doctors when a patient's condition is deteriorating. They recommended that nurses be taught assessment skills, and rather than using social language, they needed to gain confidence with using medical language. They contended that early warning scores (EWS) can facilitate communication between nurses and doctors as EWS systems provide a framework for assessment and communication of physiological information to doctors.

Although EWS systems have been introduced into surgical ward environments to improve communication between nurses and doctors, they have their limitations. A study conducted in the United Kingdom (UK) using the critical incident technique, explored the use of EWS in acutely ill patients on medical and surgical wards and found that nurses used them infrequently, too late or not at all. (Donohue & Endacott, 2010). The researchers found that EWS systems were not a key component of nursing assessment and that instead RNs looked at trends in their visual assessments of patients. They also found that the EWS were more commonly used once deterioration was recognised. Similar to Andrews and Waterman (2005), Donohue and Endacott found that nurses had difficulties articulating relevant information about the seriousness of a patient's condition to multidisciplinary team (MDT) members which then contributed to tensions in team communication. This resulted in delayed escalation of care and delayed recruitment of additional support when critical incidents occurred. The authors concluded that nursing and medical clinicians needed a better awareness of the benefits of using EWS to identify and alert others of changes when a patient's condition is deteriorating. A better understanding of each team

member's role and responsibilities was also suggested for improving communication and referrals of patients between team members. However, the study involved only a small sample of ward nurses (n=11) and was undertaken in just one site which limited the generalisability of the findings.

Clinical handover is an important component of nursing practice for ensuring continuity of patient care and as an avenue to promote patient safety (Maxson, Derby, Wrobleski, & Foss, 2012). It involves the transfer of information and responsibility of care of patients from nurse-to-nurse and has been identified as a widespread area of concern regarding communication within nursing teams (Kalisch, Weaver, & Salas, 2009). This concern was reflected in the literature searched where clinical handover was the most frequently investigated aspect of communication involving surgical ward nurses. A constant concern was the lack of structure in the way information was transferred and the level of interruptions and distractions that occurred during handovers. These, the researchers argued, were barriers to effective communication (Dayton & Henriksen, 2007; Johnson et al., 2014; Staggers & Jennings, 2009) and a threat to patient safety (JCAHO, 2015).

A variety of communication tools have been developed for the purpose of improving the transfer of information between nurses. These tools employ HF strategies, such as 'standardisation' to improve staff communication and promote patient safety (Norris, 2009). In a US study of 22 nurses, a standardised evidence-based nursing shift report was implemented in a medical-surgical ward at a large tertiary care centre as a tool to enhance communication between nurses (Chung et al., 2011). These authors' 'baseline observations' of shift reporting processes revealed variable standards in the handover where missing information could affect the patients' plan of care adversely in several cases. Following implementation of the newly developed shift report tool, the thoroughness and completeness of the nursing handover improved and the time nurses spent looking for missing information was reduced.

Another standardised communication technique being used by nurses working in surgical wards is the 'Situation-Background-Assessment-Recommendation' (SBAR)[3] technique

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[3] SBAR is a communication tool designed to standardise communication to prevent misunderstandings. It stands for situation (a concise statement of the problem), background (pertinent and brief information relating to the situation) assessment (analysis and consideration of options) and recommendation (action requested/recommended).

(Haig, Sutton, & Whittington, 2006). Researchers in the US investigated the impact of the SBAR technique on 75 medical-surgical nurses' shift reports and found significantly improved clinical handover when nurses used this standardised approach (Cornell & Gervis, 2013). A more recent study by the same researchers explored the nursing handover of 36 nurses working in a 48 bed medical-surgical unit. The introduction of the SBAR technique was shown to improve nurse-to-nurse communication as it enabled higher quality, consistent reports to be given in a shorter time (Cornell, Gervis, Yates, & Vardaman, 2014). An earlier study (De Meester et al., 2013) that was the first to show significant patient outcomes using SBAR, was conducted in medical and surgical wards in a university hospital in Belgium. The descriptive study using questionnaires involved 425 nurse participants during 37,239 admissions. It revealed when nurses used this technique to communicate information about a deteriorating patient to doctors they were more confident and better prepared to explain their concerns. This resulted in a significant reduction in unexpected deaths due to more timely admissions to the intensive care unit (ICU). As this was a single centre study the findings cannot be generalised to other settings.

Another strategy for improving clinical handover is moving from a centralised global procedure that occurs face-to-face or by tape recording at the nurses' station to a handover that occurs at the patient's bedside. It enables patients to be active participants in the process which is in contrast to usual handover methods. Researchers examined bedside handover to determine the impact on patient satisfaction and nurse satisfaction. A small US study Radtke (2013) found that patients on a medical-surgical ward reported increased satisfaction in nursing communication, from 75% to 87.6%, when bedside handover was introduced. Nurses in the study also provided positive feedback on the process. Maxson et al. (2012) found significantly increased patient satisfaction with bedside handover in a small survey of 15 nurses and 60 patients conducted in one, 11 bed surgical unit, in a US hospital. The bedside handover had a significantly positive effect on nurse satisfaction and accountability, and nurses' communication with doctors about patient care immediately after handover. In another small US study, bedside handover was also found to provide more accurate information, with fewer distractions and less time taken, allowing direct patient care to commence sooner than with conventional reporting (Evans et al., 2012).

Empirical evidence regarding the specific elements for high quality handover and the relationship between the information given and how it may be processed, remains largely unknown (Dowding, 2001; Riesenberg et al., 2010). There is evidence to suggest that the level of experience of the nurse presents challenges for standardising and improving communication effectiveness during handover (Lee et al., 2015). Carroll et al. (2012) argue initiatives directed at improving handover should therefore move beyond technical accuracy and focus on relational communication practices.

Models of nursing care delivery, and how nursing teams are configured in the surgical ward, can potentially influence communication in nursing teams. The re-introduction of the 'team nursing' model, where the care of a group of patients is shared by a team of nurses, has presented difficulties for nurses who were used to working with the 'total patient care' model. In the latter model each nurse has sole responsibility for a number of patients for an entire shift. In contrast, team nursing is hierarchical in nature and requires appropriate delegation of responsibilities and understanding of team members' scopes of practice, otherwise an inequitable workload distribution can result and lead to a breakdown in communication, team disunity and conflict (Eagar, Cowin, Gregory, & Firtko, 2010). To explore the relationship between the scope of practice and communication, Eagar and colleagues conducted six focus group interviews with 30 enrolled nurse and RN participants working in medical and/or surgical wards in three hospitals in Australia. The study which was part of a larger study exploring nursing team communication in healthcare environments, revealed that confusion of role boundaries and perceived inequities in workload distribution by enrolled nurses led to ineffective communication and discord within the team.

In addition to the impact they have on intradisciplinary communication, different models of nursing care delivery need to be considered in relation to their impact on patient safety, as nurses communicate with many different health professionals at different times in the clinical setting. To determine nurses' perceptions of interdisciplinary communication, a small study in Sydney, Australia (Fernandez et al., 2010) compared a new shared care nursing (SCN) model or teamwork approach, with the current patient allocation (PA) model. In the SCN model with its focus on teamwork, responsibility for communication relating to nursing care rested with the team leader, whereas in the PA model individual nurses were responsible for all aspects of care for their allocated group of patients over an

entire shift. A total of 150 nurses working in either the SCN model or PA model in general medical and surgical wards were surveyed and differences in interdisciplinary communication were assessed after six months. The study findings revealed little difference between the groups regarding intradisciplinary and interdisciplinary communication, however methodological issues limited the generalisability of these findings. The authors suggested larger studies with different levels of skill mix and models of care would be needed to examine this issue more closely.

It is not only the verbal aspect of communication that is important for effective handover as the quality of transfer of information can also be influenced by non-verbal behaviours such as eye contact, body posture and tone of voice. In a study conducted at the Veterans Administration Centres in the US, Frankel et al. (2012) explored the impact of non-verbal behaviours on the quality of face-to-face handovers by analysing 31 videotaped nursing handovers of 137 patients and 21 medical resident handovers of 101 patients. Their analysis revealed that four patterns of non-verbal behaviours occurred throughout handover interactions, each with varying influence on the quality and reliability of the information being conveyed. They labelled the patterns as 'joint focus of attention', 'the poker hand', 'parallel play' and 'kerbside consultation' and determined that 'joint focus of attention' was the most effective approach because it displayed coordination of verbal and visual information between individuals giving and receiving handovers. They aligned this approach to the concept of "situation awareness" or "knowing what is going on" (Endsley, 1995, p.36). Although it occurred infrequently during the handovers they determined that high reliability of information was achieved with 'joint focus of attention' and recommended concentrating on this pattern of non-verbal behaviours in educational interventions to improve the quality of clinical handovers.

Influences other than human interactions also shape the effectiveness of nurses' communication skills and can act as barriers to communication. Kalisch et al. (2009) reported that the scheduling of nurses' rosters can impact on the quality of nurses' handovers. They found that various combinations of shift hours, for example eight hour and 12 hour shifts, where nurses begin and finish shifts at different times in the same ward create a 'disjointed' handover process which is confusing. Similarly, the lack of consistent staff through the scheduling of agency or temporary staff can inhibit communication.

The physical layout of the ward which distances team members from one another and constant interruptions within the work environment also hinder team communication increasing the risk to patient safety (Kalisch & Begeny, 2005; Redding & Robinson, 2009). In response to patient safety concerns, due to deficiencies with communication amongst 'frontline' staff, several studies have examined communication technology in an effort to address this issue. According to Vandenkerkhof et al. (2009) the use of innovative communication technologies which provide direct contact between frontline staff members at all times could improve transfer of information, reduce time inefficiencies and, ultimately improve patient safety. In a quasi-experimental study conducted on a 38 bed general surgical unit in Canada, by Vandenkerkhof and fellow researchers, the use of a portable hands free system was found to cut down time locating personnel and resources for RNs using the device. Vandenkerkhof et al. concluded the device was of more benefit for reducing inefficiencies in communication compared to paging and telephone systems and had the potential for improving workflow and patient safety. However, the impact this technology had on human factors, such as the quality of communication between team members and their decision-making, was not addressed but was identified by the authors as an area for future study. These findings of Vandenkerkhof et al. (2009) confirmed those of an earlier study conducted by Breslin et al. (2004). More recently Guarascio-Howard (2011) explored the use of a wireless device that enabled increased direct communication between nurses on a medical-surgical unit and found enhanced leadership opportunities for RNs using the device which resulted in a significantly decreased response time to patient bed calls.

2.3.2. Teamwork

In the literature, teamwork in the surgical ward has generally been overlooked despite increasing interest regarding the impact teamwork has on patient safety. Most research on teamwork in healthcare using a HF approach has focussed on specialty units such as the ICU (Gill, Ryan, Morgan, & Williams, 2000), the operating room (OR) (Flin, Yule, McKenzie, Paterson-Brown, & Maran, 2006) and the emergency department (Fernandez, Kozlowski, Shapiro, & Salas, 2008).

A team is described as two or more individuals who have a specific role and who cooperatively interact with each other to achieve a common and valued goal. The interaction amongst team members extends beyond task focussed work and encompasses

thoughts, feelings and actions (Salas, Sims, & Burke, 2005). According to Salas et al., teamwork is a complex process with many variables and is not clearly defined. Following an extensive review of the literature over the past 20 years these authors undertook a thematic analysis of the variables of teamwork, and identified five core components and three coordinating mechanisms comprising effective teamwork. These five core components are: "team leadership, mutual performance monitoring, backup behaviour, adaptability, and team or collective orientation. The coordinating mechanisms include: shared mental models, closed-loop communication and mutual trust" (p. 591). These mechanisms are necessary facilitators for effective performance of the five core components. Following these findings, these authors suggested that different types of teams engage in teamwork differently, further more they contended the actual work that teams perform needs to be explored to understand the processes that contribute to effective team performance.

To determine the team processes in nurses' daily work, Kalisch et al. (2009) examined nursing teamwork in five inpatient wards which included three medical-surgical units in one US hospital. In their qualitative study they used focus group interviews (n=34) comprising predominantly RNs (n=116), and less qualified members of the nursing team (n=54) to collect data. Using the framework of Salas et al. (2005) as a guide to analyse the data, Kalisch et al. explored the applicability of their model to nursing teamwork in acute care settings. They confirmed that nursing teamwork is constructed of the five core elements and three coordinating mechanisms as described by Salas and colleagues and that the core elements and coordinating mechanisms can be applied to enhance teamwork and patient care thereby reducing teamwork failures. Kalisch et al. contended that effective teamwork comprises skills that must be 'developed and learned'. Therefore, nursing team training should target the skills known to impact on teamwork. In the same study it was discovered that successful team performance is reliant on team members talking to each other and resolving differences of opinion to effectively manage their workloads. Kalisch et al. found team members tended to avoid managing conflict for fear of triggering an argument or giving rise to defensive behaviours in others. Instead, they would refuse to work together or they would walk out of the way to avoid contact with each other.

As well as poor interpersonal relationships of team members, there are other obstacles that can impact on teamwork. For example, Kalisch and Begeny (2005) found in their study of

16 nurses in one medical-surgical unit in a US hospital that large teams, instability in the workforce, team members not knowing each other, and a lack of common purpose, all created barriers for effective teamwork. Then Kalisch and Schoville (2012) contended that nurses should work together as a team and that members of nursing teams require appropriate training and support for their teams to function effectively. More recent research by Kalisch, Xie, and Ronis (2013) showed that team training among nursing team members improved teamwork and reduced the amount of missed patient care on medical-surgical wards.

Nursing team conflict was also found to arise when there was confusion and uncertainty regarding nurses' scopes of practice. A lack of clarity regarding practice boundaries and poor delegation of responsibilities was found to contribute to perceived workload inequities. This resulted in teamwork failure due to bullying and harassment amongst team members (Eagar et al., 2010).

The quality of the interactions between nurses and doctors who work together within healthcare teams has implications for the quality of care the patients receive. In a study exploring nurse-physician collaboration in a general medical-surgical patient care setting in a magnet hospital in the US Thomson (2007) found that differences existed in the attitudes of doctors and nurses towards collaboration and that continued effort was required to improve nurse-physician teamwork in this environment.

Donohue and Endacott's (2010) previously mentioned study found that intradisciplinary teamwork and collegial support is an integral part of nursing work when dealing with a deteriorating patient. However, a problem arises for surgical teams when senior medical colleagues are occupied in OR or clinics and are not available to guide junior staff through the actions required. The study identified the importance of involvement of senior staff in providing support for junior nurses and doctors in critical situations. Without support, nurses and house officers tended to rely on the medical emergency team (MET) to take charge of the situation. Ward staff felt they were facilitators rather than initiators of patient care and tended to defer to the knowledge and experience of the MET when managing a deteriorating patient. This view differed from MET members who espoused the need for clarification of the responsibilities of ward staff in the presence of the MET.

While there was minimal literature that explored intradisciplinary teamwork, there were no studies retrieved from the literature search that specifically explored interdisciplinary teamwork involving nurses in a general surgical ward.

2.3.3. Leadership

There was a paucity of literature pertaining to leadership as a NTS required of nurses in surgical wards. Leadership featured in only one paper reviewed. In the nursing team, leadership is generally understood to be the domain of the nurse manager who has overall responsibility for the functioning of the team. Kalisch et al. (2009) however, found in her aforementioned study that in the medical-surgical wards leadership was the responsibility of the charge nurses and the RNs. Effective charge nurse leadership was essential for effective teamwork and central to the functioning of the ward and the provision of high quality patient care. The charge nurse was responsible for leading the team on each shift and the role included responsibility for ensuring there were sufficient nurses and resources appropriately allocated to patients in the wards. The leadership role of RNs entailed being responsible for directing patient care and delegating responsibilities to less qualified members of the team.

2.3.4. Decision-making

There are different theories of decision-making identified in the literature with information processing or analytical decision-making and intuitive decision-making being the two most dominant theories utilised by nurses to solve problems (Thompson & Dowding, 2009). Analytical decision-making involves collecting data about a problem, formulating a hypothesis about what might be happening and continuing to collect and analyse data until the best decision is reached to solve the problem. Intuitive decision-making is defined by (Benner & Tanner, 1987 , p.23) as "understanding without rationale". According to intuitive decision-making theory, nurses' intuitive knowledge is gained from experience and advances along a continuum from novice to expert (Benner, 2001).

The general surgical ward is a demanding environment in which patients' conditions can rapidly change. For patients experiencing postoperative complications, nurses may need to make decisions to activate the MET to address problems promptly and prevent 'failure to rescue'. A recent study by Parker (2014) involving 87 RNs working in medical-surgical wards in three different hospitals in Florida found a difference exists in the frequency of

MET callouts based on the category of decision-making nurses used. Nurses' decision-making processes were classified into one of three categories: analytic, analytic/intuitive (mixed model), or intuitive. Analysis revealed that nurses using analytical decision-making activated a MET callout about twice as often as nurses who used either intuitive or mixed decision-making processes and these nurses tended to be more experienced nurses. The author concluded that analytical decision-making processes may lead to improved patient outcomes as increased frequency of MET activation has been correlated to decreased mortality rates in hospitalised patients. Furthermore, the author suggests that nurses in acute care environments should be taught analytical decision-making skills to recognise and react to deterioration as soon as possible.

The nature of the work environment has been found to not only impact on nurses' communication and teamwork skills but also it has a direct impact on nurses' decision-making skills and the quality of care that patients receive. In the surgical ward, nurses are constantly confronted with distractions and interruptions which compete for their attention and are a potential risk for patient safety (Kreckler, Catchpole, Bottomley, Handa, & McCulloch, 2008). Redding and Robinson (2009) conducted an observational study with 32 nurses to examine the types of interruptions they experienced on a day shift in six medical-surgical wards. They confirmed that certain patterns of interruptions occur for nurses working in medical-surgical units. Their observations revealed that as nurses were distracted their focus changed, requiring them to recollect their thoughts in order to resume their original purpose. They concluded that work systems that decrease interruptions would effectively reduce nurses' cognitive workloads and improve the quality and safety of patient care.

Ebright, Patterson, Chalko and Render (2003) reported findings from a micro-ethnographic study conducted in the US to increase understanding of work complexity and its impact on nurses' decision-making. The study involved eight expert RNs with at least five years medical-surgical experience. The findings revealed eight patterns of work complexity that have the potential to threaten the safety of patients and reduce RN work satisfaction. The RNs in the study demonstrated effective coping skills to adapt to complex work situations and the authors recommended that student nurses be taught the skills they require to manage workload complexity for patient safety. Increasing work complexity was also found to negatively impact on nurses' participation in decision-making in a large study

conducted by Bacon, Lee, and Mark (2015) in the US in 278 medical-surgical units in 143 hospitals. Although it is not clear in the study how decision-making was affected, Bacon suggested that further research was needed to explore ways to improve nurses' participation in decision-making in hospitals.

Workplace culture is another factor that has been found to directly impact nurses' critical thinking and decision-making skills. Lockwood (2009) conducted an ethnographic study with 20 nurses in two different medical-surgical units in a non-magnet hospital in the US to ascertain workplace cultural influences on the quality of nurses' critical thinking and decision-making. In this study, Lockwood discovered that when faced with clinical problems in a medical-surgical setting, the way nurses problem solved was influenced mostly by what management deemed as important, such as physician or patient satisfaction, rather than the patients' condition or advice from nursing peers. As well, Lockwood identified that in a clinical setting, not supported by evidence-based practice, nurses created a workplace culture of their own in which they relied on experienced nursing colleagues to make clinical decisions based on their wisdom and experience. In the same study it was revealed that nurse-physician relationships also affected the quality of the RNs' critical thinking and decision-making. Furthermore, Lockwood found that difficult relationships with doctors curbed nurses' thinking and encouraged them to just follow 'doctors' orders' rather than to question them or provide a logical argument when they had concerns regarding a patient's care. This approach to decision-making reflects more traditional attitudes where the doctor is seen as the main authority with respect to patient care decisions. In Lockwood's study nurses felt powerless to change this as they perceived they would not be heard or they feared getting into trouble with management who considered physician satisfaction a high priority. These findings contrast with Thomson's (2007) previously cited study that found sharing responsibility for problem solving and decision-making can foster positive attitudes in relation to teamwork and nurses' job satisfaction. This in turn was shown to have positive links to patient safety and patient outcomes.

Other researchers have confirmed that workplace culture can affect nurses' decision-making. Symons and McMurray (2014) conducted an interpretive study which explored factors that influenced nurses' decision-making regarding withholding oral medications. Nine nurses working in surgical wards in two hospitals in Australia were interviewed. An

inductive content analysis revealed three main themes that affected the decisions nurses made regarding withholding oral medication: ward culture, nurses' perceptions of their roles, and patient factors. The researchers suggested that these findings would help inform future practice and lead to improved safety with medication management.

2.3.5. Managing stress

From the literature searched there were no studies that specifically explored stress management for nurses working in general surgical wards. Eagar et al. (2010) cited previously, however, argued that nurses who experienced negative self-image and low self-esteem felt discomfort and adopted various coping mechanisms to manage the resulting tension. Some of these coping mechanisms were positive such as humour, or seeking advice from managers, while others were less desirable such as 'shutting down' to avoid conflict.

An unexpected finding in Lockwood's (2009) study that had not been examined directly was that stress influenced nurses' thinking. To manage their stress nurses developed their own internal controls to help them stay calm when dealing with clinical problems. While the participants in Lockwood's study had all learned from experience that remaining calm enhanced their thinking, none could recall how this learning was acquired.

2.3.6. Coping with fatigue

There were no studies retrieved that specifically explored this NTS in nurses working in general surgical wards. However, another chance finding in Lockwood's (2009) study was that fatigue, particularly in the latter stages of 12 hour shifts, impeded nurses' thinking, possibly increasing their risk of making an error.

2.3.7. Situation awareness

The dynamic nature of the general surgical wards requires nurses to be constantly monitoring the environment, noticing what is going on around them and responding appropriately to situations as they arise. These may include an emergency, the distress of a relative, or the increased acuity of patients on the ward. Attention to the environment is termed 'situation awareness' (Endsley, 1995) and is a cognitive skill that serves as the first step in the decision-making process (Flin et al., 2008). The concept has been identified in

the surgical team for anaesthetists (Fletcher, Flin, & McGeorge, n.d.), surgeons (Yule et al., 2006) and scrub nurses (Mitchell, 2011), however from the literature searched there were no studies exploring situation awareness as a NTS used by nurses working in surgical wards.

2.4. Conclusion

The literature review has revealed that little is known about the cognitive and social NTS required of general surgical nurses. While studies have been conducted that have elicited NTS taxonomies in other health professions there were none that specifically identified this skill set for surgical ward nurses.   To increase the safety of patients and reduce preventable error it is important that the NTS required of general surgical nurses are identified. An understanding of the NTS may promote their inclusion in education curricula and increase safety in hospitals. This study explores the NTS required of nurses for safe practice in general surgical wards. The following chapter describes the research design and the methods used, and the ethical issues that were considered.

Chapter 3. Methodology and Methods

This chapter describes the methodology, the design of the study and the methods used to elicit and analyse information about nurses' NTS when providing nursing care within a general surgical ward. It also discusses the scientific rigour of the study and the ethical considerations pertaining to the research.

From the literature reviewed in Chapter Two it was concluded that further exploration was required to formally identify the NTS required of general surgical nurses. To date all of the research into nurses' NTS has been conducted in the operating room or special care units such as critical care. To explore the NTS required of general surgical nurses a qualitative approach was used. The research is comprised of two parts. Part A is an observational study that uses an inductive approach to identify general surgical nurses' NTS. Part B uses ACTA methods to examine the cognitive skills nurses use in challenging situations. To answer the research questions, HF strategies in conjunction with naturalistic inquiry (Lincoln & Guba, 1985) were utilised in this study. The two parts are reported as Part A and Part B.

3.1. Research Questions

The research questions posed for this research were:

1. What non-technical skills are required of nurses when providing nursing care in a general surgical ward?
2. What cognitive skills do nurses use in challenging situations in a general surgical ward?
3. What are the differences in the levels of performance of NTS between experienced and less experienced nurses?

3.2. Methodological Approach

As the aims of this study were to identify the NTS required of general surgical nurses in their everyday practice, and the differences between experienced and less experienced nurses in the performance of those skills it was important that the study findings reflected what was actually happening in the field 'first hand'. To gain this insight it was decided to

use a HF methodology incorporating naturalistic inquiry (Lincoln & Guba, 1985) and ACTA to collect and analyse the data.

3.2.1. Human Factors

Human Factors is a scientific discipline that studies the way people interact with one another and within a system and has its origins in industrial engineering and psychology. A key feature of HF research is that it employs a systems perspective that considers the influence of individual and group behaviours as well as organisational factors. It specifically explores the reason for failure within the system and ways to reduce human error which can lead to an adverse event if left unchecked (Fortune et al., 2013).

The unit of analysis for HF research is the human in the context of other people and the system of which they are a part (Dekker, 2011). Human Factors research attempts to understand human performance in complex settings and how complexity is dealt with in real work situations. Its focus is the relationship between the success and failure of human work, and the features of the work setting that influence the way in which work is carried out. The goal of HF research is improving safety in safety-critical systems.

In the last few decades, HF strategies have been applied as safety initiatives in aviation. Investigations into air accidents identified human factors as part of the causal chain in the majority of incidents (Helmreich & Foushee, 2010). Likewise, in healthcare there is increasing evidence that human factors contribute to error and threaten the safety of patients (Catchpole et al., 2007; Healey, Shackford, Osler, Rogers, & Burns, 2002; Health Quality and Safety Commission New Zealand, 2014; Kohn et al., 2000; Rowe, 2012). Understanding and managing human factors effectively is an important issue for error prevention and improving patient safety in healthcare.

One way to minimise human error is to improve performance of the specific social and cognitive skills known as NTS that underpin the domain specific competencies of a profession (Glavin & Maran, 2003). Human Factors research facilitates exploration of health professionals NTS (Fletcher et al., 2003; Flin & Maran, 2004; Mitchell & Flin, 2009) and the nature of error (Potter et al., 2005). As discussed in Chapter One, HF research operates on two levels: a systems level and an individual level. Level one looks at how people interact with a specific system or environment and this includes ergonomics. Level two explores the social, cognitive and personal aspects of individuals to understand

the way they interact with specific systems and the environment (Fortune et al., 2013). Level two HF research was determined to be an ideal approach to enable the identification of the NTS required of nurses in their everyday practice. Furthermore, it enabled understanding of the cognitive elements of nurses' work: what nurses were thinking about, paying attention to, and the strategies they used to make decisions and solve problems. The HF methods used in this study were non-participant observation for the identification of nurses' NTS and ACTA for understanding the cognitive elements of the cognitive skills.

3.2.2. Naturalistic inquiry

Naturalistic inquiry is not based on a preconceived idea but exists within a context and is grounded in the experiences of the individuals within their environment. It requires that research takes place in the field (Polit & Beck, 2008) enabling the researcher to learn from the participants and understand the social phenomena under study. For the researcher, being in the field makes it possible to experience the reality of that setting and understand why people behave the way they do in specific situations (Patton, 1990). In addition, there is the potential to seek understanding of the way people make decisions and/or enquire about other factors that influence their behaviour. Naturalism explores unique events that are not easily replicated as they occur in real-world situations. Naturalists take the position of relativism where reality exists within a context. It is not fixed but a construction of the individuals participating in the research. Therefore, interaction between the researcher and the participants is essential for accessing the phenomenon of interest within the context of those who are experiencing it (Polit & Beck, 2008).

Epistemologically, naturalistic inquiry assumes that the closer the researcher and participants are during the study the richer and more in depth the information will be (Polit & Beck, 2008). The findings from naturalistic inquiry result from an inductive process and are produced from the subjective interaction between the researcher and the individual who has real-life experience and first-hand knowledge of the phenomenon of interest.

3.2.3. Applied cognitive task analysis

As explained in Chapter One, ACTA was developed as part of a research project for revising and designing cognitive training materials in Navy courses as there were difficulties with established cognitive task analysis (CTA) techniques in addressing cognitive issues in applied work settings (Militello et al., 1997). Cognitive task analysis is

an extension of traditional task analysis techniques and there are many types of CTA methods currently in use in HF research (Stanton, Salmon, Walker, Baber, & Jenkins, 2005). The ACTA approach developed by Militello and Hutton (1998) is a modified CTA approach that provides a 'toolkit' of complementary interview methods, intended to extract different aspects of cognitive skill. The interview methods are designed in such a way that training in cognitive psychology is not required to implement them.

In a validation study to establish reliability and validity of the ACTA method, Militello and Hutton (1998) confirmed reliability by determining that participants, after eight hours' exposure to ACTA techniques, were able to consistently elicit similar, relevant cognitive information. In terms of validity the findings indicated that the method related to cognitive issues and experience-based knowledge and produced instructional materials validated by experts as being important information for novices. In addition, the method appeared to have high face validity amongst the participants.

3.3. Study Design

An exploratory study was undertaken to identify the NTS required of general surgical nurses in their everyday nursing practice and the cognitive demands placed on them in challenging situations. As mentioned above, these had not been previously identified. To achieve the aims of this study two techniques were used to elicit and analyse the data. Part A comprised a naturalistic observational study using non-participation observation to collect the data. This was undertaken to gain insight into nurses' practice and to see 'first-hand' the NTS nurses were required to use. Part B used Militello and Hutton's (1998) ACTA approach to identify the cognitive NTS and the differences between experienced and less experienced nurses' use of these skill. This involved three rounds of semi-structured face-to-face interviews.

3.3.1. Naturalistic observation

According to Flin et al. (2008) observation can be used to identify key NTS as it enables information to be collected on tasks being performed and the situations in which problem solving is required. Observing individuals carrying out their work routines provides data about the non-technical aspects of performance, and not just the technical or clinical skills.

In HF research, the output from observational analysis is often used as the first stage for other HF methods such as ACTA (Stanton et al., 2005).

Observational methods typically vary in the amount of structure used to systematically collect data about people's behaviour in a given context. They range from a very unstructured broad approach where the gathering of information is flexible and not precisely defined, to very structured methods which are more constrained and detailed (Polit & Beck, 2008). Because observations do not enable an in-depth account of what participants are thinking about during the observed activities, ACTA was used to complement the observational data (Crandall, Klein, & Hoffman, 2006).

3.3.2. Applied cognitive task analysis

ACTA focuses on the cognitive domain and has its roots in cognitive psychology. The benefit of ACTA is that it enables the tacit cognitive skills that are essential for skilled performance to be 'become visible' (Crandall et al., 2006) and presents results that can be used in an applied setting (Chipman, Schraagen, & Shalin, 2000). Its purpose is to systematically identify the cognitive skills required to perform a task proficiently. In this study ACTA was used to identify the cognitive skills nurses use when solving problems and making decisions. The ACTA utilises interviews as the data collection method and is conducted in three phases. It comprises a task diagram interview, a knowledge audit interview, and a simulation exercise interview. Data obtained from the three phases are synthesised and presented in a cognitive demands table.

3.4. Part A: Observation Study

For this exploratory study the data collection method selected was non-participant observation using field notes to record observations. According to Lincoln and Guba (1985), naturalistic data collection has two dimensions: fidelity and structure. Fidelity is the ability of the researcher to accurately reproduce data from the field. Structure entails the collection of data according to pre-defined protocols to ensure consistency.

There are various data collection methods for recording observational data, field notes having the lowest fidelity. However, they have a number of advantages compared to other high fidelity techniques as they are less threatening to the participants than other recording techniques such as video recording. Field notes were used for this study as they provided

the most practical means for recording observations and allowed privacy for the patients. They also enabled the researcher to record her own thoughts and insights and make comments about events that needed to be followed up at a later stage. Initially the structure of recording the field notes was very general in scope. As the observations progressed however they became more focussed on the description of events.

Observational data were collected by the researcher over a one-year period. This time frame for data collection was selected to allow the researcher to observe nurses' practice in various contexts at different times of the day, different days of the week and the different seasons, to ensure inclusion of all the NTS required of the nurses. The types of information collected were related to day-to-day activities, including verbal interactions, of participants in their work environment. While the researcher was an experienced surgical nurse, and the surgical ward a familiar environment, no fixed ideas were held about the NTS that would emerge during the period of observation. The focus of the observations was on recording the nurses' activities with the knowledge that the NTS would emerge from the analysis of the data. The technique of data saturation (Polit & Beck, 2008) was adopted to determine sample size. Once no new information was garnered after 15 observations, data saturation was deemed to have been achieved and the observational data were analysed.

3.4.1. Setting

The setting for the study was four surgical wards in a large metropolitan tertiary level hospital in New Zealand. Permission for access to the setting was gained from the hospital's Director of Nursing (Appendix A), the Research Ethics Coordinator and the Chair of the Māori Research Review Committee of the District Health Board (Appendix B). This enabled the required locality approval (Appendix C) and a submission to be made to the Regional Northern Y Ethics Committee as discussed later in this chapter.

3.4.2. Recruitment

Following meetings with the charge nurses of the four potential study wards, flyers explaining the study (Appendix D) were posted on the ward notice boards and the researcher attended staff handovers to introduce the study to the nurses and to recruit participants. The nurses were informed of the risks and benefits of being involved in the study and advised that they would be able to withdraw from the study at any time without

having to give a reason and without it affecting their employment in any way. They were given an opportunity to have their questions answered and were then invited to participate.

Volunteers were provided with participant information sheets (Appendix E) outlining the study and informing them of their rights should they agree to participate. Consent forms (Appendix F) were completed by the participants before the observations commenced.

The times and days of the observations were organised to suit the participants. All participants were contacted the day before their scheduled observation to confirm that the date was still suitable and that they were still agreeable to participating in the study.

3.4.3. Sample

The target population for this study was all RNs who met the inclusion criteria and were employed in one of the four general surgical wards in the study hospital. These wards were targeted because of the diversity of the surgical services provided. These services were predominantly acute general surgical services.

3.4.3.1. *Inclusion criteria*

General surgical nurses who were eligible for inclusion in the study were registered nurses at all levels—new graduate, competent, proficient and expert—employed by the hospital who worked full or part-time in adult general surgical wards. There were 106 potential participants who met the inclusion criteria.

3.4.3.2. *Exclusion criteria*

Registered nurses employed in managerial roles in the four general surgical wards were excluded.

3.4.3.3. *Sampling approach*

As it was not possible to state in advance how many participants would be required to reach data saturation, participants were recruited through convenience sampling and a snowballing technique (Polit & Beck, 2008), in which earlier participants referred other nurses who met the inclusion criteria. This was an appropriate sampling strategy as it increased the scope of data exposure and the likelihood that a full array of experiences would be uncovered (Lincoln & Guba, 1985).

3.4.4. The participants

Observations were conducted with the fifteen nurses who volunteered to participate. The length of their experience in general surgery ranged from three months to 20 years. Using the hospital's Professional Development Recognition Programme (PDRP) framework as approved by NCNZ (2013) and based on Benner's (1984) levels of practice—novice to expert—four participants were practising at the proficient level, nine were at the competent level and two were new graduate nurses.

3.4.5. The researcher's role

In non-participant observation, the researcher is the research instrument whose role it is to primarily view and record what is happening (Leckie, 2008). In this study the researcher attempted to be as unobtrusive as possible so as not to interrupt the nurses while they were engaged in their work. Throughout the observation period the researcher paid close attention to events as they occurred and recorded them using hand written field notes (Polit & Beck, 2008). In addition, the researcher noted her own thoughts about events that were perceived to be significant.

3.4.6. The observation process

Prior to the commencement of each observation the participants were asked if they understood the information on the participant information sheet and if they had any questions. The researcher reiterated how the observation would proceed, reassured the participants that no judgements would be made or recorded about their practice and that the focus of the observations was the NTS required of them during their shift.

All participants were advised they could ask the researcher to stop their observation at any time without having to explain why and they could request to have any data collected during the observation to be withdrawn, through to the end of the data collection period. Once it was clearly established that the participants were informed about their role and that of the researcher, and had consented to participate by signing a consent form, data collection commenced.

3.4.6.1. *Data collection*

The observations focussed on each participant which meant either following them or standing and observing their actions for an entire shift. As already mentioned field notes were used to record what they were required to do in their everyday practice and during significant events, for example sudden deterioration of a patient. As insights developed the observations became more focussed. At times, it was necessary to seek clarification from the participants regarding an action to ensure the accounts of the observations were accurate. Seeking this clarification was not always possible immediately after the event, but was carried out as soon as practicable.

During the recording of field notes participants verified their accuracy by dictating some content relating to their actions which was not directly observable by the researcher, such as the content of a telephone conversation with another health professional. Accuracy was also determined with participants at the completion of each observation by reading and recalling events from the field notes. While not all participants chose to view their data, of those who did, some indicated they were surprised about the detail recorded and the workload demands they encountered during their shift. None of the participants requested to have any of the information changed or withdrawn from the study.

During the observations written policies and guidelines relating to an action being observed were collected and read to provide a deeper understanding of the participants' practice. For example, the action required by the EWS[4] algorithm when a patient's vital signs exceeded the normal threshold.

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[4] The early warning score (EWS) is a tool used in a 'track and trigger' system to help identify adult patients at risk of clinical deterioration and to initiate early intervention to prevent further deterioration and restore physiological stability. To obtain an accurate EWS a complete set of five vital signs must be recorded: temperature, pulse, respirations, systolic blood pressure and level of consciousness. Each recorded vital sign is assigned a score which is calculated based on the EWS table in the patient's observation chart. The score for each vital sign is assigned 0, 1, 2 or 5: zero being the normal threshold for a vital sign. Once all five vital signs are recorded the total score is calculated as the EWS and used to direct clinical action using an associated algorithm. The higher the EWS, the greater the clinical concern and level of care that is required. If the EWS is zero then no action is required. For patients with an EWS that is greater than 1 action must be taken according to the EWS algorithm and documented. An EWS of 5 or more is most serious and demands a MET response.

As soon as possible after each observation, field notes were transcribed to readily recall events while they were still fresh in the researcher's memory. This process assisted in providing an account of events as accurately as possible. After 15 observations it was evident that no new data were emerging and that saturation had been achieved.

3.4.6.2. *Data analysis*

Once all observations had been transcribed they were imported into NVivo 9 database to be coded. The coding frame was developed using the transcripts of the two initial observations. To identify NTS categories these two observations were independently coded by peers from a PhD group at The University of Auckland and by HF graduate students, in a research methodology class in a United States university. The categories from the two independent groups were then compared for consistency. The two independent groups generated similar results demonstrating reliability of the data coding process. The coding frame was further refined by the researcher to include elements and sub-elements for each category. This facilitated ease of retrieval of corresponding text in each transcript. The definitions for each category were based on the generic NTS categories important for safety in high-risk work settings (Flin et al., 2008) the NCNZ competencies for Registered Nurses (NCNZ, 2012a) and the Code of Conduct for nurses (NCNZ, 2012b).

The transcripts were then re-read by the researcher before populating the coding frame with data from the 13 other observations using the NVivo 9 programme. A taxonomy comprising seven social and cognitive NTS was identified. The seven NTS were communication, leadership and management, planning, situation awareness, decision-making, teamwork, and patient advocacy.

3.5. Part B. Applied Cognitive Task Analysis

This section discusses the recruitment process, the participants, the ACTA protocol used to conduct the interviews, and the methods used to analyse the data.

Part B was designed to answer the second and third research questions: "What cognitive skills do nurses use in challenging situations in a general surgical ward?" and "What are the differences in the levels of performance of NTS between experienced and less experienced nurses?" As mentioned above the ACTA method was selected as it focuses on

the cognitive skills of a task and is appropriate for exploring decisions that need to be made during complex situations. This method can expose implicit expert knowledge that is often difficult for experts to verbalise. It also explicitly reveals differences in expert and novice performance (Militello & Hutton, 1998). It does this by identifying the knowledge and cognitive skills that experts draw on and how these differ from those used by the less experienced. It is important to understand these differences in performance in order to develop expertise in less experienced nurses to improve the delivery of safe patient care.

3.5.1. Recruitment of participants

For the second part of the study purposive sampling methods were used. As there was a 12-month gap between the first observation and the commencement of the interviews, the researcher again attended shift handovers to recruit further participants. This resulted in three volunteers agreeing to be interviewed. The years of nursing experience for the three participants ranged from three to five years. Access to expert knowledge was a critical element for this study as the ACTA method requires highly skilled subject matter experts as its data source (Militello et al., 1997). As there were no expert level nurses employed in the general surgical wards where the observation study was carried out, an extension to the study wards was sought and approved by the Northern Y Ethics Committee (Appendix Mb) and three further participants who were highly experienced in general surgical nursing were recruited. Two were categorised as experts and one as a proficient level nurse in the process of transitioning to expert level. Thus, interviews for Part B of this research were conducted with six nurses who had varying levels of professional development and experience.

3.5.2. The interview process

The interviews were conducted at a time and place convenient for each participant. Consent forms (Appendix G) were completed by the participants before the interviews commenced. Each participant was interviewed three times. At the first interview the task diagram was completed, the second allowed for the knowledge audit, and the third's focus was the simulation interview. During the interviews diagrams and tables were constructed as specified by the ACTA process and the researcher took brief notes relating to points of interest as a prompt to seek further clarification or for further discussion during or after the interviews. The interviews were audio-recorded and then transcribed verbatim by an

independent transcriber who had previously signed a confidentiality agreement (Appendix H). All participants were invited to review the recordings and/or the transcripts. Data from the 18 interviews were then analysed and synthesised to construct a cognitive demands table to present the overall finding of the ACTA.

3.5.3. The task diagram interview

The purpose of the task diagram interview (Chapter Five) is to provide an overview of the way a particular task or procedure is performed. The task diagram is a breakdown of the major steps and sequence of the task and identifies its cognitive elements. It provides a basic mental model of how the participant views the task and identifies aspects requiring the use of mental processes or cognitive skills that cannot be observed. The task diagram provides the focus for the more comprehensive knowledge audit and simulation interviews.

'Task' in the context of ACTA is defined as "the outcomes people are trying to achieve" (Crandall et al., 2006, p. 3). The specific task of interest selected for this study was a challenging situation in which the participants had dealt with a patient with a postoperative problem. A challenging situation was defined as a non-routine condition for a postoperative patient. Participants were free to select and discuss their own examples of a situation they had faced in which they felt particularly challenged.

At the beginning of each interview an overview of the focus and process was discussed with the participants and demographic data were collected. The participants were asked to think about an instance in which they recognised a patient was experiencing a serious problem or a challenging situation following surgery. Once the participants confirmed they had a situation in mind they were asked for a brief overview of what it was. They were then asked to think about the steps they took from the time they first realised that something was amiss to the point where the problem was resolved either by them personally, or by someone else.

The task diagram is accomplished by asking the participant to break down the task into three to six separate steps. The steps provide the basis to construct a flow chart to identify the cognitive elements of the task. Each participant's response was depicted in sequence as a flow diagram and recorded on a flip chart which provided a shared image of the task and what had been verbalised. The participants were then asked to identify which of these steps

required cognitive skills explained as "judgements, assessments, problem solving or thinking skills" (Militello & Hutton, 1998, p. 1620). The steps that required cognitive skills were circled on the flow diagram. This enabled the cognitive elements of the task to be identified for further scrutiny in the knowledge audit.

Each interview lasted 30 – 45 minutes and at the completion of the interviews the participants confirmed whether the task diagrams provided an accurate representation of the steps taken in the situation and also those steps requiring cognitive skills.

3.5.3.1. *Data analysis*

On completion of the interviews, the audio-recorded interview data and the flip chart data were transcribed and synthesised to provide a deeper understanding of the cognitive elements of the individual task diagrams. Each cognitive element identified in the six task diagrams was analysed for commonalities across the data set and a master task diagram was created to provide a summary of the findings. The cognitive elements identified in each task diagram were then used to focus the subsequent individual knowledge audit interviews.

3.5.4. The knowledge audit interview

The knowledge audit interview (Chapter Six) was the second interview and focused on the aspects of practice that demand complex cognitive skills relating to the task identified in the task diagram. The purpose of the knowledge audit was to identify cognitive skills and domain knowledge in the context of the situation in which they occurred. The knowledge audit probes for examples which highlight the specific strategies experts use in dealing with complex situations. The technique is useful for identifying novice-expert differences in performance by identifying things that experts know and novices do not yet know to perform a task proficiently.

The knowledge audit used a structured interview format with a set of eight cognitive probes (Appendix I). The probes were created from knowledge categories that have been found to characterise different aspects of expertise: "diagnosing and predicting, situation awareness, perceptual skills, developing and knowing when to apply tricks of the trade, improvising, metacognition, recognising anomalies, and compensating for equipment

limitations" (Militello & Hutton, 1998, p. 1621). The audit requires participants to consider how each of these cognitive probes contributes to the task being investigated.

During the interviews each probe was preceded by an explanation of its meaning to provide clarity and simplify its application. The participants were asked to recall and describe events prompted by the probe. A concise account of each event was displayed in a knowledge audit table in which the cues and strategies, difficulties, and the part that expertise played in the situation were identified. A strength of this interview technique was that it drew on the participants' actual experiences to identify the novice-expert differences.

3.5.4.1. *Data analysis*

Following transcription of the interviews a 'knowledge audit' was conducted to identify specific cognitive information. This involved working with individual interviews and deconstructing the data to detect detailed information about the cognitive elements relating to the task. This process used questions posed by Crandall, et al. (2006) as a guide to think about the relevance of the data to the research question and to guide the analysis of the data.

> Where is the person's attention? What are they paying attention to and what are they ignoring? What sense are they using? What are they looking at, listening for, touching? What are they thinking about? What are they wondering about, what are they worried about, what are they certain about? What information are they seeking and from what sources? (p. 114).

Systematically working through the interviews in this way enabled the cognitive elements and their context to be made visible. The first pass of the data provided an orientation to the data set before identifying the cognitive elements contained within the data with subsequent data passes. In all, multiple data passes were undertaken until no new insights were gained. As cognitive information was identified it was entered into individual knowledge audit tables.

The knowledge audit tables consisted of four columns which included the probe and the three specific elements explored for each probe. In all, six individual knowledge audit tables (Tables 9-14) were constructed during this phase of the analysis.

The findings from the individual knowledge audits were then summarised in a master knowledge audit table (Table 15). The cognitive demands identified in the knowledge audit were subsequently used as a foundation for the construction of a simulation exercise administered in the following simulation interview.

3.5.5. The simulation interview

The simulation interview (Chapter Seven) is the third interview conducted in the ACTA and is based on a challenging situation presented to the participants. The purpose of the simulation interview is to provide detailed information about participants' cognitive processes and a view of their problem solving processes in context.

For this interview a simulation scenario (Appendix J) was developed by the researcher from an expert's account of a patient who presented with a postoperative bleed following a laparoscopic hysterectomy. The scenario was chosen as it contained similar events revealed as challenging by participants in the two previous interviews.

The simulation was presented to participants in the form of a paper and pencil exercise. Each participant was asked to imagine they were the nurse in the scenario and to consider how they would think and act in this situation.

After exposure to the simulation each participant was prompted to recall any major events, including decisions and judgments that occurred during the scenario. Each major event was further probed for actions, situation awareness, critical cues and potential errors surrounding the event using a set of simulation interview probes (Appendix K) to elicit the information. Any information elicited was initially recorded in individual simulation interview tables (Appendix L). These tables were later summarised and presented in a master simulation interview table (Table 16).

Using the same simulation with multiple participants provided insights into different actions and assessments nurses use for managing such situations. Conducting the interviews using the same simulation with nurses with different levels of experience enabled the differences between less experienced and expert nurses' practice to be exposed. This is important information for developing training and system design recommendations (Militello & Hutton, 1998).

3.5.5.1. *Data analysis*

Analysis involved systematically examining the interviews and analysing each event identified in the scenario by the participants. The analysis was guided by the previously mentioned questions posed by Crandall et al.(2006, p. 114).

As occurred in the knowledge audit analysis, the first pass of the data provided an orientation to the data set before identifying the cognitive information with subsequent data passes. Once again, multiple data passes were implemented to gain new insights from the data.

The interview probes used for the simulation exercise interviews were also used for coding the data. As elements of cognitive information were elicited from the data they were entered into individual simulation interview tables. The six individual simulation interview tables were then analysed and the commonalities were summarised in a master simulation interview table.

To complete the analysis a cognitive demands table (Table 17) was constructed to synthesise the findings from the task diagram, knowledge audit and simulation interviews.

3.5.6. The cognitive demands table

The CDT is the final representation of the findings of the ACTA. The purpose of the CDT is to assist with synthesising the data from the three interviews. In this study the cognitive demands table presents the major cognitive demands placed on nurses when a patient with a postoperative complication is deteriorating physiologically. It also presents the NTS nurses require to respond to the cognitive demands. Furthermore, it exposes different approaches to decision-making according to nurses' level of experience.

3.5.6.1. *Data analysis*

Once the data from the task diagram, knowledge audit and simulation interviews were analysed, a cognitive demands table was constructed to organise and synthesise the findings. This process involved systematically working through the interview findings for common themes as well as conflicting information. Information relevant to the aims of the study was then categorised according to the following categories: difficult cognitive demands, why these are difficult, expert cues and strategies, and novice errors.

3.6. Scientific Rigour

Rigour in qualitative research is established if the research accurately portrays the actions and world view of the participants (Polit & Beck, 2008). Qualitative research is sometimes criticised as subjective because it relies on the researcher to act as the research instrument. To guard against potential bias in this study the researcher was guided by Lincoln and Guba's (1985) constructs for establishing trustworthiness. Lincoln and Guba proposed four criteria for establishing trustworthiness of qualitative data: credibility, transferability, dependability, and confirmability.

3.6.1. Credibility

The following methodological procedures were used in this study to increase the probability that credible findings would be produced: prolonged engagement in the setting, persistent observation, triangulation and inter-coder reliability.

3.6.1.1. *Prolonged engagement*

Even though the researcher was already familiar with the study site, the researcher conducted the fifteen observations at intervals that covered the four seasons of a year. This fitted with Speziale and Carpenter's (2007) contention that one of the best ways to increase credibility is through prolonged engagement in the study setting which is long enough to establish trust with the participants and gain a better understanding of their everyday world.

3.6.1.2. *Persistent observation*

In addition to prolonged engagement the technique of persistent observation was used. According to Lincoln and Guba (1985) the duration of the observations needs to be long enough for the researcher to determine the most relevant aspects of the observations. In this study observing the nurses through their full shifts including morning, afternoon and night shifts, through weekdays and weekends, and across the four seasons of the year ensured persistent observation was achieved.

3.6.1.3. *Triangulation*

Two different triangulation techniques were implemented to validate the data and overcome the intrinsic bias that can occur from using one method of data collection or analysis. Method triangulation and time triangulation were used for this research.

Method triangulation (Polit & Beck, 2008), which included non-participant observation and ACTA, demonstrated a consistent picture of nurses' NTS.

Time triangulation (Polit & Beck, 2008) occurred from observations conducted during various points in time over days, weeks, and a 12-month period to determine constancy of the NTS required of nurses over time. Using two different triangulation techniques provided a comprehensive depiction of the NTS required of nurses in general surgery in their everyday practice.

3.6.1.4. *Inter-coder reliability*

To reduce the possibility of biased decisions and to assist with interpretation of the observational data, the initial coding of the first two observations was conducted by two independent teams of coders. Using an inductive process each team of coders produced NTS categories which were compared for agreement. These categories were subsequently used as a coding frame for further analysis of the observational data.

3.6.2. Transferability

Lincoln and Guba (1985) suggested it is the consumer of research who establishes transferability of findings. In this research a wide range of information was gained to support an in-depth understanding of the NTS required of general surgical nurses so that others can determine whether the findings are transferrable or applicable to other clinical settings.

Field notes were recorded during the non-participant observations and provided a rich description of the NTS required of the nurse in the clinical setting. The field notes included a narrative account of the nurses' actions, their dialogue, and the context in which they were observed. Similarly, in the ACTA, notes were taken in the interviews, the interviews were recorded and participants' direct quotes were used to illustrate key points of analysis.

3.6.3. Dependability

To address the issue of dependability and to enable others to replicate this study, accounts of the research design, its implementation, and the procedures of data collection and analysis have been described above in detail.

3.6.4. Confirmability

To reduce the effect of investigator bias, triangulation was used to ensure, as much as possible that the study's findings are the result of the participants' experiences and not the perspective of the researcher (Polit & Beck, 2008). Additionally, an expert general surgical nurse provided an independent review of the results of the study to confirm the information was a credible representation of general surgical nurses' practice. Furthermore, the researcher was encouraged by her supervisor to reflect on her thoughts and feelings throughout the course of the research and to consider how these perceptions might impact on data collection and interpretation.

3.7. Ethical Considerations

Ethical approval for the research was granted by the Auckland Region's Northern Y Ethics Committee, reference NTY/09/07/059 (Appendix Ma), and the DHB Ethics Committee, (Appendix N). An extension to the study wards was sought and approved by the Auckland Region's Northern Y Ethics Committee on 16 April 2010 (Appendix Mb). The participants were provided with participant information sheets and their consent forms were signed prior to the commencement of each observation and interview.

3.7.1. Informed consent

In accordance with The Privacy Act (1993) potential participants were presented with a participant information sheet that provided an explanation of the research and informed them of their human rights as research participants. The participant information sheet included detail about the participant's right to decline the invitation to take part and, once involved in the study, the right to withdraw from the study without negative consequences. Signing and returning the consent form indicated that voluntary consent had been given and the participant had an understanding of the research.

3.7.2. Confidentiality and anonymity

The study participants were assured that any electronic data recorded about them would be anonymised and kept separate from the consent forms on a password protected computer, and field notes would be kept in a locked file in the researcher's office. As well as using fictitious names in the field notes the researcher also disguised the gender of the participants. A signed confidentiality agreement was completed by the transcriber before she was given access to the data.

Prior to each observation participants were reassured the purpose of the observation was to observe the NTS required of them and not to make judgements about their practice. They were also informed that during nurse-patient interactions the patients' anonymity or confidentiality would not be compromised as no data would be collected or reported about patients.

To keep patients safe during observations which involved nurse-patient interactions, verbal consent was first obtained from the patients for the researcher's presence. When situations arose where the researcher thought it best to do so, she withdrew even though the patient may have consented to her presence.

3.7.3. Potential harm to participants

The researcher was mindful of the psychological distress that could result for the participants from being observed while working or from issues exposed during the in-depth probing of the interviews. Participants were made aware that a counselling service was available to them should they require it.

3.7.4. Other ethical issues

Prior to undertaking the observations, the researcher discussed with her supervisors how she should respond if she observed unsafe practice during the observations. It was decided that if such a situation arose, she would first discuss the situation with the participant and if a satisfactory outcome was not attained she would discuss the issue with the participant's direct line manager. During the observations no such occasion arose where unsafe practice was observed.

3.8. Conclusion

This chapter has described the methodology and the methods used to collect and analyse the data. It has also discussed the ethical considerations. The following five chapters present the findings from Part A and Part B of the study.

Part A

Chapter 4. Observation Study

This chapter presents the findings from Part A. The data were generated from the observation study designed to identify the NTS required of nurses when providing nursing care in general surgical wards. Given the exploratory nature of the study the observations were not highly structured. Data saturation was reached after 15 observations when no new information emerged. After the observations were completed field notes were transcribed verbatim by the researcher. Anonymity was assured prior to coding of the data by using pseudonyms, changing the gender of some participants, and removing descriptors that were unique to the clinical setting where the observations were conducted. These descriptors were replaced with generic terms.

4.1. Participants

The participants were 15 staff nurses with varying levels of experience within the hospital's PDRP framework approved by the NCNZ (2013). Four nurses were practising at the proficient level and their nursing experience in a surgical ward ranged from seven to 20 years. Nine nurses were at the competent level and had one to five years surgical nursing experience. Two nurses were new graduates with three months surgical nursing experience.

4.2. Data Analysis

A coding frame was developed using the transcripts of the first two observations which were independently coded by peers from a PhD group at The University of Auckland and HF graduate students in a research methodology class in a United States university. Instructions were given independently to both groups to identify behavioural skills categories using the information contained in the transcripts. No restrictions were placed on the number of categories or how they were to be named. Appendix O sets out the process used to develop the coding frame and identify a taxonomy of seven NTS: communication, leadership and management, planning, situation awareness, decision-making, teamwork, and patient advocacy.

4.2.1. Defininitions used for coding surgical nurses' NTS categories

The seven NTS categories were defined as follows:

4.2.1.1. *Communication*

An exchange of verbal or non-verbal information (Flin et al., 2008) between the nurse and a health professional or non-health professional.

4.2.1.2. *Leadership and management*

Using authority, maintaining standards (Flin et al., 2008), delegating responsibility, guiding and directing others (NCNZ, 2012a), and organising and coordinating activities in the ward involving the nursing staff, the patients, the medical staff and allied health professionals.

4.2.1.3. *Planning*

Managing workload, allocating resources and thinking ahead (Flin et al., 2008).

4.2.1.4. *Situation awareness*

Gathering information, interpreting information and anticipating future states (Flin et al., 2008).

4.2.1.5. *Decision-making*

Defining problems, considering options, selecting and implementing options and evaluating the outcome (Flin et al., 2008).

4.2.1.6. *Teamwork*

Supporting others, coordinating activities, exchanging information (Flin et al., 2008) and collaborating with others.

4.2.1.7. *Patient advocacy*

The promoting and protecting of the health, safety and rights of patients (NCNZ, 2012b)

The findings for the extracted data from the 15 observations are described in more detail using a table for each NTS category. The table includes the element and sub-element of each category. Following each table is a discussion which incorporates text from the field

notes including direct quotes from the observed nurses. At the end of each quote the reference code for the observation is enclosed in brackets. Text from the field notes also includes the researcher's reflections.

4.3. Communication

Communication (Table 1) was a major part of the nurses' role. The majority of the communication was verbal and included conveying and receiving information between nurses, nurses and doctors, nurses and other health professionals and support services, nurses and patients and their families/ *whānau*. Verbal communication occurred face-to-face or by telephone. Non-verbal communication included written and electronic communication, and body language.

Table 1: Communication

Category	Element	Sub-element

Communication	Verbal	• Communicating with health professionals
		   o Communicating with nursing colleagues
		     ▪ Giving and receiving clinical handover
		   o Communicating with doctors
		     ▪ Sharing information
		     ▪ Requesting assistance
		   o Communicating with allied health professionals
		     ▪ Sharing information
		     ▪ Requesting assistance
		   o Communicating with other personnel
		• Communicating with patients including their family/*whānau* and care givers
		   o Sharing information
		   o Requesting information
		   o Providing patient education
		   o Responding to questions
		• Communicating by telephone
		   o Responding to general inquires
		   o Conveying information

	Non-verbal	• Utilising documentation
		   o Writing and reading clinical notes
		   o Recording patient data
		   o Referring to written communication

- Sending and receiving information electronically
- Referring to theatre lists
- Using a whiteboard
- Noticing and responding to body language

4.3.1. Verbal communication

Information about patients' care from one nurse to another nurse, to other health professionals, or to patients and their families/*whānau* was most frequently communicated face-to-face.

4.3.1.1. *Communicating with health professionals*

The health professionals nurses communicated with most frequently were nursing colleagues and doctors. Nurses communicated less frequently with pharmacists and allied health professionals such as physiotherapists and dieticians.

Communicating with nursing colleagues. Clinical handover was the most frequent purpose of communication between nurses. It was part of a process for ensuring that the continuity of patient care was maintained across the perioperative continuum. The United Kingdom's (UK's) National Patient Safety Agency defined clinical handover as "the transfer of professional responsibility and accountability for some or all aspects of care for a patient or group of patients to another person or professional group on a temporary or permanent basis" (British Medical Association, 2004, p.7). Three types of handover were observed to have occurred: the structured change of shift 'global handover', the change of shift 'bedside handover', and the 'patient handover'. The latter occurred when nurses were going off the ward or when patients were transferred to and from OR, or admitted to the ward.

Giving and receiving handover occurred on all the wards between nurses. At the beginning of each shift a 'global handover' was given in SBAR format. During the global handover, nurses were informed of the progress of all patients in the ward. They received key information about each patient and had the opportunity to ask for clarification if required.

> During the global change of shift handover nurses have a printed handover
> sheet in SBAR format which outlines patients' information, progress and

plan of care. The team leader gives handover to all oncoming staff and nurses ask questions for clarification as handover proceeds. (Observation 1)

When the global handover was completed nurses were assigned a patient load by the assigned team leader for the shift. Once the nurse-patient assignment had been made, a second more comprehensive 'bedside handover' was conducted between the assigned nurse commencing the shift and the nurse completing the shift. The handover at the bedside provided the opportunity to gain further information directly from, and about a patient. It also provided an opportunity for both nurses to view and discuss in more detail the patient's progress and cross-check written information.

> Both nurses discuss the general progress of each patient. Together they check each patient's infusion pump and intravenous (IV) fluids against the charts. They check indwelling catheters and wound drains and discuss the output. They look at patients' wound dressings. Together they read through patients' clinical notes, medication charts, vital signs and blood sugar level recordings and discuss relevant information. (Observation 14)

A 'patient handover' was always given between the ward nurse and the pre-operative nurse when a patient was transferred to the OR. The handover involved a safety check against a pre-operative check list and with the patient. Information was also requested from the patient such as the duration of fasting time prior to surgery. Any additional information not recorded on the pre-operative check list was handed over and checked against the associated documentation such as the patient's blood sugar level and the infusion rate of glucose, insulin and potassium (GIK) for a patient with diabetes. Once the checks were completed any concerns were clarified.

> The patient is transported to the pre-op area in theatre [OR] and a handover is carried out between the ward nurse and the theatre nurse. They both check through the pre-op list first and then the theatre nurse checks with the patient that the details recorded are accurate, for example nil by mouth status. (Observation 6)

> During the handover the ward nurse informs the pre-op nurse about the patient's blood sugar levels and GIK infusion. She brings the attention of the pre-op nurse to a chart in the patient's notes which they refer to as a guide to discuss the infusion rate. (Observation 1)

Following surgery when a patient was physiologically stable enough to return to the ward, the ward nurse went to the Post Anaesthetic Care Unit (PACU) to collect the patient. In PACU the ward nurse received a 'patient handover' from the PACU nurse at the patient's

bedside. During the handover both nurses assessed the patient's readiness to return to the ward and confirmed any needs that required follow up such as a specific type of wound dressing.

> The ward nurse goes to PACU to collect the patient and receives a verbal handover from the PACU nurse. Both nurses assess the patient and focus on the surgical site. They comment on the type of dressing used which the nurse will review back in the ward. (Observation 1)

Whenever a nurse left the ward a 'patient handover' of the nurse's allocated patients was given to another nurse to ensure continuity of patient care during the nurse's absence. As much as possible before leaving the ward the nurses ensured their workload was up to date. Relevant information about what needed to be attended to in the nurse's absence was handed over. Even though the nurses were on their breaks they made themselves available to be called back to the ward if needed.

> Nancy gives a handover to another nurse before going on a break. Before her break she has done everything that is due "so the other nurse will just attend to anything that comes up". She is expecting a patient back from theatre, and asks that theatre be told that she will collect the patient when she returns to the ward from her break. Nancy informs the other nurse that she will be having her break near the ward so she can come and get her if needed. (Observation 15)

A 'patient handover' may also be given by telephone when a patient is ready to be transferred to the ward from another unit such as the emergency department.

> "It's a nurse ringing from ED to give a handover of a patient being admitted with pain, post mastectomy." (Observation 11)

Communicating with doctors. In the general surgical ward, doctors are the other health professionals nurses communicated with most frequently. Their interaction with doctors involved sharing information relating to the patients' progress and keeping them informed about patients' care needs. Nurses initiated communication with doctors when they were concerned about a patient or to request assistance such as a change in treatment.

> Mani asks the house officer to chart stronger analgesia for one of her patients and requests Tramadol and Sevredol be charted which is done. (Observation 2)

Although the nurses knew the medical intervention that was required for the patient, they often did not communicate this knowledge directly to the doctors. Instead, the nurses guided the doctors by asking questions.

> Sally updates the house officer on the patient's progress as he is not taking oral fluids. She asks the house officer "Do you want to put in an IV line?" "Yes, okay" says the house officer. (Observation 13)

Communication between a nurse and doctor is not always planned. Discussions about a patient's progress or their care can often occur at opportune moments such as during doctors' rounds or at the nurses' station.

> The doctors are at the patient's bedside. Mel initiates communication with them regarding the patient. One of the doctors converses with the patient and Mel updates him about the patient's progress with the information she received during handover. (Observation 1)

> The doctor is reviewing patients' notes at the nurses' station. Jo and the doctor then discuss various patients' plans of care for the night. (Observation 12)

At the completion of their ward rounds, doctors sometimes approached the nurse responsible for a specific patient to inform them about changes they had made to the patient's plan of care, as nurses were not formally part of the doctors' ward rounds.

> The doctors have completed their round and following this have verbally reported to Nikki changes to the plan of care for their patients. Nikki updates her management planner accordingly. (Observation 10)

Sometimes doctors communicated information about a patient's plan of care to any nurse they saw as they did not know who to hand the information over to. They assumed that the information would be reported.

> The doctor approaches Mel and informs her about two patients who are going for an ultra sound scan and the times they are going, even though they are not her patients. Mel then leaves what she is doing and spends time seeking out the nurse to hand over the information to. (Observation 1)

Handing over information to the first available nurse that the doctor saw required the nurse receiving the message to stop the work they were doing, seek out the nurse the information was intended for and then pass on the message. While this strategy may have saved time

for the doctor, it wasted time for the nurse who had to convey the message. It also had the potential for miscommunication if the message was not then communicated accurately.

Communicating with allied health professionals. Throughout the course of their shifts, the nurses communicated with a number of allied health professionals as they shared or requested information regarding a patient's health needs or the care they required. This included communicating about aspects such as an update about a patient's treatment, preparation for discharge, or to directly seek information about a patient. As with the communication that occurred with doctors, there was no systematic process regarding how the interactions occurred with these allied health professionals. Often the interactions were unplanned and time was wasted as the allied health professional frequently did not know which nurse to speak to. Usually he/she approached the first nurse they saw on the ward who would either re-direct them or go and look for the nurse concerned. Some allied health professionals knew where to find the nurse/patient allocation on the whiteboard and could quickly identify the nurse they needed to communicate with.

Following their interaction with patients, allied health professionals usually documented information about the visit in patients' clinical records. Sometimes the information was discussed with the nurse. Not all allied health professionals routinely documented their visits with patients. When nurses were aware of this, they would record that the visit had occurred when writing their own clinical notes or they would follow up with the allied health professional concerned and remind them to write in the patient notes.

> The dietician has come to see one of the patients in Nikki's care. They share information regarding the patient's progress and the dietician advises Nikki to remove the nasogastric tube and start solid food. Nikki documents the communication with the dietician in the patient's clinical notes. While writing her notes Nikki says she also needs to "chase up" the social worker to write-up his/her notes for one patient. (Observation 10)

When doctors were not immediately available for allied health professionals to communicate with directly, nurses were sometimes conduits for passing on information about a patient's care. For example, a social worker asked a nurse to pass on information to a house surgeon regarding a change to a patient's discharge plan which required a discharge summary to be completed. The nurse duly passed on the message to the house surgeon.

>A social worker approaches Jill regarding a patient reviewed in the team meeting. She informs Jill that the patient's wife has since changed her mind and will take the patient home. She asks Jill to notify the House Surgeon so the discharge summary can be attended to. (Observation 8)

Communicating with other personnel. Nurses constantly communicated with other hospital personnel who came to the ward, for example hospital orderlies. Nurses provided suggestions and advice to hospital personnel when they were on the ward or problem-solved for them when the information they had been given was not clear. This often interrupted nurses' work. For example, the bed allocation of a new patient being admitted to the ward may not be apparent to the orderly transporting the patient from another department. The orderly seeks the information from a nurse who may not have it at hand. The nurse is then required to leave what she is doing to find the information the orderly needs.

>Nikki is about to take the observations of one of her patients in contact isolation and is donning a gown to enter the room as a new patient is being wheeled into the ward by an orderly and accompanied by a relative. The orderly asks Nikki "Do you know where this patient is going; I can't see their name on the board?" "I can see you are busy" he says. Nikki takes off the gown and goes to the nurses' station and finds the allocated room for the patient, then passes on the information to the orderly. (Observation 10)

4.3.1.2. *Communicating with patients including their family/whānau and caregivers*

Verbal communication with patients including their family/*whānau* and caregivers most frequently involved the nurse conveying or requesting health information in order to promote the patients' well-being. Responding to queries from family/*whānau* and caregivers about the patient's care was a significant component of the interaction.

>Sally advises the patient's daughter about the on-going care her mother requires when she is discharged. The daughter says she thinks her mother needs rest home care …. Sally informs her she will refer her to the social worker. (Observation 13)

>Jill is approached by relatives who explain they are from out of town and want to know what is happening for the patient. "Can you tell us?" Jill takes them to see the patient. (Observation 8)

4.3.1.3.   *Communicating by telephone*

Despite there being a ward clerk who could answer and field telephone calls during office hours, the nurses were constantly interrupted by telephone calls which were transferred through to the nurses' station.

> Alice answers the phone at the nurses' station. It is x-ray department wanting to know if a patient needs an escort to go to radiology. Alice explains "usually the ward clerk answers the phone, but if not the call comes through to us." (Observation 11)

Responding to general enquiries. Communication with family/*whānau* or caregivers sometimes occurred by telephone and commonly involved a general enquiry about a patient.

> "It's a nurse calling from the rest home where a patient came from. She is enquiring about him." (Observation 12)

> "It is a relative enquiring about the patient returning from theatre." (Observation 5)

In response to such calls, the nurses only provided general information about the patients. Nurses are not permitted to disclose information about a patient without their consent (NCNZ, 2012b; Privacy Commissioner, 1994). For example, they made comments such as the patient had a good night's sleep or was comfortable. If it was reasonable to do so, and with the patient's permission, nurses offered to transfer the call to the patient, or ask for a phone number the patient could call. Sometimes the caller requested that the nurse pass on a message to a patient.

> "It is a patient enquiry". [The nurse] goes to the patient concerned to pass on a message from the caller. (Observation 1)

Conveying information. The nurses made telephone calls most frequently to speak to a doctor because of their concern about a patient. These included emergency calls. When immediate medical assistance is required, for example when a patient's condition showed physiological deterioration, as evidenced by an EWS of five, an emergency call was made by the nurse. This summoned the MET to the ward and the patient was attended to without delay.

In less critical situations nurses called the MET directly and communicated their concerns about their patients and their actions using an SBAR handover to a MET team member.

> Ren rings the MET team. She says "[The patient] has an EWS three at the moment." She proceeds to give an SBAR handover and informs the MET of the patient's vital signs and her concerns. She gives a history of events and informs them she has a doctor in attendance. (Observation 7)

If a situation was urgent, and a doctor was not immediately available on the ward, a patient's treatment which required medical authority, such as a prescription for intravenous fluid was gained by the nurse through a telephone order.

> Mary phones the doctor. She says "we need to keep the patient nil-by-mouth and we need to have IV fluids charted. Can you give me an order please?" The Dr asks Mary for information about the patient then gives the order. (Observation 5)

Similarly, in urgent situations, doctors telephoned nurses and requested specific treatments or tests such as an electrocardiogram (ECG) for a patient with chest pain to be carried out before they arrived to assess the patient.

> "It's the doctor coming in to see the patient and he wants an ECG done" says Ren. (Observation 7)

The nurses received telephone calls from other departments in the hospital which sometimes created disruption to workflow when there was an unexpected demand that was time consuming. For example, the radiology department might ring unexpectedly and request a patient be transferred for an x-ray, or pharmacy may request a patient's chart be faxed to them.

> Jo says "Its x-ray department calling for the patient to go to x-ray". It's completely out of the blue". (Observation 12)

> "It was pharmacy asking for a patient's chart to be faxed to them" says Mary. (Observation 5)

When a patient's condition is changing, timely communication between the nurse and the doctor is needed and knowing which doctor to contact is imperative for the nurse. However, the nurses were not always able to make immediate contact with the doctor they needed to speak to, as ward contact lists were not always kept up to date. In this situation

nurses had to call individual doctors on a contact list until they located the right one. This situation wasted nurses' time and annoyed doctors when they were called unnecessarily.

> Often I get put on to the wrong doctor and they get annoyed that you have called them as they don't know the patient. I then ask them if they know who the House Surgeon is for that patient. Sometimes they know. Sometimes they don't, so I just have to keep going down the list until I get the right one. It can take a lot of your time. (Observation 8)

Even when nurses knew which doctor or team to contact they were still presented with problems if the patient was located in a different ward to his/her medical team. In these situations, nurses wasted time as they repeatedly put out calls requesting doctors to come to the ward and waited for them to respond.

> One of Alice's patients is [a medical patient] and needs fluids charted. She looks on the computer to find who the team is for the patient. She explains getting a medical team up to a surgical ward is quite difficult and time consuming. "Nurses need to keep calling them and documenting this until they come". (Observation 11)

4.3.2. Non-verbal communication

Documentation including written and electronic formats, electronic messaging, whiteboards, and noticing body language, were included as non-verbal communication.

4.3.2.1. *Utilising documentation*

During their shifts, nurses recorded and reported a substantial amount of information about patients. This included writing detailed nursing reports about each patient in his or her care. Through documentation, nurses communicated to each other and other health professionals and administrators, the progress of the patient, their care needs and the care provided to them.

Writing and reading clinical notes. Nurses' documentation in the clinical notes used a standardised 'SBAR' framework. In addition to clinical notes, nurses recorded information about care plans, medications, and various assessments such as vital signs, fluid intake and output, wound management, and pain management as well as significant psychosocial factors such as patients' readiness for discharge. Additionally, the nurses recorded significant information about the observed status of patients during hourly rounds.

> Ann writes her clinical notes in preparation for handover to oncoming staff. She uses the SBAR framework and documents the nursing care given to her patients. This includes assessments such as EWS scores and pain scores, dressing changes, removal of luers, analgesia and other medications administered, blood sugar levels, activities of daily living (ADLs) and fluid therapy which includes documenting intake and output on the respective charts. (Observation 9)

Clinical notes are central to a patient's care and their accuracy is vital for keeping nurses, doctors and allied health professionals informed about the patients' progress. When nurses were not able to communicate directly with doctors, they relied on clinical notes as the means of communication for keeping them up-to-date about the patient's plan of care and their progress.

> The doctors sometimes give verbal instructions regarding patient care but if a nurse is not available, for example is busy with another patient then communication is through notes written in the patient's chart. Mel reads the notes and sees the doctors have written that a patient is for discharge tomorrow and for district nurse follow-up. The patient will have a caregiver staying with her at home. Mel proceeds to write information for the caregiver regarding the patient's medications on discharge. (Observation 1)

Often doctors communicated with nurses only through the patients' notes. Unless the situation required immediate attention, doctors did not routinely communicate face-to-face with individual nurses. Instead information was more commonly communicated by writing in the clinical notes, though doctors did not alert nurses to this. The nurses however were aware of this line of communication and periodically checked their patients' notes for changes made by the doctors. Implementing changes, however, could be delayed if the nurses were held up from reading their patients' notes because they were busy attending to other patients or because they were not aware that the doctors had seen the patients.

> Doctors don't usually talk to us about what is written in the notes…unless it is something urgent then they will tell us. (Observation 6)

> Beth goes and reads the patients' notes after the doctors have seen her patients. She modifies her plan of care accordingly and explains the changes to the new graduate who is working with her. (Observation 4)

> Alice checks her patients' charts for updates from the doctors. She finds one patient has been charted antibiotics for a urinary tract infection and proceeds to prepare and administer the antibiotics to the patient. (Observation 11)

Recording patient data. Nurses recorded patients' vital signs and analysed the physiological status of a patient according to the EWS. In the event of a patient who 'normally' presented vital signs outside the normal threshold, such as a persistently low blood pressure because of a chronic cardiac condition, nurses anticipated that doctors would communicate their expectations of an appropriate response by prescribing an individual threshold for the patient. Otherwise, unnecessary callouts are made to doctors or the MET, which wasted both the nurses' and doctors' time.

> The nurse reiterates her concern to the registrar that he has not activated the early warning scoring system when a patient has an increased EWS. The nurse suggests to the doctor he changes the EWS thresholds if a response is not required according to the current limits set for the patient. (Observation 2)

> Julie takes the patient's blood pressure and comments that it is low. She sees on the patient's chart the doctors have changed the threshold for this patient's blood pressure so she is not concerned. (Observation 3)

Referring to written communication. Other forms of written communication such as referral letters and clinical notes provided by allied health professionals also kept nurses informed about the patients' care from the MDT perspective. Furthermore, nurses referred to written communication provided by others to keep them informed about the running of the ward, such as theatre lists, guidelines, protocols and algorithms.

4.3.2.2. *Sending and receiving information electronically*

Nurses used electronic communication to gain input into patients' care from various sources. For example nurses text-page doctors or send referrals by facsimile to other health professionals.

> "Nurses fax [facsimile] referrals to the appropriate services such as district nursing for a wound dressing. We do this autonomously if the patient needs district nursing care. We also send referrals to occupational therapists, physiotherapists, social workers, diabetic nurse specialists, wound care specialists." (Observation 6)

4.3.2.3. *Referring to theatre lists*

While the theatre list did not specify individual OR times, they provided brief details which informed nurses about the patients who were scheduled for surgery. Then, notification of when a patient was due in OR was often as short as ten minutes beforehand

or not until the OR orderly arrived on the ward to collect the patient. This resulted in a rushed preparation of a patient for OR and interrupted the flow of nurses' work.

> "You don't really know what time they will go to theatre until the orderly turns up to take them. With acute patients there is no set time. Only the non-acute list has pre-designated theatre times. But on this ward most patients are on the acute list." (Observation 5)

> It seems a bit rushed. Patients going to theatre are on a list but no times are available so nurses just need to be aware that they will get a call just ten minutes beforehand. (Observation 6)

4.3.2.4. *Using a whiteboard*

A central white board which nurses kept up-dated each shift was located in the nurses' station. It was used to communicate a variety of information to a number of different health professionals as well as the nurses themselves. It provided information about patients as well as key information needed for the safe running of the ward.

> [The whiteboard] has recorded on it the patient's name, room number, allocated nurse, medical team, and any special requirements the patient has such as IV therapy. The team leader for the shift is also identified as well as other important information which can be found at a glance such as completed checks of resuscitation equipment. (Observation 15)

4.3.2.5. *Noticing and responding to body language*

Nurses took cues from their observations of patients' body language. If they noticed a change in a patient's appearance and were concerned they acted on this information for the benefit of the patient.

> "She was expecting to be discharged yesterday, but I noticed the way she looked at lunchtime indicated she wasn't well. I was concerned and wanted to keep her in". (Observation 5)

This section has illustrated the variety of communication methods nurses constantly used. It has shown that the communication skills nurses require occur at both a verbal and non-verbal level.

4.4. Leadership and Management

Leadership and management (Table 2) was identified as a NTS required of the nurses to manage the ward, the nursing staff, the patients, their medical team and allied health

professionals. They provided leadership for nursing colleagues, enrolled nurses [5] , healthcare assistants[6] and other health professionals to maintain safe care in the surgical wards. In surgical wards, effective leadership and management can influence team performance and reinforce safe work practices by ensuring that safety standards, procedures and policies are complied with.

Table 2: Leadership and Management

Category	Element	Sub-Element
Leadership and management	Using authority	• Enforcing hospital policy/using assertiveness
	Maintaining standards	• Supervising • Ensuring best practice
	Delegating responsibility	• Managing the situation
	Guiding and directing others	• Advising colleagues • Mentoring students • Orientating new team members

4.4.1. Using authority

This requires the leader to take decisive action if required by the situation to achieve a safe outcome. Nurses must know when to apply their professional authority for managing the safe care of patients.

4.4.1.1. *Enforcing hospital policy/using assertiveness*

Hospital policies provide a set of principles that guide and direct the actions and conduct of individuals within an organisation to provide safe and effective care. They relate to legislation, a standard or best practice, and set the fundamental requirements for safe care.

[5] Enrolled nurses are regulated health workers who practice under the direction and delegation of a Registered Nurse (NCNZ, 2012c). In the surgical setting enrolled nurses must work in a team with a registered nurse who is responsible for directing and delegating nursing interventions.

[6] Health care assistants are unregulated health workers who work under the direct supervision of a Registered Nurse who delegates responsibility to them.

The nurses demonstrated leadership and management by ensuring that hospital policies were complied with in the best interests of their patients. When there was a lapse in adherence to hospital policy by visitors or other health professionals, the nurses exerted their influence to safeguard the management of safe patient care. For example, nurses used their authority to maintain infection control practises of visitors at a patient's bedside or to manage the numbers of visitors to enable the nurses to deliver efficient patient care.

> The nurse notices that the interpreter speaking to a patient who is being cared for in isolation is not wearing personal protection equipment. She informs the interpreter about the need for gowning before entering the patient's room and instructs her accordingly. (Observation 1)

> It is not visiting hours yet and a number of visitors have arrived to see a patient. Mary informs them that only one person at a time can go in as the nurses are with the patient. Two more visitors arrive and Mary again reiterates "one only please." (Observation 5)

The nurses also demonstrated leadership and management by acting as a resource for new house surgeons on the ward and ensuring they were informed of their responsibilities regarding hospital policies specific to their scope of practice, for example the procedure for gaining special authorisation for medications.

> Alice informs the doctor that "the medication needs special authority" The doctor replies, "I don't know ... I don't know how to do it". Alice replies "You need to do it otherwise the patient won't get their medication." The doctor goes to see the patient and returns. He confirms authorisation has been given and has checked this with pharmacy. (Observation 11)

4.4.2. Maintaining standards

This relates to ensuring compliance with essential standards for safe care by other team members or role-modelling best practice.

4.4.2.1. *Supervising*

Leadership and management in the general surgical team required the more experienced nurses to oversee the performance of individual team members to ensure patient safety. They also provided team members with opportunities to develop their knowledge and technical proficiency. In the nursing teams the more experienced nurses frequently supervised the less experienced nurses when they were learning to perform complex technical skills.

> Ann supervises a less experienced staff member with insertion of a nasogastric tube. (Observation 9)

4.4.2.2. *Ensuring best practice*

Leadership and management also entailed adhering to best practice in order to maintain standards of patient care. For example, the nurses safeguarded cultural safety and ensured Tikanga[7] was maintained by actively encouraging family/*whānau* support and respecting involvement of a nominated spokesperson to protect the patients' health beliefs and rights.

> One family member asks Sally about the patient. Sally tells the family member she can only discuss this information with the person who has been nominated as spokesperson. Sally informed him a family meeting has been arranged for Friday, which the relative indicated he is happy with. (Observation 13)

4.4.3. Delegating responsibility

Delegation promoted successful teamwork and encouraged team members to take responsibility for their actions.

4.4.3.1. *Managing the situation*

There were often situations that placed competing demands on a nurse's attention. These included aspects of patients' care needing to be delegated to another team member to maintain the flow of care. To make safe and informed decisions about who to delegate responsibility to, nurses needed to have knowledge of the capabilities and scope of practice of the individuals they worked with. Once the delegated activity had been carried out, the nurse who delegated the responsibility needed to confirm that it had been accomplished to their satisfaction.

> Sally approaches a HCA who has been given some delegated responsibility [for patient care] by Sally and speaks to her. Sally receives a handover from the HCA about the cares she has given to Sally's patients. (Observation 13)

> "They [HCAs] can take vital signs, but I only let them do this on stable patients. If the patient is unstable I do this". (Observation 8)

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[7] Tikanga is 'ways of doing and thinking that are just and correct' as determined by Māori.

4.4.4. Guiding and directing others

Nurses guided and directed the work of others to maintain patient safety. This included nursing colleagues and students, doctors and allied health professionals.

4.4.4.1. *Advising colleagues*

Experienced nurses demonstrated leadership when they shared their knowledge and provided advice to less experienced team members.

> The junior doctor asks Nancy about nicotine patches and how much to prescribe. Nancy and another nurse both inform the doctor it depends on how much the patient smokes. "Is there a chart for that?" he asks. "No, just chart one [patch]" say both nurses. (Observation 15)

> A junior nurse approaches Ren for advice about an IV infusion. The IV fluids have almost finished. The junior nurse explains "the doctor said she would chart it and hasn't." Ren advised, "you need to contact the doctor again and get it charted." "What should I do in the meantime?" "Slow it down until it has been charted," suggested Ren. (Observation 7)

4.4.4.2. *Mentoring students*

The nurses were required to take responsibility for guiding the practice and learning of student nurses. Learning opportunities for students were often unplanned and occurred as situations arose. They included situations that required the use of NTS such as decision-making or technical skills such as administering IV medication.

> Alice advises the student about prioritising care for a patient as the student is not sure what to do next. Alice gives the student some options to choose from; however, the student is not able to decide what to do first so Alice guides her …. (Observation 11)

> The student is observing Sally administer IV medication. While she is giving the medication Sally demonstrates and explains to the student what she is doing. (Observation 13)

4.4.4.3. *Orientating new team members*

Experienced nurses were required to conduct the induction of nursing team members, new to the ward. They supported these team members while they gained the knowledge and skills necessary for satisfactory completion of the orientation programme.

> As Mel comes out of the patient's room she is approached by the Clinical
> Nurse Educator who advises her that the nurse who is new to the ward
> needs to complete the medications and calculations orientation package for
> sign off. She asks Mel to guide her with this. Mel confirms her support.
> (Observation 1)

At times orientating new team members included a less formal role such as teaching new house surgeons the general flow of ward work and the mechanics of accurate documentation, such as filling out blood request forms. This was considered important by nurses to ensure that junior doctors were better prepared to fulfil their role and to maintain patient safety.

> The nurse says "the blood will be late being given now, but the patient
> needs it. I suppose I should have checked the doctor had filled the forms out
> properly as I was standing nearby at the time. I had to get the on-call to do
> it. We have new doctors on the ward. This lot just started Monday so we
> have to look out for them and what they are doing. We see lots of mistakes
> when they first start, … the doctors rotate every three months. When we get
> a new batch it does slow down our workload as we have to teach a new lot
> of house surgeons about the working of the ward. We just get used to them
> and another lot starts". (Observation 14)

This section has illustrated the leadership and management skills required of nurses. It has explained how this NTS was used by the nurses to influence team performance, reinforce safe work practices and ensure that safety standards were complied with.

4.5. Planning

Planning (Table 3) is important for the delivery of quality care. Nurses use a variety of strategies to ensure care is provided in a timely manner.

Table 3: Planning

Category	Element	Sub-element
Planning	Managing workload	- Prioritising patient need - Being prepared - Being adaptable - Being organised - Grouping cares
	Allocation of resources	Requesting equipment and supplies

4.5.1. Managing workload

Nurses were required to implement effective strategies to ensure patient care was not compromised. They needed to be flexible to manage unexpected events safely.

4.5.1.1. *Prioritising patient need*

Nurses managed their workloads by prioritising patient care according to patients' progress and needs. At the beginning of each shift nurses were allocated a workload determined by each patient's acuity or nursing care requirements. Nurses prioritised a patient's care by considering different factors. For example, a patient scheduled for an early procedure was attended to first to enable prompt preparation of the patient and to ensure that all patient care and safety checklists had been completed prior to the patient leaving the ward.

> "First priority is to check a patient is ready for radiology as he needs to be ready by 0730 for a gastroscopy". Before doing anything else Ren goes to the patient introduces herself, and checks all necessary cares and preparation have been completed. (Observation 7)

The physiological status of the patient was also an important factor the nurses considered when prioritising need. The nurses used their clinical knowledge in conjunction with their assessment findings to determine the priority for their patients' care needs.

> For example, if you have two patients, EWS four for a patient with infection and EWS three for a patient who is septic, then priority will be for the septic patient because of the potential for deterioration compared to the patient with infection even though their higher EWS score suggests the patient is more of a concern. (Observation 5)

When timing of an intervention was not critical such as the removal of sutures it was afforded a much lower priority.

> Nikki explains, after removing a patient's sutures "it wasn't a priority this morning so I left it until now". (Observation 10)

4.5.1.2. *Being prepared*

The observations revealed that effective time management was necessary for safe and efficient delivery of care. However accurate timing of patient care was not always possible. Factors external to the ward often impacted on a nurse's workload. For example, an 'on-call' schedule for surgery required nurses to be prepared to take a patient to OR at a

moment's notice. This was problematic when the nurse had to leave the care of another patient.

> You can be with a patient and attending their cares when you have to stop and attend to another matter such as this patient going to theatre. (Observation 5)

4.5.1.3. *Being adaptable*

Adapting to inefficiencies created by factors external to their work environment was a strategy nurses used to manage their workload. For example, when resources such as linen, medications or wound dressings were not available, nurses adapted by delaying patient care or using alternative supplies. This created pressure on their efficiency and often created annoyance for other team members.

> "It really impacts on planning patient care. You cannot shower patients when there are no towels available or no linen to make beds, so you have to delay things until it arrives this can really put you behind. Like this morning ... we had no theatre gowns available either so we had to send the patients to theatre in ordinary gowns. Theatre gets annoyed but we can't help it". (Observation 5)

Nurses also adapted to shortfalls by seeking supplies from another ward which was observed to be time consuming for nurses and unsatisfactory for patients.

> Mel explains that the elastic pants the patient needs to hold his dressings in place are not now included in the ward budget so there are none available on the ward. However, realising [the patient's] predicament Mel goes to the adjacent ward to see if they have something [the patient] can use in the meantime. However, they do not have any in stock either. Mel returns and informs the patient who is even more dissatisfied that he has to wait for his wife to supply the items. (Observation 1)

4.5.1.4. *Being organised*

During the shift unexpected events happened that increased a patient's acuity and placed greater demands on the nurses' time. Nurses needed to be organised so they could manage these situations competently. For example, when a patient's condition deteriorated they needed to focus their attention on that patient while maintaining the safe care of their other allocated patients.

> Mani's patient needed a lot of attention. I asked who would be caring for her other patients during this time. Mani responded that good time

management is very important and having all patients' care up-to-date when something unexpected happens means the nurse can focus their attention on that patient. (Observation 2)

To assist in managing workload, the nurses devised a 'shift planner' which they used like a checklist throughout the shift to ensure as much as possible that all nursing care for each patient was delivered on time. The timing of medications and monitoring of patients' vital signs postoperatively were particularly important.

Beth uses a time shift planner to manage her day. She includes the times the patients' observations are due when medications are due, and when all patient cares are required. (Observation 4)

4.5.1.5. *Grouping cares*

To save time and manage their workload more efficiently nurses group patient cares, when it is reasonable to do so. For example, patients who have medication due to be administered would have their vital signs recorded at the same time rather than as two separate activities.

"The patient requires a BSL [blood sugar level] and insulin before breakfast. I'll do the obs as well to group cares". (Observation 13)

4.5.2. Allocation of resources

Nurses didn't directly allocate resources required for patient care. Instead they relied on others for the allocation of the resources they needed.

4.5.2.1. *Requesting equipment and supplies*

Some supplies were stored in other departments, which required nurses to request them to be delivered to the ward when needed. However, the delivery times for requested items was variable and the nurses learned to be prepared to wait for them when planning care.

Ann tells me that pigtail catheters require a special dressing from radiology, so nurses have to ring the radiology department to request the dressing and then have to wait for it to be delivered to the ward. She comments that nurses need to include this time factor when planning care. (Observation 9)

Similarly, the prompt delivery of patient meals to the ward was important for nurses to be able to plan and deliver timely care. This was especially important for the administration of some medications. For example, delay in the expected delivery time of meals impacted

on the timing of medications needed to be taken before food. It also impacted on the timing of insulin administration which needed to be given within a safe time period prior to meals. When meal service was unusually delayed, it posed a risk of hypoglycaemia for a patient who had already been administered insulin.

> "It [the breakfast trolley] was on time this morning! We got excited because it was here at 8:30 ... it is usually late. As it turned out, they had sent the wrong trolley so they had to take it away again and now we are waiting for the right one to come back" I asked if it impacts on patient care and the nurse replied "yes particularly for diabetic patients who need insulin or patients who need ac [before meals] medications". (Observation 5)

This section has explained the elements of planning required of nurses to provide quality care. It has illustrated how nurses used this NTS to meet unexpected events and ensure care was not missed.

4.6. Situation Awareness

In the dynamic surgical environment, situation awareness (Table 4) was a NTS used by the nurses to perform effectively. Based on their past experience the nurses gathered information, interpreted what it meant then prepared to respond to what might happen in the future.

Table 4: Situation Awareness

Category	Element	Sub-element
Situation awareness	Gathering information	• Assessing the patient • Attending to visual information • Attending to auditory information
	Interpreting information Anticipating future states	• Asking questions • Thinking ahead

4.6.1. Gathering information

The nurses constantly scanned the ward environment and collected information from visual and auditory cues. They gained information from many sources such as the

appearance of the ward, the actions of people within it, and the equipment in use. The information gained from what they could see and hear provided the nurses with an overall awareness of what was going on around them and enabled them to prepare for potential problems and events.

4.6.1.1. *Assessing the patient*

The nurses constantly assessed their patients and gathered information while attending to them. Experienced nurses could determine what was happening for the patients by the cues they gained from their patient observations. For example, the way a patient wanted to be positioned in bed after a gastroscopy procedure prompted a nurse to think about the risk of a gastric bleed and the safety of the patient.

> Ren comments to me that the patient wants to sit upright. "I'm not sure if it is from nausea, but I am thinking too he has the potential for a gastric bleed". (Observation 7)

4.6.1.2. *Attending to visual information*

The general appearance of the ward environment and work areas provided cues about the busyness of the ward. For example, walking into the ward at the commencement of a shift one nurse could tell by the presentation of the treatment room that the previous shift had been an eventful one. In contrast to less skilled healthcare assistants, the nurse was aware how important it was to maintain an organised work area in anticipation of an unexpected event at any time.

> Mary says "I'm always aware of what is happening around the ward. I always notice things like yesterday morning when I came on, the treatment room had boxes of stuff lying everywhere. I wondered what sort of night they had had. I asked the healthcare assistant why she hadn't tidied up. I explained it is their responsibility to keep that area re-stocked and tidy. It is important that things are always kept clean and tidy as anything could happen at any time". (Observation 5)

4.6.1.3. *Attending to auditory information*

Nurses listened for alarms on equipment, such as infusion pumps, which signified the pump needed replenishing or attending to. They listened for alarms on patient monitoring equipment such as pulse oximeters and patient call bells, which indicated a patient or a nurse required assistance.

> Cherie tells me it is the busiest time of the shift as she goes to answer a patient's call bell and attend to a pump alarm while having to settle her patients for the night and give all the medications. (Observation 14)

> Ren hears an alarm and says "that's my patient's pump I need to go and attend to. I noticed as I walked past before that it was just about ready to be changed". (Observation 7)

An emergency bell cued nurses to stop what they were doing and to immediately respond to the call.

> A bell rings and suddenly Nancy and another nurse standing in the corridor look towards a flashing red light. By their response I realise it is the emergency bell. (Observation 15)

4.6.2. Interpreting information

4.6.2.1. *Asking questions*

Nurses were constantly interpreting information about patients and the ward around them. They understood what specific cues meant and when action was required. A strategy nurses used to seek confirmation of their understanding of cues was to ask questions.

> Alice returns to attend to a patient for discharge and while attending her "hears" the patient in the next bed. She walks over to the patient and asks her "Are you sore?" "Yes," replies the patient. "Do you want some pain relief?" "Yes," she says again. "Okay I will get something checked for you," says Alice. (Observation 11)

4.6.3. Anticipating future states

4.6.3.1. *Thinking ahead*

When a situation had developed or was developing, nurses were thinking ahead and engaging other team members to assist them for the safety of the patient. For example, on observing that a patient receiving morphine had an altered respiratory rate, a nurse called for the assistance of another nurse before leaving the patient, to notify the doctor. In anticipation of further deterioration, the nurse on her return brought the resuscitation equipment and placed it at hand.

> She takes the recordings of a patient and asks a colleague to check the patient as the patient's respiratory rate has altered and the patient is receiving morphine for pain relief. Both nurses assess the patient. One nurse

remains with the patient. The other nurse leaves to call for medical assistance and returns with the resuscitation trolley which is placed just outside the patient's room. (Observation 8)

Once a risk had been identified experienced nurses put into action interventions to alert them to a change in a patient's status; for example, increased monitoring of a patient's vital signs when he/she was at risk of developing a complication.

> Jo tells the patient she will be observing her regularly overnight and that a monitor will be kept on and recording her blood pressure, pulse and oxygen saturations. She explains the monitor has alarms set that she can hear and that she will be watching it regularly. The patient indicates that she is reassured with this explanation and settles down. (Observation 12)

Thinking ahead was also important when nurses administered medications to patients. They considered the potential for the patient to have an adverse reaction to the medication and what they should do if such an event occurred.

> Julie explains when drawing up medication for one of her patients that "the medication and the choice of equipment is standard procedure, though I am always thinking about whether the patient will react to the drug when giving a medication and what I should do". (Observation 3)

When nurses recognised potential problems that they anticipated doctors might not be aware of, they would think ahead and indicate to doctors what was required for the patient to ensure his/her needs were met.

> Ren tells me she needs to follow up on a patient with the doctors. "He had [treatment] months ago and nothing since. I want to check this has been followed up and I'm flagging it to them [doctors]. It is written in the nursing notes but I know from experience doctors may not read them so I'm making sure they are aware". (Observation 7)

This section has shown that situation awareness is a NTS required of nurses to interpret what is going on around them. The nurses constantly used this NTS to monitor the environment and gather information about the patients.

4.7. Decision-making

The nurses constantly engaged in decision-making (Table 5) concerning patients' care and often made decisions independently. At times they shared the decision-making process when they worked collaboratively with other health professionals.

Table 5: Decision-making

Category	Element
Decision-making	Defining problems
	Considering options
	Selecting and implementing options
	Evaluating the outcome

4.7.1. Defining problems

When faced with challenging situations the nurses defined problems and considered options to determine an appropriate response. The nurses' level of experience influenced the way they made decisions.

4.7.2. Considering options

Less experienced nurses followed protocols to guide their decision-making. Unlike the experienced nurses, they did not use clinical judgment to consider the options they could use when faced with a clinical problem. For example, a new graduate nurse recorded a blood pressure for a patient that revealed an EWS of five. The nurse subsequently followed the EWS algorithm and put out an emergency call for immediate medical assistance. The response from the callout resulted in no further action from the MET regarding the patient's medical management. In contrast, an experienced nurse who understood the reason for the patient's low blood pressure and the current management of the patient's health problem recognised that the doctors needed to amend the vital signs threshold on the EWS for this patient to avoid unnecessary callouts. These factors were something the less experienced nurse did not consider when dealing with this clinical problem.

> The new graduate nurse put out an emergency call [for immediate medical assistance] because a patient had a EWS score of five due to a drop in blood pressure. [A systolic blood pressure less than 80mmhg is EWS five and according to the EWS algorithm requires a MET call out and response]. The patient was seen by the doctors and no further orders were given. Alice explains the new grad did the right thing to put out the call but the doctors need to be reminded if they don't want to be called they need to change the thresholds. The nurse is a new grad so she wouldn't think to do this [ask doctors to change the thresholds on the EWS]. (Observation 11)

4.7.3. Selecting and implementing options

When there was a change in a patient's condition, the more experienced nurses used analysis to support the decisions they made when selecting and implementing options for patient care. The analysis often involved collaboration with medical staff when determining the safest option, for example, making the decision to recommence intravenous fluids for a patient who presented with clinical signs of low fluid volume.

> The doctors have already charted IV normal saline if the patient needs it. As his urine output is low I have decided to recommence it this morning. The doctors have charted fluids for him again on their ward rounds. (Observation 4)

4.7.4. Evaluating the outcome

Part of the decision-making process for the nurses required them to evaluate information about a patient's care needs which was important for the safety of the patient. For example, a patient with a portacath—an implanted venous access device for the delivery of medications—was ready for transfer from the emergency department to the ward. The nurse receiving the handover understood that none of the nursing staff on the ward were credentialed to manage these intravenous devices, therefore to ensure the safety of the patient the nurse requested a peripheral intravenous line be inserted prior to the patient's transfer.

The nurses made decisions based on their evaluations about the effectiveness of the care the patients were receiving following surgery. This enabled the nurses to determine if changes were required to patients' plan of care. For example, the nurses evaluated patients' fluid status to determine the effectiveness of intravenous fluid therapy, or patients' pain score to determine the effectiveness of analgesia.

> Mary attends to her postoperative patients. She records their vital signs, checks their wounds, checks their wound drainage and records the amount. Mary tells me she is thinking about how much they have drained and the type of drainage since theatre. The patients' IV sites are checked and Mary confirms they have the correct IV fluids infusing and they are running to time. Mary checks the patients' urinary output; asks the patients if they have passed urine (PU) or want to PU. She records the output of one patient with a urinary catheter noting the volume drained over the last hour and states "it's normal". Each patient's pain is assessed and their comfort determined on a scale of 0-10 to determine the effectiveness of their analgesia. Pain medications are administered accordingly. (Observation 5)

This section has shown that the nurses were constantly required to make decisions about their patients. Most decisions made by the nurses focussed on direct patient care. When they were concerned about a patient the nurses often used this NTS in collaboration with the doctors.

4.8. Teamwork

Teamwork (Table 6) was an essential NTS for the provision of safe care. Nurses were observed to be part of two different teams: the nursing team, and the MDT. When a patient was admitted to hospital for surgery they were assigned to one specific consultant who was the leader of a surgical team which included a registrar and a house surgeon. As more than one consultant was associated with a ward, this resulted in more than one ward-based surgical team. Nurses kept doctors informed about the progress of patients in their surgical teams and notified them with their concerns when there was a change in the patients' condition. When a patient's condition deteriorated nurses provided care in response to the directions they received from the doctors.

The nursing team included a varying skill mix and typically comprised registered nurses, enrolled nurses and healthcare assistants. Student nurses periodically formed part of the team when they were present on the ward during clinical rotations. The nursing team was ward-based, and team members worked together and independently to provide care to patients in response to patients' surgical procedures and their anticipated care needs.

The nursing team structure was hierarchical and the charge nurse coordinated and managed the running of the ward. A designated nursing team leader coordinated and managed team activities on all shifts. Registered nurses were responsible for providing care and initiating nursing interventions that were appropriate for each patient's condition. However in the nursing team the same nurses did not always work together as they were rostered on different shifts to maintain a twenty-four hour nursing coverage of the ward. This altered the team dynamics with each shift.

After office hours, nurses were required to take-on extra responsibilities. They managed the whole ward to keep it safe in addition to being responsible for the patients in their care. In the absence of the charge nurse, the nurses were responsible for ensuring there was adequate staffing for the next shift. They also kept the status of the patients updated on the centralised database, while taking into account any changes in care. After office hours

nurses carried out administrative work normally undertaken by the ward clerk such as obtaining patients' clinical notes and preparing paperwork for new patients admitted to the ward, and for patients undergoing surgery. Without the presence of the ward clerk nurses had to answer all telephone calls to the ward and these were numerous. Nurses also provided interim support to patients when allied health professionals, such as dieticians, were not available to address patients' problems.

On the night shift a specific coordinator was not designated, and all nurses performed that role. Nurses had very limited access to medical staff as there was only one registrar on night shift to cover all wards. Consequently, doctors did not usually come to the ward unless called. If a patient was causing concern the nurses did not directly call a doctor. Instead they communicated with the on-call medical-emergency-team-nurse, an expert, who assessed the patient and provided a plan of care for the nurses to follow.

The MDT was comprised of nurses, doctors and allied health professionals. The nurses' role within the MDT was to work collaboratively with the other team members. There was limited group interaction in the MDT and team members from different disciplines worked alongside each other rather than collaboratively. The team members tended to communicate with each other individually rather than in a team situation. Their involvement with another MDT member was typically initiated when there was concern about a patient. However when a patient was making expected progress, discussions about their plan of care occurred less frequently as there was a mutual understanding and written protocols for the care that was required.

Even though nurses were the only team members constantly at the patients' bedside, it was evident they did not see their role and responsibilities as a function of the MDT. Formal MDT meetings occurred off the ward and few ward nurses attended these or contributed to discussions about the patients' plans of care with the surgical team.

Table 6: Teamwork

Category	Element	Sub-element
Teamwork	Supporting others	• Back up and assist • Fostering of team interdependence • Team self-awareness
	Coordinating activities Exchanging information Collaborating with others	

4.8.1. Supporting others

4.8.1.1. *Back up and assist*

To carry out teamwork effectively in the nursing team and to provide safe care to patients, nurses supported each other. They were adaptable and willing to help out by taking on extra responsibility when another team member needed assistance with a patient's care.

> Mani told me that what is enjoyable about working on this ward is the team. They all help and support each other and take on extra responsibility if another team member needs assistance. (Observation 2)

As part of the MDT the nurses provided backup to the doctors and assisted them with clinical tasks such as obtaining blood cultures.

> The patient has an elevated temperature and the Dr suggests to Sally "a septic screen to be done." Sally explains that "the patient has a PICC line so we need to check there is no infection. We will do an MSU to check for a UTI and an x-ray for chest infection. We may do bloods also". Sally then collects the equipment to assist the doctor to take blood cultures. (Observation 13)

4.8.1.2. *Fostering of team interdependence (Flin et al., 2008)*

In the nursing team the nurses demonstrated mutual trust and relied on each other to meet team goals. They were prepared to work together for teamwork to succeed.

> "We rely on each other. I asked Jay to give two of my patients their medications and keep an eye on them for me. He is very busy too so we manage best we can. But we need to work together as a team at times like this". (Observation 7)

However, there were also instances where poor teamwork pushed the responsibility of one nurse's work onto another without consultation. For example the nurse who methodically checked through charts and documents to ensure they were completed, up to date and correct, had to finish the work of others who had not maintained their own documentation.

> Alice continues to check through the patients' charts to plan care for her patients and notices some charts, e.g. the fluid balance chart, are not dated or written up accurately so she attends to this. Alice comments "I seem to be the only one that constantly checks through and updates charts and doing others' work. It needs to be accurate and correct, but others don't always do it". (Observation 11)

4.8.1.3. *Team self-awareness (Flin et al., 2008)*

Teamwork in the nursing team required that nurses had a shared understanding of each other's roles and could anticipate each other's needs. In changing situations they adapted their workloads to maintain effective patient care.

> For example yesterday I had five patients allocated but an emergency call for another nurse's patient resulted in me offering to take on the other nurse's three patients to enable her to focus on the emergency call. (Observation 2)

4.8.2. Coordinating activities

When a patient required input from another MDT health professional, other than a nurse, the nurses were required to coordinate these services of other healthcare professionals through a formal referral process.

> The patient indicates she needs home help as she can't bend over because of her wound. Alice says she will refer her to the social worker for review for home help. (Observation 11)

Within the nursing team, senior nurses could be delegated the coordinating role for the whole ward. For example, before going off the floor the charge nurse gives a cell phone to the delegated nurse to carry and respond to in addition to his/her allocated workload.

> The charge nurse informs Alice she is going off the ward and Alice now takes over the coordinating role. She carries a cell phone. "Anyone from around the hospital may call this time of day … usually operations management". (Observation 11)

4.8.3. Exchanging information

Within the MDT, nurses communicated information to other team members to help plan patients' on-going care. For example they contributed knowledge derived from their observations of the patients to assist in developing a shared understanding of a patient's readiness for discharge.

> Jill says "the MDT discussed the patient's care and readiness for discharge. It included doctors, physio, social worker who was the lead health professional in the meeting, nurse, and cultural support worker. The nurse's contribution included the cares the patient needed and how the patient was managing taking their medications". (Observation 8)

4.8.4. Collaborating with others

In the MDT the nurses also worked together with other health professionals to implement safe patient care by assisting with hands-on tasks as well as sharing knowledge about the patients' current status.

> The physiotherapist is on the ward and Nikki discusses the mobility needs of one of her patients. The physiotherapist follows Nikki to the bedside of the patient and asks Nikki about the patient's equipment which includes IV therapy, nasogastric feeding via pump, and an indwelling catheter. The physiotherapist asks Nikki what can be done with each of these so the patient can be mobilised. Nikki proceeds to explain the equipment to the physio and together they mobilise the patient. (Observation 10)

This section has illustrated the teamwork skills required of nurses. It showed this NTS required nurses to be part of two different teams—the nursing team and the MDT— each with different responsibilities for the nurses' role.

4.9. Patient Advocacy

Patient advocacy (Table 7) is one of the NTS nurses required to support patients and promote their safety and well-being as determined by the patient.

Table 7: Patient Advocacy

Category	Element	Sub-element
Patient advocacy	Promoting and protecting the health, safety and rights of patients	• Speaking up • Providing support

4.9.1. Promoting and protecting the health, safety and rights of patients

The nurses were proactive in maintaining patient safety by making sure staff and visitors observed hospital policies and also ensuring the privacy of patients was upheld. They also supported patients during interactions with doctors.

4.9.1.1. *Speaking up*

The nurses maintained patient safety by expressing their concerns to doctors when patients' care needs were not being met.

> Beth is concerned that no IV fluids have been charted so she has contacted the doctor by phone to express her concerns and asks the doctor to chart fluids to be given IV. (Observation 4)

4.9.1.2. *Providing support*

The nurses realised that patients often felt vulnerable and were reluctant to ask doctors for information about their progress or care, as they perceived the doctors were busy. When patients felt anxious about asking questions during doctors' rounds the nurses upheld the patients' rights and provided support for them. The nurses assisted patients with recall of information or initiated the discussion with doctors on the patients' behalf, with their prior consent.

> Ren explains she goes with doctors to support the patient as "they sometimes feel intimidated by the number of doctors present [approx. five to six]. They think doctors are busy and they don't like asking them. I'm there to advocate for the patient or just to jog [the patient's] memory if they have questions they want to ask about their progress which we've discussed". (Observation 7)

This section has illustrated the components of patient advocacy required of nurses and how this NTS was used by the nurses to support and promote patients' rights.

4.10. Discussion

Of the seven NTS identified in the coding frame, communication was the most frequently observed NTS and it was found to underpin all the other identified NTS. Exchange of information occurred consistently throughout the nurses' shifts and involved health professionals and non-health professionals using both verbal and non-verbal communication.

A large part of the nurses' communication involved the planned activity of a verbal handover at various points of patients' perioperative experience. This interaction provided a report of the patients' care and an outline of the treatments the patients had received and the future treatments the patients would require. The handover ensured that staff taking over care of the patients, received accurate information which was critical for maintaining patient safety.

The nurses' interactions, however, were not always planned. As opportunities arose, the nurses often supported and educated patients and their families/*whānau* about the patients' condition and management of care. There were other instances in which unplanned interactions frequently caused distractions and significant interruptions to the efficiency of nursing work which in turn had implications for patient safety. This included responding to general enquiries from the public and other health professionals, both face-to-face, when the nurses were stopped in the corridor by someone seeking information or assistance; and by telephone.

In healthcare, inefficiency in communication amongst health professionals has been identified as a major contributor of adverse events in patients (Arora, Johnson, Lovinger, Humphrey, & Meltzer, 2005; Awad et al., 2005; Leonard et al., 2004). Similarly problems with communication in other high risk industries have resulted in adverse events. For example, inadequate communication and sharing of knowledge in the space shuttle programme, was highlighted amongst other teamwork failures as a contributing factor in the Challenger and Columbia disasters (Farjoun, 2005).

The complexity of patient care in the general surgical ward makes it critically important for nurses to communicate effectively with all team members, not only during routine handovers but also when communicating their concerns about patients to other health professionals. According to Murray and Foster (2001) good communication is what unites a team. They described communication as "the web that binds a group" (p. 636) and identified it is an essential component of effective patient care for surgical teams. Likewise, Driskell and Salas (1992) maintained that effectiveness of communication is the distinguishing feature of good and poor functioning teams. For example, improved communication amongst METs has demonstrated a 65% reduction of cardiac arrests in hospitals (Bellomo et al., 2003). Furthermore, the embedding of effective communication

strategies, to overcome the differences in health professionals' approach to communication, was found to greatly enhance patient safety.

Other safety critical industries such as nuclear power plants have demonstrated that efficient exchange of information between team members is an essential skill to improve the safety and performance of personnel (O'Connor, O'Dea, Flin, & Belton, 2008). It is also an effective strategy for reducing risk in civil aviation (Campbell & Bagshaw, 2002). In the general surgical ward where patient safety is paramount, it was evident that nurses' communication skills within that environment impacted on the care the patients received and that proficient performance of this skill, was a requirement for safe nursing practice.

Leadership and management was also an important skill for the nurses to provide safe and effective care and necessitated the nurses using their professional authority and being proactive. However leadership and management is not a skill area where nurses have traditionally received training (Grindel, 2006). Even so, in this study during instances when there was a risk to safety standards, the nurses took the lead and reinforced compliance or role-modelled best practice for the safety of the patients. The nurses also provided leadership to junior doctors by working collaboratively with them and acting as a resource while they gained experience on the wards. Similarly, experienced nurses shared their knowledge with less experienced nurses and guided and directed them in managing patient care.

Other important elements of leadership and management involved orientating new team members and taking responsibility for teaching student nurses. A less formal role included teaching junior doctors the general flow of ward work and guiding them with policies, procedures and documentation they were unfamiliar with. The nurses also provided direction to junior doctors when prescribing errors were noted such as incorrect dosage of medications and route of administration.

To be effective leaders, it is claimed that nurses should be confronting the major issues that impact on patient safety such as inefficient work processes and staffing shortages (Grindel, 2006). However nurses' preparation for clinical leadership has received little attention (Royal College of Nursing, 2009). While there are many studies exploring the leadership and management skills of organisational managers in healthcare (Carr, 2009; Casida & Pinto-Zipp, 2008; Ten Haaf, 2008), in contrast there is an absence of literature

investigating leadership and management skills of nurses at the 'sharp end' in healthcare and particularly relating to patient safety.

On the ward, nursing leadership influences the quality of patient care (Casey, McNamara, Fealy, & Geraghty, 2011). Traditionally, the leadership role was facilitated by the charge nurse, and was predominantly a clinically focussed senior nursing role of vital importance to the safe care of patients. The charge nurse role, however has evolved into an administrative position cutting the ties to clinical practice. Consequently ward level leadership has weakened and clinical support is lacking even though the demands associated with increasing workloads and patient complexity are constantly mounting (Castledine, 2005; Giles, 2008). More recently there has been a growing recognition of the benefits of leadership and management training at staff nurse level for safeguarding high quality healthcare and increasing nurses' political and organisational ability in addition to increasing the strength and retention of the nursing workforce. In one National Health Services Trust in England, evaluation of an interactive leadership programme for nurses wanting to advance their careers to a more senior role, found that participants had increased collegiality, and had more positive career aspirations and a greater understanding of the NHS structure. All of these features were perceived to be desirable attributes for the charge nurse role (Enterkin, Robb, & McLaren, 2013). The nurses in the current study demonstrated that strong and effective clinical leadership and management is a critical skill nurses require to maintain the smooth running of the surgical ward, to provide quality patient care, and to sustain a safe clinical environment.

Planning care of patients was a fundamental skill the nurses used to manage their workloads. In complex and dynamic environments planning is often difficult and plans may need to be adjusted according to a patient's condition or as situations develop (St. Pierre, Hofinger, Beurschaper, & Simon, 2011). Competing pressures on the nurses' time required that they planned and prioritised the patients' care. The nurses set priorities based on known events such as the physiological status of patients, the care they required and the resources needed to implement the plan. The nurses recognised that effective time management was a critical factor that underpinned the plan. To guide their own time management, the nurses developed a shift planner or time management plan following handover from the previous shift. The shift planner was used as a checklist to ensure that everything was done on time throughout the shift and that nothing was overlooked. To

save time the nurses grouped patient cares whenever they were able to do so. The nurses were aware that patients were at risk of developing complications that could arise at any time and increase a patient's acuity. However this issue was not factored into the plan and the nurses prepared for unforeseen situations by being organised and on schedule with patient care. Being adaptable was a critical strategy for effective planning especially when resources were not immediately available. When situations developed that were not planned for, such as delays in the delivery of needed supplies, the nurses revised their plans and implemented alternative options to accommodate the shortfall and continue the flow of care.

Planning, a key step in the nursing process[8], is a method for problem solving and decision-making in nursing practice (Hood & Leddy, 2006). However, the nurses in this study did not only follow the five steps of the nursing process when making decisions about the patient's plan of care, as they also considered contextual factors that impacted on the patient's situation when devising their plans. Previous research has found that in some situations experienced nurses tend to side-step the nursing process and instead use intuition to make clinical judgements (Benner, Tanner, & Chesla, 2009). Unlike the nurses in Benner et al.'s study there were no expert nurses in the current observation study and these findings are a reflection of the level of skill and knowledge of the nurses who participated in this study.

Situation awareness was a skill the nurses used to monitor the clinical environment and the people within it, and this awareness formed the basis of the nurses' decision-making and subsequent actions. The nurses constantly gathered visible and audible information and responded to the cues they interpreted as being significant. As well as responding to actual events, situation awareness enabled the nurses to anticipate potential problems and to think about what might happen and then prepare for any future events that might eventuate.

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[8] The nursing process is a systematic approach to decision-making and consists of five steps. It focuses on identifying and managing the actual or potential health problems of individuals or groups. The five steps are assessment, nursing diagnosis, planning, implementation and evaluation. Assessment involves the collection of objective and subjective data from which the nursing diagnosis is formulated. The planning stage establishes long term and short term goals for the plan of care. The implementation stage establishes the interventions that will be provided to the patient to achieve the goals. The final stage is evaluation of the patient's progress towards meeting the goals and may require a revision of the plan of care if the goals have not been met.

Studies in aviation have found that human errors have been a consequence of poor situational awareness (Jones & Endsley, 1996; M.Thomson, Onkal, Avcioglu, & Goodwin, 2004). The nursing literature, however, is lacking exploration of this key component of nursing practice.

Decision-making was an integral part of the nurses' practice and a skill that the nurses engaged in continuously throughout the shift. This finding is consistent with research conducted in a critical care setting which revealed that nurses made patient care decisions approximately every 30 seconds (Bucknall, 2000). The situations in which the nurses in the current study were required to make decisions varied as did their approaches to resolving problems. Most of the nurses' decision-making related to clinical situations or problems such as actual and potential risk of physiological deterioration, medication administration, fluid and electrolyte management and evaluating patient care. Flin et al. (2008, p.44) termed this process "dynamic decision-making". Underpinned by the naturalistic decision-making approach, dynamic decision-making suggests that the decision-making method selected will be determined by the demands of the situation.

The ways in which problems were addressed in the current study were greatly influenced by the level of experience of the nurses. For example the more experienced nurses were more analytical in their approaches and had broad overviews of the situations. They recognised the significance of visible and invisible and/or ambiguous cues and were more prompt in their responses than the less experienced nurses. The latter had a narrow focus on clinical problems and only concentrated on what they could see. They tended not to think critically about situations or use clinical judgement. Instead when clinical problems arose less experienced nurses strictly followed protocols or routine to guide their decision-making. In contrast the more experienced nurses' knowledge enabled them to expedite resolution of patient problems. These findings are consistent with Benner, Tanner and Chesla (1992) who found that clinical experience shapes decision-making. In their study of critical care nurses they identified that less experienced nurses were task-focussed while experienced nurses had a more holistic view of the patient. According to O'Neill, Dluhy and Chin (2005) competent decision-making requires the input of a knowledgeable nurse, however the literature provides very little, or no understanding of beginner nurses' decision-making and therefore this is an area of nursing practice that is less understood and requires further exploration. Given the prevalence of decision-making in the practice of the

nurses in the current study, it is surprising to find there is a dearth of literature exploring this NTS for this population of nurses.

The observations revealed that teamwork provided the foundation of patient care delivered to surgical patients and that nurses were part of two teams: the MDT and the nursing team. The nurses' role in both teams was inextricably linked. As part of the MDT nurses provided nursing care to patients 24 hours a day seven days a week. Periodically, when time allowed or the patients' condition necessitated it, the nurses attended doctors' rounds and provided input about their patients' progress and the plan of care. They also worked collaboratively with other health professionals as a patient advocate for the safety of the patients.

Within the nursing team, the nurses provided nursing care to the patients they had been allocated. As well, the nurses were responsible for managing a ward full of patients 24 hours of the day. The nurses' joint roles were physically and cognitively demanding as nurses were the only health professional group on the ward and in contact with the patients 24 hours a day. It was clear from the observations that the nurses' responsibilities were contingent on the teams they were connected to.

The importance of nursing teamwork was evident when patient care demands on an individual nurse were high and the nurses relied on and trusted each other to provide the necessary support to ease any of their workloads. For example the nurses worked together and shared the volume of work and took it upon themselves to back up and assist each other by taking on extra responsibility. This necessitated that they understood each other's responsibilities and could anticipate one another's needs in order to adapt their workloads according to changing situations, such as the physiological deterioration of a patient who required one-on-one nursing care.

As well as organising their own activities the nurses coordinated care in collaboration with an array of other health professionals in the MDT, such as dieticians and social workers. The health professionals the nurses collaborated with most frequently were physiotherapists and doctors.

Although teamwork and problem solving with other health professionals is an aspect of practice that the nurses engaged in, it was not a skill they had been formally taught. Instead, the nurses had been socialised into their teamwork role with other health

professionals on the wards. Kalisch et al. (2009) contended that for effective team performance an expected professional relationship within and across healthcare teams needs to be established. Using Salas ' model of teamwork (Salas et al., 2005) to explore team processes amongst nurses, they also concluded that nursing teamwork skills in acute care inpatient settings are vital for patient safety and need to be developed and learned through team training.

Patient advocacy was a non-technical skill the nurses exercised to support the patients in their own decisions about their healthcare or to intervene in the best interests of the patients when patients were unable to speak up for themselves. Nurses provided a voice for the patients regarding their progress during doctors' rounds and provided support when patients were being seen by a number of doctors. The nurses championed patients when they asked questions about their choices, their treatments, and their rights. There is an absence of literature exploring this role for nurses who provide care to patients in general surgical wards.

4.11. Conclusion

A key finding in this observation was that nurses managing the care of general surgical patients require the NTS discussed above. They included communication, leadership and management, planning, situation awareness, decision-making, teamwork, and patient advocacy. It is clear these particular NTS are an important component of the provision of safe nursing care for general surgical patients.

 Other safety-critical industries, such as aviation have long recognised the importance of these skills for maximising safety and minimising the impact of hidden failures in their systems, such as faulty decision-making, inadequate problem solving or substandard teamwork and communication. In contrast, there has only been a growing interest in human factors over the last decade as healthcare organisations start to appreciate that technical proficiency of health professionals is not enough to prevent poor patient outcomes and adverse events (St. Pierre et al., 2011).

The exploratory nature of the observations revealed that much of the patient care provided by nurses involved NTS, both social and cognitive skills, that complement the technical aspects of nurses' practice. Social skills such as communicating with others were easy to determine through observation alone, however the cognitive skills underpinning a

cognitive task, such as the decisions made regarding patients' care-needs remained hidden. An effective means of identifying unobservable cognitive processes is to ask individuals to talk about events where cognitive skills were used. As the overall aim of the study was to identify the NTS required of general surgical nurses, the ACTA method was selected to identify the cognitive skills nurses use in their everyday practice. The following four chapters present the process of data collection, analysis and results of the ACTA.

Part B

Chapter 5. Task Diagram Interview

The following four chapters present the findings from the ACTA in which three different interview techniques were utilised to explore the cognitive skills required of general surgical nurses in the context of a challenging or non-routine clinical situation. The findings from the three interviews were combined into a cognitive demands table (Table 17).

The purpose of the next four chapters is to illustrate the cognitive processes that influence nurses' practice and to depict what the nurses were thinking about and paying attention to during their involvement in a challenging situation. The strategies the nurses used to make decisions about the events as they occurred and the sense they made of what transpired are discussed.

This chapter presents the findings from the data generated from the first interview, the task diagram interview, conducted individually with six nurses: two expert nurses, one proficient nurse and three competent nurses. It maps the tasks nurses undertake when delivering quality patient care in challenging situations and identifies the steps that require cognitive skills. The task diagrams will provide insights into the cognitive demands for nurses when faced with challenging situations and provides the foundation for the more in-depth knowledge audit interview, simulation interview and cognitive demands table (Militello et al., 1997) to be presented in the following chapters.

First the demographic information of the participants is presented and this is followed by the six individual task diagrams developed from the interviews. The purpose of the individual task diagrams is to give a broad overview of the major steps, and the sequence in which they were carried out by each participant when dealing with a challenging clinical situation. The key steps in the sequence which require the most cognitive skill are then identified for further scrutiny in the subsequent knowledge audit and simulation interviews. Finally in this chapter a summary of the essential steps for delivering quality patient care in challenging situations is presented in a master task diagram (Figure 7).

5.1. Participants

The Part B study participants included three highly experienced and three less experienced nurses. Two of the three less experienced nurses had been participants in the earlier observational study.

Table 8 presents the demographic characteristics of the participants. It includes: their stage of professional development according to the hospital's PDRP, their total years of general surgical nursing experience, and their nursing qualifications.

5.1.1. Stage of PDRP

Two participants were at the expert level and one participant was at the proficient level but in the process of transitioning to the expert level. Three participants were at the competent level.

5.1.2. Years of general surgical nursing experience

The number of years of total general surgical nursing experience varied widely from three to 50 years. The highly experienced nurses included two expert level nurses: one with eight years' experience and the other with 22 years, plus a proficient level nurse with 50 years' experience. The proficient level participant had recently submitted an application for advancement to expert level. The three less experienced nurses were all at competent level. One had five years' experience and two had three years.

5.1.3. Nursing qualifications

Two of the three less experienced nurses had a Bachelor of Nursing degree and relevant Post Graduate certificate; and one had a Bachelor of Science in Nursing. Two of the highly experienced nurses, one expert and one proficient, had hospital-based qualifications - Registered General and Obstetric Nurse. The third highly experienced nurse and expert had a Bachelor of Health Science degree in Nursing.

Table 8: Demographic Characteristics of Participants

Participants	Stage of PDRP	Years of general surgical nursing experience	Nursing qualifications
A	Competent	3	BN, PG cert
B	Competent	5	BSN
C	Expert	8	BHSC (Nursing)
D	Expert	22	RGON
E	Proficient	50	RGON
F	Competent	3	BN, PG cert

It is noted that years of experience in a position does not necessarily equate with expertise. According to McHugh and Lake (2010) experience is a contextual variable in terms of expertise. Benner (2001) noted that experience is not the same as longevity as it is an active process that requires access to actual situations which promote clinical knowledge development. The table suggests that a tertiary qualification may have accelerated professional development of expert practice.

5.2. Task Diagram Interviews

The participants were asked to recall a time they recognised a patient was experiencing a serious postoperative complication or a challenging situation following surgery. The information recalled was summarised in a task diagram. The individual task diagrams produced different accounts of challenging situations which occurred during the postoperative period. Each task diagram provided a simplified mental model of how the participant viewed the situation in addition to the cognitive demands within the task that could be probed in subsequent interviews.

The challenging postoperative situations called to mind were: ineffective patient controlled epidural analgesia (PCEA) [9] , a respiratory complication following laparoscopic cholecystectomy in a patient with chronic obstructive pulmonary disease (COPD), a bleed

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[9] PCEA is a programmable patient controlled drug delivery system for administering analgesic medication into the epidural space by way of an infusion pump

following tonsillectomy, an adverse drug reaction to stemetil, an anastomosis leak following a laparoscopic gastric bypass and hypotension in a patient with heavy drainage from a wound fistula. Each task diagram produced cognitive demands specific to the context and the nature of the task or challenging situation represented. In each of the six task diagrams there were similarities and differences between the cognitive demands. In four situations the participants identified that the initial cue in recognising there was a problem, was the appearance of the patient. The initial cue in another situation was a low blood pressure recording. One participant recalled the initial cue had come from the patient requesting analgesia for excessive pain. In all task diagrams the participants did not identify recognition of the initial cue as a cognitive demand. Each of the task diagrams will now be discussed in turn.

5.3. Task Diagram: Participant A

5.3.1. Response to ineffective postoperative PCEA

This task diagram (Figure 1) focuses on PCEA for postoperative pain management. The challenging situation recalled by the participant occurred when the participant was a new graduate. The participant recalled a situation where a patient receiving epidural analgesia was experiencing "unbearable pain unrelieved by the prescribed medication". The task diagram illustrates that resolving the problem involved six steps: Awareness of ineffective analgesia, assessment of the patient's level of pain and the dose of analgesia administered, reference to pain management protocols, consulting with and seeking advice from a senior nurse, requesting assistance from the acute pain team, and monitoring and evaluating efficacy of analgesia. The three cognitive demands underpinning this process are considered in turn.
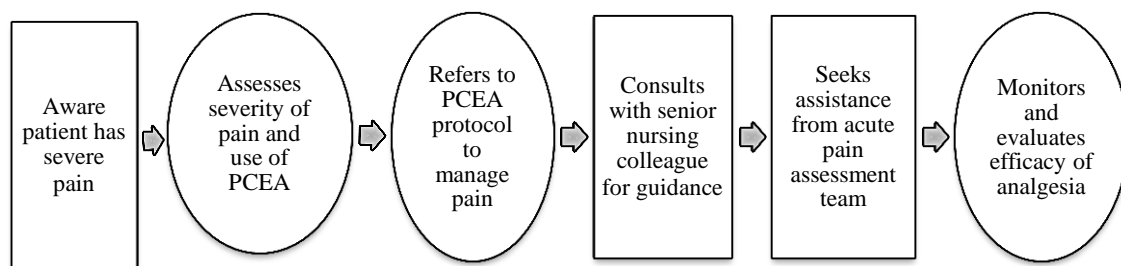
Figure 1: Task diagram of a nurse's response to an ineffective PCEA for a patient with postoperative pain
The circled steps indicate where cognitive skills were required.

The first cognitive demand involved establishing the patient's level of pain and determining the amount of medication that had been delivered to the patient by epidural infusion. This decision was informed by the nurse's assessment of the patient's level of pain using a pain scale from zero to ten. Dermatomes[10] were also assessed to determine the block level of the epidural analgesia. When a 'patient controlled' device is in operation, observations of the patient's attempts for controlling their pain are recorded. Once these facts were established, the second cognitive demand of the task was initiated and the pain management protocols were referred to. If the patient's pain score is greater than 5/10 the nurse can either reinforce the patient's use of the pump, or adjust the dose of the infusion according to prescribed standing orders and confirmation from the acute pain team. These actions require the nurse to know the administration protocols of the medication as well as its desired actions and side effects. Prior to initiating any of these actions the participant asked a more experienced colleague for guidance. The problem was identified and appropriate actions were taken to manage it. Once new orders from the pain team had been implemented, a third cognitive demand was elicited: monitoring and evaluating the effectiveness of the newly prescribed analgesia.

5.3.1.1. *Complex cognitive element*

Because of the intensity of the pain, pain assessment and pain management were identified as the most cognitively complex elements within the steps of the task diagram and were the focus of the knowledge audit interview.

5.4. Task Diagram: Participant B

5.4.1. Early recognition and response to a respiratory complication

This task diagram (Figure 2) focuses on a patient with a history of COPD who developed a respiratory complication three days after a laparoscopic cholecystectomy. The participant recalled the situation in which a patient looked distressed, sweaty and was holding his chest. The nurse asked how he was feeling and the patient responded that he "felt different from other days." The nurse asked if he had chest pain and the patient responded "no" but

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[10] Dermatomes: A dermatome is a specific area of skin supplied by a single spinal nerve. The level of epidural block is determined by the area of sensitivity along sensory dermatomes when ice is applied to the skin.

that he was short of breath. The nurse assessed the patient and confirmed significant oxygen de-saturation by pulse oximetry. Prescribed oxygen was given and the patient's oxygen saturation levels "stabilised". However the patient wanted the oxygen removed as it was making him feel worse. The nurse immediately recognised a serious respiratory problem had developed and called for an urgent medical review of the patient.
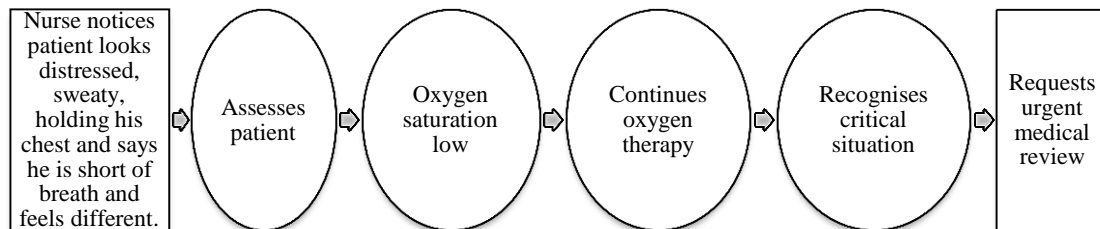
Figure 2: Task diagram of a nurse's early recognition and response to a respiratory complication in a postoperative patient with COPD
The circled steps indicate where cognitive skills were required.

The task diagram illustrates that this situation involved six steps. The first being the nurse alerted to the problem by the patient's body language. Subsequent steps show the actions taken which led to early recognition of a critical situation and the request for an urgent medical review.

5.4.1.1. *Complex cognitive element*

The fifth step, recognising a critical situation, was identified as the cognitively complex element within Participant B's task diagram. This element was explored in more depth during the knowledge audit interview.

5.5. Task Diagram: Participant C

5.5.1. Early recognition and response to a post-tonsillectomy bleed

This task diagram (Figure 3) focuses on a patient who had a postoperative bleed following a tonsillectomy. The steps underpinning the management of this postoperative complication are discussed in the sequence of events. The first element involved knowing "something's not quite right" with the patient. This step was informed by the visual cue of "restlessness within an hour or two following surgery". The time factor was an important cue. From previous experience the nurse knew that the manner and appearance of the

patient "is not anaesthetic-related or a respiratory problem as these events usually occur earlier as the patient is coming around out of anaesthetic". When changes in the manner and appearance of the patient occurred an hour or two after surgery, attention was rapidly directed towards looking for a cause other than an anaesthetic-related problem.
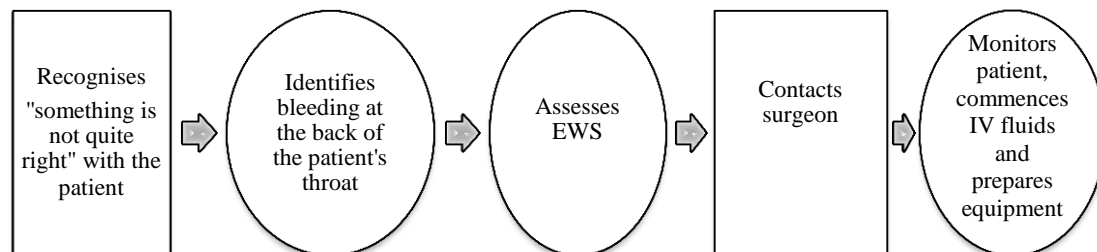
Figure 3: Task diagram of a nurse's early recognition and response to a postoperative bleed in a patient following tonsillectomy
The circled steps indicate where cognitive skills were required.

The second step in the task diagram involved decisions relating to identifying the problem. This step occurred after it had been established that the patient's airway and breathing were not the source of the problem. When blood was seen in the mouth and at the back of the patient's throat, the problem was evident. The focus was then turned to the patient's circulation and assessment of the EWS, as an increasing score was a concern.

The last two steps of the task diagram involved the participant's actions in response to observation and assessment of the patient. The participant's decision- making centred on preventing further physiological deterioration. In this situation the participant notified the surgeon of the problem and initiated administration of intravenous fluids according to prescribed standing orders.

5.5.1.1. *Complex cognitive element*

The second step which involved identifying the problem was seen as the most cognitively complex element within Participant C's task diagram and was the focus of the knowledge audit interview.

5.6. Task diagram: Participant D

5.6.1. Early recognition and response to an adverse drug reaction to Stemetil

This task diagram (Figure 4) focuses on a patient who had previously been discharged home following surgery and was re-admitted to the ward with nausea and generally feeling unwell. The cognitive elements underpinning the management of this postoperative complication are now considered in the sequence of events.
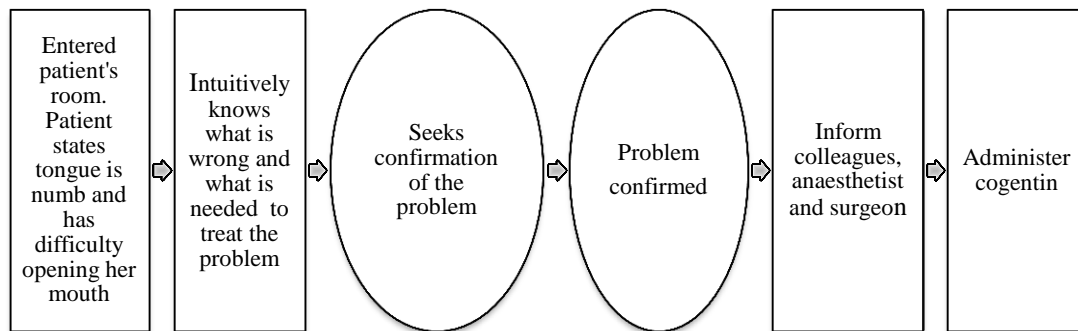
Figure 4: Task diagram of a nurse's early recognition and response to an adverse drug reaction to Stemetil
The circled steps indicate where cognitive skills were required.

The first step of the task diagram is informed by attention to visual cues and verbal cues. Recognition of the potential impact of these cues enabled rapid decision-making by the participant.

The second step is informed by intuitive knowledge and immediate recognition of an adverse reaction to the drug Prochloperazine (Stemetil). Even though the participant had not seen this problem before she immediately identified what she was seeing and what the solution was. "The patient said her mouth was numb and she was feeling symptoms of a lock-jaw situation … her tongue was basically uncontrollable. My immediate thought was she must have been given Stemetil, and she needs Cogentin".

The third step in the task diagram involved decisions related to confirming the problem. The participant initially sought confirmation from the patient who indicated a lack of recall regarding medications she had taken prior to re-admission to hospital. Several other sources were checked to assist with confirmation of the cause of the problem. It was

revealed that neither the patient's mother, the patient's medication record, nursing colleagues, nor the surgeon could confirm that stemetil had been administered.

The fourth step of the task diagram involved decisions related to confirming the problem and involved relying on intuitive knowledge to support this. Because the nurse "just knew that medication had caused this problem" and "sometimes people forget" she was confident asking the patient's mother again if her daughter had taken anything for nausea. This second line of questioning confirmed the problem. It prompted the patient's mother to recall that the patient's general practitioner had prescribed Stemetil suppositories which she had used prior to coming into hospital.

The fifth step involved alerting the surgeon and anaesthetist of this finding and confirming with colleagues the seriousness of the situation. The participant informed nursing colleagues so they were prepared to assist where needed as there was potential for compromise of the patient's airway. Observation of the patient was increased and vigilance maintained with "strict monitoring".

In the final step of the task diagram the anaesthetist assessed the patient and prescribed Cogentin which was administered by the nurse and the problem was resolved.

5.6.1.1. *Complex cognitive element*

The third step which involved seeking the cause of the problem and the fourth step in which the problem was confirmed became the focus of the knowledge audit interview.

5.7. Task Diagram: Participant E

5.7.1. Early recognition and response to a post-bariatric anastomotic leak

This task diagram (Figure 5) focuses on a patient who had a leaking anastomosis following laparoscopic bariatric surgery. The cognitive elements underpinning the management of this postoperative complication are now considered in the sequence of events. The first step in which the participant identified there was a problem is informed by visual cues. The participant could tell by "the patient's body language, furrowed brow, and terrible pain" that "something is not quite right".
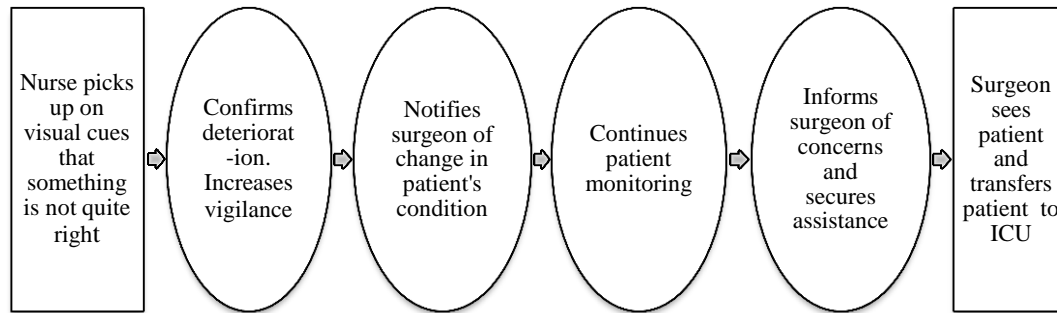
Figure 5: Task diagram of a nurse's early recognition and response to an anastomotic leak following laparoscopic bariatric surgery.
The circled steps indicate where cognitive skills were required.

In the second step the participant's decision-making is centred on confirming the problem. The participant recorded the patient's vital signs and noted the patient was "a bit tachycardic" and "her temperature was up a bit". She was "shallow breathing a bit" and oxygen saturations were "a bit less than expected so that immediately makes you think". The patient's "abdomen was a little bit tighter than you would normally expect, but not badly so". Combined with the patient's inability to tolerate sips of water and excessive pain, these findings indicated to the participant that a serious problem was developing. The participant recalled immediately increasing the frequency of the patient's vital signs recordings.

The third step shows the surgeon was notified of the change in the patient's condition, however the participant recalled that "he was very reluctant to do anything" at that point, and recollected she monitored and observed the patient for another hour. "You just know that it's not right ... she was deviating from the norm … and that warrants doing something about it fairly quickly".

The fourth step showed the participant contacted the surgeon a second time and requested him to come in and see the patient. The surgeon reviewed the patient and transferred her to ICU. A leak in the anastomosis was subsequently confirmed.

5.7.1.1. *Complex cognitive element*

Determining the possible cause for the patient's deviation from the expected postoperative recovery and securing the surgeon's assistance were identified as the most cognitively challenging elements of this situation and were the focus of the knowledge audit interview. Even though the experienced nurse had not dealt with this specific complication before,

her experiential knowledge enabled her to "see" the problem in its early stages. Gaining the surgeon's awareness of the serious nature of the problem and subsequent intervention occurred at a later stage. The nurse had gained awareness of the problem from the patient's body language, severity of pain, intolerance to sips of water, excessive reflux and vomiting bile. Similarly, securing medical assistance was cognitively challenging as the nurse was aware that the surgeon was initially 'seeing' the problem differently to her as the patient's vital signs were not showing significant physiological changes.

5.8. Task Diagram: Participant F

5.8.1. Response to hypotension meeting 'EWS 5' criteria

The Participant had one year's general surgical nursing experience when this challenging situation occurred. The task diagram focuses on a low blood pressure recorded during standard four-hourly vital signs observation of a patient who had developed an abdominal fistula following a right hemi-colectomy and formation of a stoma nine months previously. The cognitive elements underpinning the management of this challenging situation are now considered in the sequence of events.

The first step in the task diagram (Figure 6) was informed by the patient's systolic blood pressure recording of 68mmhg. According to the EWS guidelines a systolic blood pressure less than 80mmhg meets the criteria for 'EWS 5' and therefore a call to the MET is required.

In the second step the participant is faced with uncertainty about calling a code. Undecided, the participant asked a more senior nurse to check the patient's blood pressure. In the third step the participant consulted with the clinical nurse specialist in the MET to seek advice about the problem and how it should be managed.
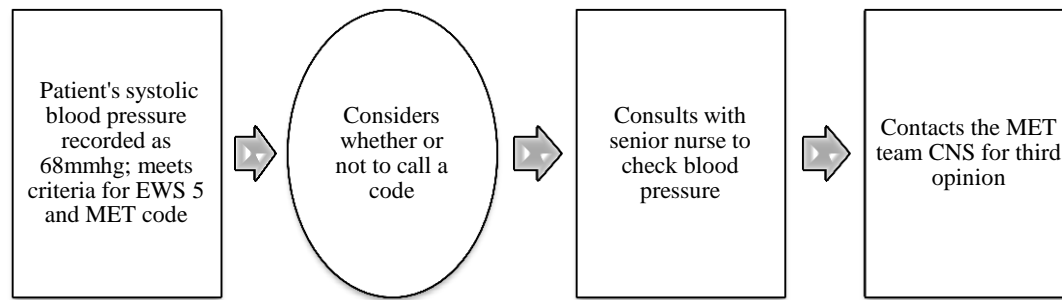
Figure 6: Task diagram of a nurse's response to hypotension meeting 'EWS 5' criteria
The circled step indicates where cognitive skills were required.

5.8.1.1. *Complex cognitive element*

Making the decision not to call a code immediately was identified by the participant as the most cognitively challenging element of this situation. This step in the task diagram was selected as the focus for the subsequent knowledge audit interview.

5.9. Master Task Diagram

The master task diagram (Figure 7) summarises the cognitive demands from the individual task diagrams discussed above. It provides a conceptual structure of the nursing management of a challenging postoperative complication. Once all the task diagram interviews were completed, the task steps in each task diagram were analysed for common elements which were then synthesised and compiled in the master task diagram.
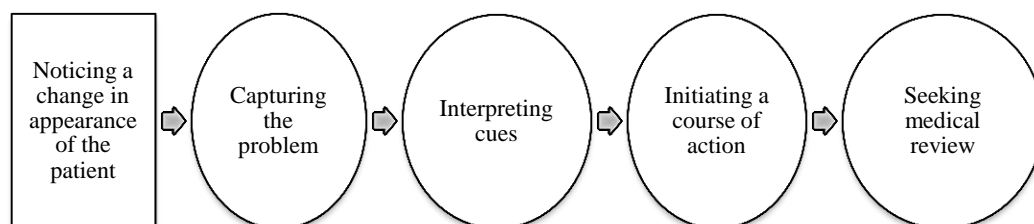
Figure 7: Master task diagram of nurses' early recognition and response to challenging situations concerning postoperative patients.
The circled steps indicate where cognitive skills were required.

5.9.1. The elements of each step

Five task steps were identified as critical elements for skilled performance in challenging situations involving postoperative patients. The first step in the master task diagram was not identified by the participants as cognitively demanding. The elements identified as

cognitively demanding and requiring the use of cognitive skills were categorised as: capturing the problem, interpreting cues, initiating a course of action, and seeking medical review.

The task diagrams revealed that management of the situation was the responsibility of the nurse until the nurse handed over responsibility to medical team members following medical review. Initially it was the appearance of the patient that nurses recognised as a critical cue for the physiological status of the patient. Recognising its significance was a skill that developed with experience. Some participants identified that they relied on intuition and therefore did not go through an analytical reasoning process to make decisions. Benner and Tanner (1987) in their classic study and Rew (1990) previously identified the important role that intuition plays in nurses' decision-making. Furthermore Klein (2008) explained when a situation is perceived as familiar or typical, experts draw on patterns of information stored in their long term memory and this enables a fast and automatic response. Klein termed this approach 'recognition-primed decision-making' (RPD). In contrast, when situations were not familiar the task diagrams revealed that the participants analysed those situations further or gained assistance from more experienced colleagues to initiate a course of action to resolve the problem.

The task diagrams also revealed that the initial detection of a problem and determining subsequent nursing actions were more challenging for less experienced nurses. They had difficulty discerning the significance of a patient's appearance when confronted with new and challenging situations. They delayed making decisions as they were uncertain of what to do. Lipshitz and Strauss (1997) explained that a delay in actions in such situations results from being 'overwhelmed' by a wealth of conflicting information rather than a lack of knowledge.

The task diagrams have provided representations of the specific activities undertaken by nurses in challenging situations, and revealed the cognitively challenging aspects. These cognitively challenging aspects are related to the NTS identified in Chapter Four: situation awareness, decision-making, planning, teamwork, leadership and management, communication, and patient advocacy. For example to notice a change in the condition of patients requires nurses to have situation awareness skills; capturing the problem and interpreting cues requires decision-making skills; initiating a course of action requires

planning, teamwork, and leadership and management skills; and seeking medical review requires communication skills and patient advocacy.

5.10. Conclusion

This chapter has highlighted the cognitively challenging elements for nurses, of situations concerning changes to the physiological status of postoperative patients. The task diagrams provided direction for the subsequent knowledge audit and simulation interviews. The master task diagram has provided a summary of the individual task diagrams.

The following chapter presents the findings from an analysis of the more detailed knowledge audit interviews which explored the cues and strategies nurses use in challenging situations and why such situations present challenges for less experienced nurses.

Chapter 6. Knowledge Audit Interview

This chapter presents the findings from the knowledge audit interviews which are the second phase of ACTA. The purpose of the knowledge audit was to identify cognitive skills and domain knowledge in the context of the situation in which they occurred. The interviews yielded six knowledge audits of the challenging situations previously identified in the task diagram: ineffective PCEA, respiratory complication, post-tonsillectomy bleed, adverse drug reaction, anastomosis leak and hypotension. Each knowledge audit is summarised in a table. The knowledge audit identified the aspects of expertise the participants used when dealing with the cognitive demands of the situation they recalled. It also includes the cues and strategies they used and an explanation of why each situation presents difficulties for less experienced nurses.

Once identification of the cognitive demands from each interview had been exhausted the individual knowledge audit tables were examined further to identify common threads and meaning for each aspect of expertise. The six interviews were then amalgamated into one master knowledge audit table (Table 15).

The knowledge audits revealed that in all the challenging situations, the participants recalled they were the first person to recognise there was a problem. In two incidents: the anastomosis leak and adverse drug reaction; the participants had not had previous experience in dealing with the specific situations. They had, however, had experience in managing other similar complex situations. The participant who recalled the respiratory complication had previous experience of patients with COPD but not in a surgical context. In the cases of hypotension and ineffective PCEA, the participants had no prior experience in handling complex situations and needed further guidance from more experienced colleagues. The participant who described a post-tonsillectomy bleed was the only participant who had previously experienced dealing with the complication they recalled.

The findings from each knowledge audit will now be presented and discussed in detail. While all probes (Appendix I) were administered with each interview, there were some instances where data were not generated for a specific probe during the recall of events.

6.1. Knowledge Audit: Participant A

6.1.1. The cognitive demands of ineffective postoperative PCEA

6.1.1.1. *Past and future*

The knowledge audit for participant A (Table 9) shows the challenges that can occur with managing PCEA. In response to the past and future probe the participant revealed they had not previously encountered the challenging situation recalled. Although the participant had previous experience with managing epidural infusions, this was the first time a patient had presented with a problem: "the patchy blocks" accompanied by pain, so unbearable the patient was unable to focus on anything else. In order to resolve the problem, the participant called upon a more experienced colleague for advice and guidance. The difficulty for the less experienced nurse in this situation was that even though they could see there was a problem they did not have enough experiential knowledge to know what needed to be done to find a solution or how to do it independently.

> She had an epidural and unfortunately it wasn't working well. She was getting sort of patchy blocks and for some reason she wasn't coping despite oral pain relief as a top-up. I guess I can't do it on my own to decide what's best for her. You could actually see the patient was in so much pain. And because she was in so much agony she couldn't focus. I usually ask my senior colleagues or coordinator…and that's when I go ahead and do it.

6.1.1.2. *Big picture*

With regard to understanding the big picture, the overall comfort of the patient in relation to their surgical procedure was the critical factor to be aware of. In terms of comfort, the patient's body position and their reluctance to move were significant cues the participant took notice of.

> When she's had that surgery…you know straight away where that pain would be…I think it was just her position I think, it was the way she was sort of lying…. And she said "no stop that's enough it hurts".

The findings revealed that when dealing with patients' discomfort, less experienced nurses do not look at the whole situation or consider factors other than the severity of the patient's pain. They focus their attention on medication and hope.

> She's telling me "give me something else, it's not working". And you're looking through the chart hoping there is something gonna pop out in front of you that's going to say choose me I'll be able to help her. But yeah it just doesn't seem to work.

6.1.1.3. *Noticing*

'Patchy blocks' are a significant cue when a patient has epidural analgesia. Proficiency with pain assessment is critical for determining what action to take in this situation.

> Well first they [senior colleagues] want to know what's wrong, how bad is the pain. They come in and see the patient and assess the patient and that's when we do contact the acute pain team to come and see the patient ASAP [as soon as possible].

The difficulty for less experienced nurses when they identify 'patchy blocks' is they do not appreciate the implication of this cue as they are still learning about pain management and developing their pain assessment skills. Consequently they cannot make autonomous decisions regarding pain management in non-routine situations.

6.1.1.4. *Job smarts*

Regular pain assessment, being prompt with analgesia and keeping the patient informed about their medication are strategies gained from experience that nurses use to promote effective pain management. Working smart is an important aspect of expertise for maintaining patients' comfort.

> What I've learnt is that you give the pain relief to the patient regularly. Regularly assessing patients and just making sure that it's working. Let the patient know they might need something a little bit stronger.

In challenging situations when analgesia is ineffective less experienced nurses lack efficiency with pain management as they are still learning about the options available to them. They rely on protocols to guide their decision-making as they do not know how to respond to the patient's pain.

6.1.1.5. *Opportunities/improvising*

When analgesia is ineffective experienced nurses are comfortable with offering suggestions to doctors to initiate change with the prescribed pain management regime. They do not hesitate to call upon doctors to improve the outcome for the patient.

> They [senior nurses] figure out a way to manage her pain, then they get the doctors involved. They let them be aware about the patient's situation and to review her.

Less experienced nurses are reluctant to suggest changes to patients' pain management regimes as they are not confident with their decision-making. They fear they will be blamed if they make a wrong decision and the patient suffers.

> You don't want to make an error, and if something happens to the patient you will get into trouble. You just follow the protocol…

6.1.1.6. *Self-monitoring*

The self-monitoring probe revealed that when nurses are fatigued or stressed because of heavy workloads, they are aware this interferes with their performance through impaired clarity of thought and forgetfulness. Their main concern is avoiding making an error.

> And the ward has been so extremely busy. I guess if you're suffering from fatigue….It can interfere with your performance and may not help you sort of think thoroughly on how to manage the patient's care. You tend to sort of forget things, yeah, and, we're human but you don't want to make a big error with a patient.

6.1.1.7. *Anomalies.*

When there is a problem experienced nurses will readily check any misleading information about epidural equipment or any other discrepancies they encounter with pain management. This may be from written or verbal communication or from their observation of the patient or the infusion device. To understand the situation they know that in addition to assessing the patient, they also need to check the functioning and programming of the infusion pump against the charting of the prescription and seek clarification about the information that has been handed over verbally.

> They [experienced nurses] definitely follow up…with the charting, check the machine make sure that it's been entered, the dosage is it correct- ask again, are you sure? They sort of rectify.

Less experienced nurses may lack awareness that a 'patchy block' level is not a normal event and needs exploration to find a cause. They struggle with managing such abnormalities as they lack experience with how pumps work or they may be unfamiliar with the associated charting.

6.1.1.8. *Equipment difficulties*

The findings revealed that experienced nurses can quickly identify problems with epidural infusions. For example when called upon in this situation, the experienced nurse assessed the patient and was prompted to inspect the pump and tubing. It was quickly discovered that a disconnected filter was the cause of the problem.

> They [experienced nurses] tried to find out what's the cause. Checking the epidural site and also the epidural pumps. And just making sure the dosage is correct on the machine. Then looking at the filter …it wasn't actually connected. And because she wasn't getting any blocks that would indicate the reason why…plus how long it's been disconnected.

The difficulty for less experienced nurses is a lack of awareness of the potential for the disconnection of the infusion. Consequently they narrow their focus on the dosage of medication the patient is prescribed and don't look for other causes.

Table 9: Knowledge Audit of the Cognitive Demands of Ineffective Postoperative PCEA

Probe	Aspects of expertise	Cues and strategies	Why difficult? (for novice)
Past and future	Identifying ineffective epidural analgesia and potential for patient harm	Patchy blocks Unbearable pain Patient cannot focus because of level of pain Call senior colleagues for advice/assistance	They have no previous experience and do not realise the importance of cues
Big picture	Determining that the overall comfort of the patient is what is expected for their surgical procedure	Knowledge of surgical procedure Look at body position – lying or sitting Notice refusal/acceptance to change position	They focus on pain and medication They do not understand the association between how the patient is feeling and what is going on physically
Noticing	Detecting the patient has patchy blocks and pain is not being relieved	Conduct pain assessment Inspect appearance if epidural site Look at delivery of analgesia:	They overlook significant cues as they are still developing assessment skills

		continuous or intermittent infusion Call acute pain team	
Job smarts	Being prompt with analgesia	Regular pain assessment Inform patient of pain relief options and timing of analgesia	They cannot make autonomous decisions and rely on pain management protocols for decision-making
Opportunities/ improvising	Initiating change in the pain management regime	Deviating from the protocol with approval from the pain team registrar	They are unable to initiate change due to fear of making a wrong decision
Self-monitoring	Managing fatigue, stress and tiredness to prevent error	Aware of reduced performance, impaired clarity of thought and forgetfulness with heavy workloads Workload Management: Initiates time management plan. Focus is narrowed onto sickest patient	
Anomalies	Exploring ambiguous information	Discrepancies with verbal and written communication Check pump settings Check patient vital signs and block levels	They have limited knowledge of infusion pumps They may not understand charting
Equipment difficulties	Knowing the pump is running at the prescribed rate and the block level is patchy	Inspect the infusion equipment for disconnection	They are not aware of the potential for disconnection

6.2. Knowledge Audit: Participant B:

6.2.1. The cognitive demands of a postoperative respiratory complication

6.2.1.1. *Past and future.*

The knowledge audit for participant B (Table 10) shows the challenges that can occur with a surgical patient who has a chronic respiratory condition. In response to the past and future probe the participant recalled a patient with a history of COPD who three days earlier had undergone a laparoscopic cholecystectomy. On approaching the patient the participant recognised from his appearance that he was presenting with a significant respiratory complication. The participant recalled that the patient had a history of COPD and was concerned he could deteriorate because of this comorbidity.

> He looked different, he was sweating, he looked distressed, his colour was fine. He's not the type of patient who would ring the bell…When he said he had shortness of breath feeling, you know that there's something very wrong. I just went gosh what's this. Initially I am thinking what happened, what's happening, what other factors familiar to this one. I am thinking about the history of the patient… he has just had a lap. chole [cholecystectomy]... he has COPD so there is some respiratory complication. I think if he deteriorates very fast…if he goes into arrest.

Table 10: Knowledge Audit of the Cognitive Demands of a Postoperative Respiratory Complication

Probe	Aspects of expertise	Cues and strategies	Why difficult? (for novice)
Past and future	Knowing the patient has a respiratory problem and anticipates the patient could deteriorate and respiratory arrest	The patient has a history of COPD is sweaty, distressed and short of breath	They lack exposure to complex situations and do not recognise important cues
Big picture	Understanding that it is unusual for a postoperative patient to feel worse when oxygen is administered	Understand the impact of COPD on a surgical patient If patient reports "feeling different" and/or "short of breath" then assess oxygen saturation and assess EWS	They do not appreciate the connection between individual cues They do not understand the significance of what the patient is feeling

Noticing	Recognising that the appearance of the patient and how they are feeling are consistent with a significant respiratory problem	Look for critical cues: patient feels different, has a distressed facial expression, sweating, patient's normal skin colour, short of breath and holding chest	They miss seeing cues as they do not recognise the significance behind them
Job smarts	Knowing the capability of team members	Know who to contact. Be familiar with the available resources. Be prepared to take the lead and support junior medical staff	They have a superficial knowledge of what actions to take They do not know what resources are required
Opportunities/ improvising	Teaching colleagues during their first encounter with a complex situation	Have an awareness of colleagues' inexperience with a complex situation Share what you know and draw attention to critical elements	They rely on text book learning
Self-monitoring	Maintaining composure	Remain calm and work competently to reassure the patient Reflect on events and debrief with colleagues	They exhibit anxiety because the experience is unfamiliar They may not be comfortable debriefing with experienced colleagues
Anomalies	Recognising the patient is feeling worse with supplemental oxygen and is refusing it despite being short of breath	Contact experienced doctor for urgent medical review	They lack experience with oxygen therapy and do not recognise atypical events

The findings indicate that the initial appearance of the patient, knowing the patient and the significance of what he was feeling, were key factors that led the participant to determine how the problem had developed and where it could lead to. The participant was also

informed by knowledge of the patient's past health history in conjunction with knowledge about the surgical procedure and an awareness of factors that were familiar regarding respiratory complications. The difficulty for less experienced nurses is they lack exposure to complex situations and they do not recognise important cues.

6.2.1.2. *Big picture*

In response to the big picture probe the participant identified the critical elements that are significant in this situation and how they affect each other. The participant was able to piece together the cues needed to build a fuller understanding of the whole situation. The critical cue in this situation was the patient feeling worse with oxygen therapy. Knowing the patient's comorbidities was equally important. The patient's self-report of feeling different and short of breath was another important cue. The difficulty for less experienced nurses is that they may struggle to identify the connection between the cues and the overall problem.

> He said he feels different from other days…it's a shortness of breath. When you check the pulse oximeter he really de-saturates when he doesn't have oxygen … So I manage what I can do at that time. So we placed oxygen on, it stabilised and then we had to remove it [because] he said it's making him feel worse. There are problems post-op but … not like this one … it was just hard to spot … but the thing is he had COPD.

6.2.1.3. *Noticing*

In response to the noticing probe the participant recalled it was the patient's general appearance that was the most distinctive feature indicating there was a problem. Although the colour of the patient's skin was normal, his facial expression, sweating, body-posture and self-report of shortness of breath, were meaningful cues that presented a pattern of a respiratory problem to the participant. The difficulty for less experienced nurses is they do not realise what is not visible and miss significant cues such as the meaning behind a facial expression.

> General appearance yeah. The patient was sweating so you know that the patient is really in distress. His face was … his colour was okay but the facial expression … you know when a patient is not okay and feeling distressed. He was holding his chest, but he said it is not chest pain but it's shortness of breath.

6.2.1.4. *Job smarts*

In response to the job smarts probe the participant recalled several strategies which were found to be especially useful for working efficiently. In a challenging situation knowing your resources and who to contact are important strategies. When a patient's condition is causing concern, junior doctors are the first line of contact for nurses. Experienced nurses know that new junior doctors will be unfamiliar with ward routines, procedures and documentation. In critical situations experienced nurses will take the lead. They inform new junior doctors of what is required for the safety of the patient.

> You need to know the resources we have, and the people to contact … the house officers are new every 3 months … they are the first line of call, then the MET team … when they are really new, it's quite hard … we're the one who's dictating what to order. When you are in a critical situation you go beyond what you're doing every day.

Inexperienced nurses do not work efficiently in challenging situations as their understanding of what is happening is limited and they are unsure of what actions to take. They may not notice or think about problems arising from comorbidities.

> Especially when a nurse is new, they forget … because you don't know what you're doing or what is going to happen next or if there are other problems.

6.2.1.5. *Opportunities/improvising*

The opportunities /improvising probe identified 'on the job learning' opportunities where nurses learn to apply their theoretical knowledge to practice. The techniques experienced nurses use to mentor less experienced nurses are sharing knowledge of their actions in challenging situations, highlighting the critical elements to look for and explaining what worked for them in a similar situation. The findings also suggest experienced nurses improvise by shaping their actions from previous experience to suit the context of the current situation. The difficulty less experienced nurses have is that they initially rely on what is learned from textbooks to support their practice.

> We share within our colleagues our experiences, you share what you have, what you did, something that other people don't know. When a nurse has handled this patient before or handled other patients that had the same situation you learn. They tell you … oh I like this, this is what they did before, it looks like this … this is COPD this is a patient that de-saturates … And then you learn from that. Oh I like those talks. When I was a

student you just remember … the books, the learning from school. If you haven't done it before what we learn from school we enhance when we go to the field.

6.2.1.6. *Self-monitoring*

The self-monitoring probe revealed that experienced nurses manage stress by monitoring and adapting their performance.   In stressful situations they stay composed and work competently which is reassuring for patients and promotes their well-being.

> Super stressful yeah. We're human … we are dealing with life here. Inside you are trembling because you care, but you stay composed in front of the patient and the family. You show them you know what you are doing and give them reassurance and help him feel better. When you are stable in yourself you can just do it.

Following a stressful situation experienced nurses are comfortable debriefing with their nursing and medical colleagues about any concerns they have or what they are feeling. They also give and receive suggestions for improving performance.

> When a very stressful situation comes … yeah, we're colleagues so we talk about that … you voice out your concerns, what you're feeling. We get to talk to the doctors in a non-stressful situation … they tell us and we tell them what our suggestions are.

Less experienced nurses in contrast are not able to check their anxiety. When they are involved in the care of a patient who is deteriorating they do not look confident. This can be unsettling for patients and their family/*whānau*. They may also be doubtful of their actions and what they should know. This differs to the actions of experienced nurses who reflect on stressful events and think about their performance.

> When a nurse is new you're shaking when you're assisting doctors. It's not good when they [family/ *whānau*] see someone taking care of their loved ones who look shaky, because they themselves are shaky because they don't really know anything about what the doctors are doing. But nurses we're supposed to know … you think about what has happened, you think about the patient when you drive home.

6.2.1.7. *Anomalies*

In response to the anomalies probe the participant recognised there was a potentially life threatening problem when the patient was short of breath, and had low oxygen saturation, yet could not tolerate having oxygen administered.

> If the patient is de-saturating the initial thing is to put on oxygen, and he was actually refusing the oxygen ... you knew there was a problem … he had this CO_2 retention. When a patient has that situation … how to manage oxygenation you have to be good at that … If you don't know you will put the patient's life in more danger.

In critical situations experienced nurses are assertive in calling for the level of medical assistance they know they require to manage the problem. The participant, on recognising that the patient had a serious respiratory complication, did not hesitate calling the more experienced registrar ahead of the house officer for a medical review. This was to expedite escalating the care of the patient.

> I called the registrar before calling the house officer. I said I really need you right now. I did the right thing. On the next shift he was transferred to ICU because when they check the ABG [arterial blood gas] they saw everything was wrong.

The difficulty for novices (nurses and doctors) is they may have limited experience with managing respiratory complications and take too long in deciding what actions to take. In critical situations a delay in calling for an urgent medical review puts the patient at increased risk of further deterioration.

6.3. Knowledge Audit: Participant C

6.3.1. The cognitive demands of a post-tonsillectomy bleed

6.3.1.1. *Past and future*

The knowledge audit for Participant C (Table 11) shows the challenges that can occur with a patient who has visible bleeding at the back of the throat and the potential for haemorrhage following tonsillectomy. In response to the past and future probe the participant recalled walking into the room of a patient who had a tonsillectomy two hours previously and noticing that something was "not quite right" with the patient. From a brief observation, the participant recognised the patient's sweaty, pale appearance, and his restlessness in conjunction with the time elapsed since surgery were cues indicating blood loss. The particpnat checked the back of the patients throat and before doing anything else placed an emesis bowl within reach of the patient and ensured he had his call bell. From

previous experience the participant knew from the appearance of the patient that he would have swallowed blood that would cause him to suddenly vomit without warning.

> You can kind of tell when they've been back from the ward for a while and then something's not quite right … like an hour or two later. Like walking into the room they look sweaty and pale, and at the same time visually they're restless, so something's happening. It's usually pretty obvious. You know it's not anaesthetic related. You know some people are restless coming around out of anaesthetic but these sort of things [bleeding] normally happen a bit later on. You look at the back of their throat … usually at the same time I will be giving them a vomit bowl and see they have their call bell … from previous experience they don't actually say they are feeling sick … then all of a sudden it [swallowed blood] just comes up … it usually all happens at the same time.

The difficulty for beginning nurses is they are concentrating on getting tasks finished and misinterpret what they are seeing. They make incorrect decisions as they do not sense what is happening with the patient or know where it is leading to. For example, they may see the patient looks sweaty and give them a cool flannel.

> Probably beginning nurses, are more focussed on tasks … possibly get the next patient's obs [vital signs] done and not realising that something's happening. They might just give them a cool flannel and then leave the patient.

6.3.1.2. *Big picture*

In response to the big picture probe the participant recalled the critical elements in this situation were the patient's sweaty, pale appearance and restless behaviour as they were not consistent with a normal recovery. Together the pattern of cues provided the participant with a quick understanding of what was happening with the patient. The cues prompted a follow-up with assessment of the patient's EWS.

> I think the biggest thing is what they look like or are demonstrating. You know their manner, like how restless they are. How they're sweaty, pale and restless …. Increasing heart rate, nausea and pain are also concerns.

Beginning nurses do not recognise the significance of a change in the patient's appearance. There may be uncertainty and they will wait and see before making a decision about what action to take.

> Beginners, maybe not realising …. Maybe just not doing much at the time, like waiting and seeing kind of thing.

6.3.1.3. *Noticing*

In response to the noticing probe the participant focused on the change of behaviour of the patient. The participant recognised that increasing agitation is also an indicator that the patient is bleeding.

> So it was behaviour … major agitation. He was working himself up, but it was because he was having a bleed. I don't think consciously he was aware.

The difficulty for beginning nurses is they may not recognise the significance of the change in the patient's behaviour. They may perceive an agitated patient as intimidating rather than thinking about the underlying cause.

> Having not seen it [major agitation,] …. I think it'd be quite intimidating. You'd just want to protect yourself and the other patients.

6.3.1.4. *Job smarts*

When a potential postoperative haemorrhage has been identified the patient requires immediate surgical review and constant monitoring. In response to the job smarts probe the participant focussed on working efficiently. Seeking assistance and delegating responsibility to other team members enabled multiple tasks to be carried out proficiently. This involved preparing intravenous fluids and setting up equipment prior to the doctor's arrival.

> Before the doctor comes have fluids primed and ready to go. If you think they need an emergency trolley … get someone ready to do it or get someone doing the obs [vital signs]. We've got monitors, so you just keep it attached.

Beginning nurses do not make decisions quickly. They have difficulty knowing what to do first and may cause delay with treatment while they decide.

> What to do first, knowing what to do first. Do they go away and leave the patient and call the surgeon. Or do they do the obs [vital signs] first. I've noticed them delay putting up fluids because they're still thinking what to do.

6.3.1.5. *Opportunities /improvising*

In response to the opportunities/improvising probe the participant recalled that if a patient is bleeding ice packs can be used initially to control bleeding. The participant also stated

that in this situation easy access around equipment is necessary to improve work efficiency. This is important for the safety of the patient. To achieve this experienced nurses know how to set up the work environment and what equipment is needed.

> At that moment if someone is bleeding you can improvise with ice packs to control bleeding … also have equipment ready that you know you might need. Positioning, making equipment easier to access. So you're setting up your work environment to suit you or the situation.

Beginning nurses have difficulty setting up an efficient work environment as they may not know what is needed or where to find it. They do not act effectively in complex situations as they are distracted by what they are seeing and are unfamiliar with what is needed. They can be overwhelmed which impairs their comprehension of events.

> Maybe not knowing what you need, where to find it or what it looks like. Maybe feeling overwhelmed by what they're seeing. Sometimes you're a bit stressed and you can't see what's right in front of your eyes.

6.3.1.6. *Self-monitoring*

In response to the self-monitoring probe the participant recalled that being stressed or busy when trying to manage a demanding workload can lead to cues being missed. Experienced nurses can adapt their practice and improve their performance based on what they have learned from a previous experience.

> You're stressed or busy trying to manage the workload and maybe not listening to the patient. So for the next time, you're aware to first listen to that person.

The participant recalled beginning nurses have difficulty with self-monitoring in a similar situation as they can only focus on one thing at a time because of tunnel vision.

> Beginners have difficulty managing their time. Getting focussed down one way, tunnel vision.

6.3.1.7. *Anomalies*

In response to the anomalies probe the participant could not recall an example.

6.3.1.8. *Equipment difficulties*

Experienced nurses know that monitoring equipment does not always give accurate readings and they learn to trust their own judgement when the equipment does not match what they are seeing.

> Quite often there's not a good connection … for example, the oxygen probe
> … it's quite obvious because of their normal colour. You can see the visual
> doesn't match up with what the monitor's telling you.

The difficulty for beginning nurses is they may not realise they are seeing a false reading and they document just what they see. They do not think to check the accuracy of abnormal readings.

> … they might write it down without checking or using a different monitor.

Table 11: Knowledge Audit of the Cognitive Demands of a Post-tonsillectomy Bleed

Probe	Aspects of expertise	Cues and strategies	Why difficult? (for novice)
Past and future	Recognising a potential haemorrhage and cardiovascular collapse post tonsillectomy	The patient appears to be "not quite right" and is sweaty, pale and restless Look in patient's mouth for blood and check back of throat for bleeding Place an emesis bowl in reach of the patient and ensure they have the call bell	They are task focussed and do not recognise the significance of visual cues They do not think beyond what they can see
Big picture	Being aware that the appearance and the behaviour of the patient are not consistent with a normal recovery	Assess EWS for evidence of postoperative bleeding Inform surgeon of concerns	They wait and see as they do not realise what is happening
Noticing	Realising the significance of the change in the patient's behaviour	The patient becomes agitated	They may find the patient's behaviour intimidating and focus on protecting

	and temperament		themselves and other patients
Job smarts	Seeking assistance from nursing team

Multitasking and preparing necessary equipment while waiting for doctor to arrive | Inform colleagues of the situation and that they may be required to assist - define what they will be required to do

Delegate tasks and responsibility

Prime IV lines
Attach electronic monitoring equipment
Have emergency trolley at hand | They have difficulty deciding priorities |
| **Opportunities/ improvising** | Using ice packs to control bleeding

Setting up the work environment to suit the situation | Know and obtain the equipment needed

Position equipment for easy access | They become overwhelmed by what they are seeing

They do not know what equipment is needed where to find it or what it looks like

They are stressed and their comprehension is impaired |
| **Self-monitoring** | Realising the impact that being stressed and busy has on own actions | Adapt practice | They have tunnel vision and difficulty managing time |
| **Equipment difficulties** | Recognising when pulse oximetry equipment is giving an inaccurate reading | The appearance of the patient such as skin colour does not match the pulse oximetry recording

Check position of probe | They believe what the equipment is telling |

6.4. Knowledge Audit: Participant D

6.4.1. The cognitive demands of an adverse drug reaction to Stemetil

6.4.1.1. Past and future

The knowledge audit for participant D (Table 12) shows the challenges that can occur with an adverse drug reaction. In response to the past and future probe the participant recalled a critical situation that she had no previous experience of, yet, she understood immediately what was happening and what was needed to resolve the problem. The situation involved a surgical patient who was feeling generally unwell and had recently been readmitted to the ward with persistent nausea. The participant had just started the shift and went to see the patient who explained that her tongue was numb and that she had difficulty opening her mouth. She also had difficulty controlling her tongue. Immediately the nurse recognised the patient was having an adverse drug reaction to Stemetil, an anti-emetic. On inquiring about medications the patient had taken, the patient told the nurse she could not recall having taken anything. On checking the patient's clinical notes, there was no indication that the patient had been given Stemetil, nor was there any previous history of a reaction to medication. When consulted, nursing colleagues could not offer any further information about the situation. The surgeon was contacted and confirmed that Stemetil had not been prescribed on discharge. The participant however understood the situation and knew where it was leading and persisted with her inquiry. From the patient's mother the participant learned that Stemetil suppositories had been prescribed by the patient's general practitioner following discharge and were given at home. In this situation, the participant's understanding of events and knowledge of the possible outcome, led to the timely administration of Cogentin to treat the patient's symptoms and prevent a potential crisis.

> And, she said her tongue was numb. And, she also was feeling symptoms of a lock-jaw sort of situation. She just had a feeling her tongue was basically uncontrollable ….And, so my immediate thought was she must've been given Stemetil. It wasn't documented anywhere … the surgeon said there was no information in the notes that she had had Stemetil. Other staff said they were uncertain what it was … But, I felt that she had to have had Stemetil for the symptoms she was presenting … you just knew that medications had caused this problem ... So, her mother, I said, are you sure your daughter hasn't had any Stemetil, she said no, she hasn't. And, then she said, ah yes, Mr … prescribed Stemetil and she had had it at home …Within, probably a half an hour … basically her airway was

> compromised and her tongue just went black I'll never forget that. So, we were able to give her the Cogentin and avert a serious situation. It's amazing how things can be forgotten.

The difficulty for less experienced nurses is they do not think critically about problems. They will read notes and focus on what they can see. They do not delve into a problem and do not consider what they can't see such as information that may have been omitted in an assessment or documentation.

> It was difficult in that you didn't have all the documentation. People, I felt, weren't looking outside the square, as to, what was causing this girl to be re-admitted

6.4.1.2. *Big picture*

In response to the big picture probe the participant identified the patient's airway as the critical factor to be aware of and to keep track of. The main feature that provided understanding of the whole situation was the appearance of the patient's tongue. Coupled with an intuitive awareness of the situation the participant was able to quickly piece together what was happening. Noticing the decline in her condition completed the picture of deterioration.

> The most important factor was maintaining her airway and having facilities to maintain that …we just got an airway available but her tongue just darted out. It was really quite dramatic … and just having that instinct that, you know … it was progressing, it wasn't getting any better.

The difficulty for less experienced nurses in uncertain situations is they do not recognise early warning signs or think what they mean, such as a patient who is experiencing difficulty with drinking. They do not assess the whole situation to gain an understanding of what is happening with the patient. The participant stated "… she'd been observed, she had difficulty drinking ... they weren't looking".

6.4.1.3. *Noticing*

In response to the noticing probe the participant indicated that experienced nurses quickly notice the magnitude of a problem based on the appearance of the patient. They will take the time to seek out the reasons why a situation has occurred when indications are not immediately apparent from assessment data.

> As time goes on, you suddenly, you just look for reasons why something's happened.

When facing a complex situation less experienced nurses do not take opportunities to delve deeper for sources of information when problem solving. In this situation less experienced nurses did not recognise the patient's mother as a source of information regarding factors which led up to the event.

> They admitted her and they did all her recordings … but they weren't quite sure what was going on … but they didn't delve deep enough, they could've just questioned the mother further.

6.4.1.4. *Job smarts*

In pressured situations the participant identified that knowing where resources are so they are available and prepared when needed, saves valuable time and is vital for patient safety. Knowing when to notify the doctor and how to delegate responsibility to other staff members is the key to working more efficiently.

> The medication [Cogentin], it was in recovery, I mean, that's minutes wasted … know where my resources are, if I need them … that's being smart … making other staff members aware …. When to notify, is important, I also think that you can perhaps get someone to do that for you. Delegate so that you can stay [with the patient].

The difficulty less experienced nurses have in time-pressured situations is the time wasted by delaying calling for assistance of a doctor as they do not understand what is happening and do not know what to say. Another difficulty is they do not think about the resources they have available. They do not make use of the resources they have to support their decision-making, such as looking up the side effects of medications, or talking to the patient or their family/*whānau.*

> I never have seen it [drug reaction] either, but if you think something's not right …. Or, if you think it's a particular medication, look it up … talk to the patient … talk to the mum, you know. I think that's where your experience comes in.

6.4.1.5. *Opportunities/improvising*

In response to the opportunities/improvising probe the participant responded that she did not improvise in this situation. Difficulties for less experienced nurses were not identified with this probe.

6.4.1.6. *Self-monitoring*

Reflecting on practice is a strategy experienced nurses use to self-monitor and adjust their performance. When a challenging situation arises, nurses can easily over-commit themselves by thinking they can manage the situation plus manage an already demanding workload, especially when there is a lack of staff or a lack of delegation. When experienced nurses are over-committed they are aware they are not able to fully focus on the situation and are less efficient. The stress such demands create may not be felt immediately, but occurs later at home when there is time to reflect on events. Hindsight provides the opportunity to recall the situation and strategise future management of similar events. Difficulties for less experienced nurses were not identified with this probe.

> If it's a major situation management-wise, I think sometimes you can over-commit yourself and, think you can do it all, You just think I can do that and I can do that as well, and not delegate people to help you. I don't tend to get stressed, that probably happens later when you get home.   In hindsight, you perhaps could've said "can you look after someone?"

6.4.1.7. *Anomalies*

In response to the anomalies probe the participant recognised the patient's appearance was consistent with an adverse drug reaction yet there was no other data that supported this idea. This prompt, captures the importance of intuitive knowledge to enable answers to ambiguous information.

> If you think something is not quite right, you know. The notes didn't say she had gone home with the prescribed Stemetil and she hadn't had it anywhere else. Its instinct, it just had to be medication causing it.

The difficulty for less experienced nurses is that when they are unsure of what is happening they look at the clinical notes to find an explanation and do not explore further.

> They weren't sure what was going on. Well they said "but it's not written anywhere". It's those sort of comments.

6.4.1.8. *Equipment difficulties*

Experienced nurses quickly recognise when monitoring equipment is providing inaccurate information by the appearance of the patient. They know to check the attachment of the equipment and to confirm the recording by checking it manually.

I had a 'propac' and, you're getting a slow pulse but you're looking at the person and thinking well, it shouldn't be that slow. You've taken the pulse and you've picked up on their true pulse rate … check to see that everything's put on correctly.

When monitoring equipment displays an abnormal parameter less experienced nurses may not think to check the recording manually or refer to the patient's chart to establish the data trend.

… they may not think to just check their pulse rate or check the notes.

Table 12: Knowledge Audit of the Cognitive Demands of an Adverse Drug Reaction

Probe	Aspects of expertise	Cues and strategies	Why difficult? (for novice)
Past and future	Intuitively knowing the patient is experiencing an adverse drug reaction to Stemetil and requires Cogentin to prevent a potential airway obstruction	The patient states her tongue is numb The patient is feeling symptoms of "lockjaw" and her tongue is uncontrollable Ask patient if any known drug allergies Realise people forget or have difficulty remembering Follow instinct and confirm Stemetil has been given	They do not recognise early warning signs They lack knowledge of medication reactions They do not think "outside the square" for example the reason why the patient was readmitted
Big picture	Knowing the importance of maintaining the patient's airway as continuing decline could result in obstruction	Call for assistance from colleagues and request emergency equipment Observe for signs of a compromised airway Have oxygen and suction ready Inform the surgeon	They are not sure of what is happening and do not know how to pursue the problem

		and anaesthetist	
		Reassure and do not alarm the patient	
		Increase monitoring of the patient	
		Obtain medication known to treat the problem	
Noticing	Sensing this is not a minor problem; it is progressing and not resolving	The patient has difficulty controlling her tongue, difficulty opening her mouth and difficulty drinking	They do not delve deeply enough when a problem is unfamiliar
		The patient's tongue turns black	
	Finding there are no medications documented in the clinical notes that could cause this problem	Look further for a reason why something has happened if it is not evident in clinical notes	They just read and act on what is documented in the notes and do not look any further
Job smarts	Not wasting time	Become the patient's advocate	
		Know what resources are needed and where they are located	They do not locate and make use of available resources
		Know when to notify the doctor	They delay calling for assistance of a doctor as they do not know what to say or understand what is happening
		Delegate tasks	
		Ask for assistance from colleagues	
Self-monitoring	Being aware of the impact of being over- committed with a demanding workload due to lack of staff and running the ward as duty leader and not	Delegate responsibility if possible	
		Ask for assistance from colleagues	
		Use reflection to	

	focussing on the situation	adapt future practice	
Anomalies	Recognising the patient's appearance is consistent with an adverse drug reaction yet initial inquiry is not supporting this observation	Seek answers to ambiguous information	They do not know where to look for answers to unfamiliar problems
Equipment difficulties	Knowing that electronic monitoring equipment can display inaccurate information	Know what is normal for the patient Observe what the patient looks like Check attachment of equipment and reposition if necessary Compare electronic with manual recordings	They record what the monitor displays They do not make comparisons with manual pulse rate or previous recordings

6.5. Knowledge audit: Participant E

6.5.1. The cognitive demands of a post-bariatric anastomotic leak

6.5.1.1. *Past and future*

The knowledge audit (Table 13) for participant E shows challenges that can occur with a patient following laparoscopic bariatric surgery. In response to the past and future probe the participant recalled recognising there was a serious problem that required prompt surgical review because of the appearance of the patient and the patient's behaviour. The participant subconsciously recognised a pattern of cues that she knew indicated the presence of a complication with the surgery, although the patient's vital signs were stable.

> Well the first thing, as soon as I looked at her I knew, this body language, this furrow here, you know … sort of deduce a little bit in your mind without realising. And when you say, how are you feeling? They look at you and say, alright. But you look at how they reply …. She was miserable you pay attention to what they say. I didn't like that body language … and

> the other thing is she couldn't get comfortable. So there was a bit of restlessness. I knew when I looked at her pallor, and also that little sheen, a pain response, just sort of partially sweaty. But not badly so, because that's actually quite a late symptom. They're nearly always going to show [deterioration] before you even think about doing recordings ... she'd had her half hourly recordings up until 8 [pm] and according to the chart they were alright but I knew that there was something going on there.

The difficulty for less experienced nurses is they may not notice subtle changes as they lack opportunities to gain experience with managing complex patient problems. Consequently they cannot project into the future or foresee how events may unfold.

> And the chances of new grads having nursed a bariatric patient who has had problems are fairly remote … they don't know.

6.5.1.2. *Big picture*

In response to the big picture probe the participant identified the most important factor for this situation was thinking about the outcome for the patient. Consideration needed to be given to what they thought was happening and alternatives for the cause of the problems. Being able to interpret the visual cues was important to generate an understanding of what was happening with the patient. The critical cues in this situation were the symptoms the patient was presenting, along with vital signs. Being able to quickly synthesise information was necessary to gain an understanding of what was happening with the patient. In this situation the patient had increasing discomfort and restlessness and difficulty getting comfortable. Initially the vital signs remained stable and did not indicate there was a problem. Even so, vital signs were closely monitored to detect a change as that is the critical element doctors will respond to.

> Well I think the most important thing is thinking what the end result could be. I think that's the basic thing you have to watch and put them all together. It's being able to put them together. The more things that aren't normal the quicker you do something about it. But increasing discomfort, restlessness is a dead giveaway ... so you're watching that but you have to watch those recordings because that's your proof when you ring, you've got to have something to produce. You can't just say a nebulous, 'oh I think something's going wrong because she's not comfortable. So I put her on half hourly [recordings] just because I didn't quite know even at that stage.

The difficulty for less experienced nurses is they do not necessarily see the significance of the cues that are presenting or think to look at what is causing them. The participant explained "a less experienced person doesn't necessarily see that … or twig on."

6.5.1.3. *Noticing*

In response to the noticing probe the participant recalled patterns of changing behaviour displayed by the patient that were suggestive of an anastomosis leak or an intra-abdominal bleed. Constant restlessness and an inability to get into a comfortable position were the cues the participant immediately identified as being significant and warranting further consideration. The participant perceived the symptoms the patient was experiencing were not a recent development, although the handover from the previous shift did not indicate there had been any change in the patient's behaviour since surgery.

> So, you know, things going through your mind … you know that it's a leak or a bleed to produce those symptoms … you know that they can't get comfortable and they want to sit up in a chair. They want to get back into bed, they want to sit with their feet up, they want to go for a walk, they cannot get comfortable … and I thought now how long has she been doing that in the afternoon and nobody's picked it up.

The difficulty for less experienced nurses is that they may not realise this is unusual behaviour and they leave the patient as they think it is normal for them. They do not appreciate the importance of being able to position a patient comfortably and what it means if you can't make a patient comfortable.

> But they'll sit on this and think it's sort of fairly normal and walk out again. Nurses don't appreciate the value of positioning comfortably … I suppose it has taken me 20 years to learn if you can't make a patient comfortable ... you have a problem.

6.5.1.4. *Job smarts*

In response to the job smarts probe the participant recalled being able to instinctively prioritise patients and being proficient with assessing patients were useful ways of working more efficiently in challenging situations while managing a demanding workload. Also knowing the capabilities of the nurse you are receiving handover from may have some bearing on what needs to be accomplished first. For example, an experienced nurse may quickly prioritise seeing patients who have been under the care of a less experienced nurse as they know the limitations of the less experienced nurse's practice.

> I had five post-ops from that day. You unconsciously prioritise your patients, I think. You have to be very quick at assessing. I prioritise according to who I'm taking over from … if I know it's an inexperienced new grad you go in fairly quickly.

Less experienced nurses do not easily prioritise their workloads. Also they can waste time by not considering tasks that could be carried out simultaneously to work more efficiently and safely.

> I make a point of saying 'don't forget next time make sure you check that wound properly, and that's not the only thing, check the IV… I'm telling you it's a good idea to check everything … all sorts of things can happen'.

6.5.1.5. *Opportunities/improvising*

In response to the opportunities/improvising probe the participant recalled ways of being able to ease patients' discomfort without always relying on medication. Experienced nurses have learned the benefits of making patients comfortable by repositioning them and supporting them well with pillows.

> Now as soon as I took everything off and made her comfortable, one pillow behind her back, one underneath her arms because it helped her to breath and put the knees up a bit and warmed her because her feet were cold, oh she said, "that's taken all my pain away". It can be something so simple like turning the pillow over.

In contrast less experienced nurses are inclined to use medication without considering alternative options such as a change of position to ease patients' discomfort.

> It's something that can easily be missed; they rush off and get some pain relief, without looking at what else you can do.

6.5.1.6. *Self-monitoring*

The self-monitoring probe revealed that heavy workloads impact significantly on the quality of care patients receive. When patients with complex or changing needs require a lot of the nurse's attention and workloads are high, other patients receive less of the nurse's time and changes can go unnoticed. Experienced nurses constantly self-check and find it particularly taxing if they cannot make adjustments to ease their workloads in order to provide the care patients need. They start to doubt their ability to cope when they unintentionally omit care because they have missed a minor cue.

> If you've got a big workload and ultimately you're responsible for those patients, you still have to go do much of it yourself … you can only do so much … things can go wrong, you can neglect things and there is no getting away from it because human nature being what it is you can't spread yourself, you know, too thinly … you're concentrated all in one area…you

> just get to the point where you start doubting yourself … the sort of thing I would have picked up earlier under normal circumstances … just something minor.

Conversely less experienced nurses may be less attentive to their own performance. They use basic observational skills to assess patients and lack awareness of the cues they can miss.

> A lot of it is carelessness … it's not just a matter of looking at them [the patient] lying there.

6.5.1.7. *Anomalies*

In response to the anomalies probe the participant revealed that experienced nurses quickly pick up on the development of unusual events in patients' progress. For example the participant recognised that the patient had developed signs and symptoms that were not consistent with a normal recovery from gastric bypass surgery and required urgent review by the surgeon.

> So the ice that she was allowed to suck, she wasn't even tolerating that particularly well. The pain was getting up, always, between five and six … epigastric pain. It was quite severe, colicky and at times it was sharp. You know it's not right. And she'd had her IV panadol and other meds, but the IV narcotic I withheld that for a little while because I didn't want her to vomit. Before that she did start to get this reflux and she said that the fluid that she was swallowing didn't seem to be getting into her stomach, "it's coming back up again." They can always tolerate the fluid from ice they suck, so that is a bad thing to look for. She started to get tachycardic so I gave her morphine and it did fix things for a short time but she was still not able to get fluids down. She did start to vomit a bit and it was getting a bit biley. Then the pain kicked in again. And then she had this tight feeling. Then her blood pressure started to drop over the next three recordings and her pulse started to shoot up and combined with a temp of 38 that needed quick attention. So I rang the surgeon again. He saw her and he said "I think she must have a leak. I think we will have to transfer her." So he did.

Less experienced nurses do not recognise these signs as being atypical for this surgery as they have not had enough experience to identify when events are amiss. Without experience they rely on procedure manuals which contain routine information that may not adequately address the many variances that can occur during a patient's postoperative recovery. An important resource for less experienced nurses to gain this knowledge is nurses who have experience and can recognise and point out atypical situations in the context of the patient's surgical procedure.

While we try to have procedure manuals and that…but they don't have that sort of stuff [deviations from normal]. That's the sort of thing you would expect that whoever is preceptoring to mention.

6.5.1.8. *Equipment difficulties*

Following the equipment difficulties probe the participant recalled that monitoring of vital signs often showed a discrepancy between what is being displayed on the monitor and what the experienced nurse knows is happening with a patient.

Oh yeah, that happens a lot. You know that something is wrong. Your recordings can be dead normal to coin a phrase, but you know that there's something needs following up, you ring the anaesthetist … this can be an intuition experience.

In contrast when there is a change in a patient's behaviour and their vital signs are normal, less experienced nurses do not realise there could be an underlying physiological problem. They think the patient will settle on their own without the need for intervention and do not assess further.

You go and have a look at the chart if you haven't already looked, you know it's important to get on top of it; you go through all the things. But a less experienced nurse may think it'll go away. They don't investigate further by asking a few questions.

Table 13: Knowledge Audit of the Cognitive Demands of a Post-bariatric Anastomotic Leak

Probe	Aspects of expertise	Cues and strategies	Why difficult? (for novice)
Past and future	Recognising the patient has signs and symptoms indicative of a serious complication following gastric bypass surgery	Notice the patient's body language. The patient has a furrowed brow, cannot get comfortable, is a little restless, and has pale moist skin Pay attention to what the patient says. The patient indicates they are feeling miserable	They lack experience with bariatric patients and may not recognise subtle changes
Big picture	Considering possible reasons for the	Know trend of EWS since surgery and	They do not understand the

	patient's presentation and in addition to changes in the patient's behaviour look for changes in the EWS	increase frequency of observations to ½ hourly Observe for increasing discomfort and restlessness	significance of cues or what causes them
Noticing	Determining the comfort of the patient and recognising the development of significant cues that warrant further consideration for a possible anastomosis leak or bleed	The patient rings the call bell more frequently because of increasing discomfort The patient has increasing restlessness and cannot get comfortable. They want to sit up in a chair, then get back into bed. They want to sit with their feet up, they want to go for a walk	They do not appreciate the value of positioning comfortably They do not recognise this as unusual behaviour for patients following bariatric surgery
Job smarts	Being able to manage a challenging situation with a demanding workload of five postoperative patients	Prioritise patient care Proficiency with assessment skills Know the capabilities of other team members	They hastily do tasks and do not prioritise
Opportunities/improvising	Repositioning the patient to make them comfortable and to ease pain	Remake the bed. Turn pillows over Position the patient so they are well supported with pillows behind their back and under their arms Provide a pillow to cuddle to make breathing easier Bend knees slightly to ease tension on abdomen, or	They rush to get pain relief without considering other options They are not able to manage basic care to get the patient comfortable

		position on their side with pillows between their knees	
Self-monitoring	Being aware of not picking up on minor patient cues early due to a demanding workload	Having self-doubt about coping when you can't get things done May neglect things because you can't spread yourself thinly Feeling upset about a patient and doubting your own ability to cope Ask colleagues for assistance knowing you can only do so much	They lack experience and may be careless as they do not know what to pay attention to They are not aware they miss early cues or where to look for them
Anomalies	Knowing that patients normally tolerate oral fluids and discovering that the patient has developed reflux Knowing that pain is usually well controlled with IV panadol and determining the patient requires IV narcotics. Realising deterioration in vital signs can be slow and insidious.	The patient develops reflux when taking small amounts of oral fluids The patient has increasing epigastric pain that is sharp, crampy and colicky in nature and more severe with small amounts of oral fluids The patient starts to vomit small amounts of bile The patient has slight abdominal distension The patient has a gradual drop in blood pressure, rapid increase in	

		pulse rate, slight decrease in oxygen saturation and elevated temperature Request surgical review	
Equipment difficulties	The vital signs may be normal but the nurse knows there is a physiological problem with the patient	Trust intuition, assess patient and follow up concerns with doctor	They do not investigate problems further

6.6. Knowledge audit: Participant F

6.6.1. The cognitive demands of hypotension meeting 'EWS 5' criteria

The knowledge audit for participant F (Table 14) focuses on the decision not to call a code for a patient who has an 'EWS 5' status because of hypotension. The participant recalled the situation occurred in the first year of practice as a RN and the knowledge audit shows the challenges that can occur when the nurse has not previously had experience in a similar situation.

6.6.1.1. *Past and future*

In response to the past and future probe the participant recalled the patient in this situation had a high fluid output through an abdominal wound fistula following bowel surgery several months earlier. The patient now presented with a low blood pressure during routine vital signs recordings that met the criteria for a MET code callout.

The participant suspected the patient's low blood pressure was due to the high fistula output, though had no understanding of what this could lead to as the participant had no personal experience of dealing with this problem before. Yet, the participant in this situation decided not to immediately call an emergency code because the patient was alert and had no symptoms of hypotension such as dizziness.

From previous observation of a similar situation the participant had learned the MET questioned nurses when they had called them out for a patient who was alert. Therefore in

this situation the participant was undecided about what action to take to manage the problem and asked a colleague to double check the patient's blood pressure. The colleague agreed a code was not necessary, but the participant remained uncertain about the required action to take. She had not worked with the colleague before and was unsure whether or not to trust his opinion. Eventually the participant called the clinical nurse advisor (expert nurse) to come to the ward to help with the management of this problem.

> The patient had a low pressure which is criteria to call the MET … I didn't call the MET right away because the patient was up talking, didn't have any symptoms of dizziness that might come with low blood pressure so I had another one of my colleagues double check the blood pressure. It was difficult; I hadn't worked with him so there was no trust. Then I wasn't too convinced so I called the CNA [clinical nurse advisor]. I had a suspicion that his blood pressure might have gone low because of his high fistula output. I was in the early stages of learning then. I didn't know yet the impact of low blood pressure through the body's organs. So I didn't know where it was gonna lead if it stays that low. I have seen before the code team arrive they say the patient is alert, why have you called a code? That led me to think that maybe they don't want me to call a code.

The findings indicate that when the vital signs show there is a significant physiological problem, in uncertain situations, less experienced nurses' have difficulty making decisions and deciding what actions to take. The participant expressed her difficulty in managing this problem resulted from a previous observation of a similar situation, and a limited understanding of what the problem could lead to.

6.6.1.2. *Big picture*

In response to the big picture probe the participant recalled the most important elements in this situation were ascertaining if the patient was exhibiting signs and symptoms of low blood pressure and determining if he had adequate cerebral perfusion.

> Yes, asking if they were showing any symptoms of having a low blood pressure, and just seeing that they can still open their eyes, talking back to me, which means that he's still got blood flowing through his brain.

The difficulty for less experienced nurses is knowing when to follow protocols and when to use clinical judgement to support their decisions and their actions. Because of their lack of experience, they struggle with the risk of being reprimanded by senior staff who do not agree with their decisions.

> It was difficult to decide whether, if I should follow protocols. Against being told off by a senior medical officer. It was at different times but I've seen people get told off.

6.6.1.3. *Noticing*

In response to the noticing probe the participant recalled a meaningful cue was observing the connection between the high fistula output and the rate of the intravenous fluid replacement therapy the patient was receiving. The participant recalls being concerned and thinking that the patient's blood pressure could drop further without additional intervention.

> I got that connection from the fistula output and the mil [millilitre] per mil replacement that he's been having. I was concerned that his blood pressure might go down even further if there was nothing done.

The difficulty for less experienced nurses is that they focus on one element such as an abnormal blood pressure and are not concerned about other factors as they lack understanding of what is happening with the patient. They do not observe the whole patient or think critically about the situation they are being presented with.

> As a less experienced nurse … back then, my understanding was fairly low. Well looking at just the blood pressure and not considering all these other things so much. Especially the breathing, I didn't used to be too concerned about that.

6.6.1.4. *Job smarts*

With experience, nurses learn to group and prioritise cares, and have any necessary equipment ready. They use these strategies to work smarter and use their time more efficiently.

> I had started grouping things together because apart from his high requirement for close observation, he was in a single room at the end of a corridor. So when I came to him to measure the replacement, I was getting ready to start replacement and to check his blood pressure and vital signs at the same time.

Less experienced nurses are focussed on completing tasks and cannot determine priorities as they do not know what is and isn't important. This is frustrating for them as they rely on others who may prioritise differently and they don't always understand why.

> I was working mainly based on task. I was good at getting them done
> because that's what they want me to do. I still needed a lot of guidance
> about things that I can leave, things that I can do earlier …. Well my
> prioritising was different. Yes, I remember I was struggling.

6.6.1.5. *Opportunities/improvising*

The participant could not recall noticing a way of doing things differently or improvising
in this situation.

6.6.1.6. *Self-monitoring*

With experience nurses learn to self-reflect as a strategy to improve their practice when
there is uncertainty or confusion about the management of a patient's care. Debriefing with
colleagues, however may be more challenging. For less experienced nurses, self-reflection
is difficult because they have a limited knowledge base on which to monitor their practice.
Reassurances about their actions from more experienced colleagues are not always enough
for them to adapt their practice. They need a deeper understanding of why decisions are
made before they can confidently make adjustments to their practice.

> It was still the confusion, whether to call a code or not call a code. I
> remember reflecting on the situation but at the time I didn't talk to anyone. I
> mean I couldn't find how I could improve my practice at the time coz my
> knowledge wasn't enough as well. Now I know it was far from enough.
> Regardless of their reassurance it didn't answer my questions. I do learn a
> lot from colleagues, but a deeper understanding that's through post-grad
> study.

6.6.1.7. *Anomalies*

Experienced nurses know what to look for and how to intervene in unusual situations.
They recognise whether or not an emergency code should be called based on their
assessment and what they know about the patient. In unusual situations less experienced
nurses do not recognise the trends leading up to the event as they are not aware of what is
typical for the situation they are dealing with.

> It's not hard to spot that it's unusual. I can remember something else about
> trending that I didn't really get at the time. Because the blood pressure
> hasn't been high most of the time … I wasn't aware then … it must be one
> of the reasons why they [senior nurses and doctors] weren't too concerned.

6.6.1.8. *Equipment difficulties*

With experience nurses learn that correct technique with the set-up of monitoring equipment is important for accurate measurements. Any discrepancies with patients' vital signs are easily checked manually. Less experienced nurses may not think about technique when monitoring blood pressure such as the correct cuff size on the sphygmomanometer or the placement of a stethoscope. They tend to believe the reading they get rather than checking their technique or the equipment when the equipment is telling them something different to what they are seeing in the patient.

> Yes, so either my stethoscope, I didn't have a good stethoscope, to listen for blood pressure, but I didn't think that would matter much. His arm was really small, I wasn't using the small size cuff. I was using just a regular cuff. It wasn't particularly big but it was a regular size. That I didn't take into consideration … it's not gonna be that accurate.

Table 14: Knowledge Audit of the Cognitive Demands of Hypotension

Probe	Aspects of expertise	Cues and strategies	Why difficult? (for novice)
Past and future	Recognising there is an inconsistency between the patient's presentation and EWS protocol	The patient is alert and is not exhibiting signs and symptoms of hypotension Ask colleague for second opinion Seek advice from clinical nurse advisor	They have not seen this problem before They are unsure of the potential progression or impact of the problem
Big picture	Being aware the patient has adequate cerebral perfusion and is not exhibiting signs of hypotension	Patient opens eyes when spoken to and responds appropriately Observe for symptoms of low blood pressure	They are unsure whether they should follow protocols and risk being 'told off' by a senior medical officer
Noticing	Identifying the patient's blood pressure could drop further	Note fistula output Maintain the balance between fistula output and IV fluid replacement	They may just look at the blood pressure and nothing else

Job smarts	Managing care of a patient who requires close observation	Group cares Have all necessary equipment available	They have no experience of the situation and do not know what other indicators may be present
Self-monitoring	Being aware of uncertainty about the situation	Reflect on the experience Debrief with colleagues Further study to deepen knowledge	They are not confident to adapt practice
Anomalies	Identifying unusual events and analysing trends leading up to the event	Determine the trend and normal range of the patient's blood pressure	They do not think to analyse trends of patient's recordings
Equipment difficulties	Recognising a blood pressure recording does not reflect the appearance of the patient	Check the cuff size Check technique Compare manual and electronic recording	They may not think to compare manual and electronic recordings or check technique and cuff size

6.7. Master Knowledge Audit Table

The master knowledge audit table (Table 15) presents the combined data from the six individual knowledge audit tables. It shows what experienced nurses know and what they can do when faced with a challenging situation involving a patient with a complication following surgery. The table presents different aspects of cognitive skills required to manage the complication proficiently. It reflects the wealth of knowledge experienced nurses draw on to quickly recognise abnormal events and their ability to anticipate where problems are leading to. Overall the table has captured categories of cognition relevant to the challenging situation of a patient presenting with a postoperative complication.

Table 15: Master Knowledge Audit of the Cognitive Demands of a Challenging
Postoperative Complication

Probe	Aspects of expertise	Cues and strategies	Why difficult? (for novice)
Past and future	Recognising the development of a postoperative complication and knowing there is the potential for further decline and risk to patient safety	Know what cues and patterns to look for relative to the time elapsed since surgery Do not hesitate to call for assistance	They lack experience and do not recognise the significance of early cues and patterns
Big picture	Knowing the expectations of a normal recovery for the surgical procedure and being responsive to patients' changing needs Knowing how to manage the patients changing needs safely and when to seek assistance from medical staff	Conduct regular assessments and observations of the patient to determine progress. Increase frequency if indicated Get to know the patient through continuity of care Identify priorities and the actions required to minimise further decline Initiate collaborative management when required	They may be overwhelmed and do not think to look beyond the immediate problem They tend to wait and see as they do not understand what is happening
Noticing	Detecting non-routine changes in the patient's behaviour or physical appearance and understanding what would have to happen for those changes to appear	Assess for possible causes of cues Seek a second opinion from another colleague about concerns	They rely on monitoring equipment and do not delve deeply into a problem
Job smarts	Being prepared	Be prompt with	They rely on

	and not wasting time. Knowing capabilities of team members. Securing the resources required to enhance work efficiency. Keeping the patient calm	actions and prepared to take the lead Remove unnecessary equipment and set up needed equipment to provide a safe working environment Maintain a calm and reassuring manner while keeping the patient informed about significant changes	protocols to decide what to do as they are not sure of their options They delay initiating care as they do not know what to do first
Self-monitoring	Staying composed while managing a complex situation	Determine priorities and delegate tasks to prevent work overload Be flexible and able to adapt to the demands of a changing situation Reflect on actions and debrief with colleagues	They do not delegate or ask for assistance with other patients They are not able to adapt as they fear making a mistake
Opportunities/improvising	Managing the well-being of the patient until definitive intervention is available Teaching colleagues in their first encounter with a complex situation	Use complementary therapies to keep the patient safe and comfortable Share knowledge of similar situations with colleagues and discuss the choices made	They do not improvise as they fear getting into trouble and rely on text book learning to solve problems
Anomalies	Knowing there is a problem because the	"Not feeling happy about the patient"	They have not had enough experience to

	patient "doesn't look right" although objective data does not reflect a significant change in the physiological status of the patient		develop intuitive knowledge
Equipment difficulties	Observing that the physical appearance or behaviour of the patient does not reflect what is being displayed by monitoring equipment or is not consistent with equipment settings	Check attachment, connection and positioning of equipment Assess patient's observations manually Replace equipment if necessary	They believe what the equipment is telling them and do not think to check placement or connection of equipment, or to do manual checks

6.8. Conclusion

This phase of the study has presented the key aspects of cognitive expertise which enable experienced nurses to deliver superior performance in challenging situations. The findings from the knowledge audit show there are contrasting differences between experienced nurses' and less experienced nurses' responses to challenging situations. Unlike less experienced nurses, experienced nurses can quickly recognise and resolve problems. They can apply their knowledge to improvise when necessary or manage situations when there is uncertainty. Additionally the study has revealed that identifying and managing the care of a patient with a complex postoperative complication that leads to physiological deterioration is the most cognitively demanding task that nurses have responsibility for in the surgical ward.

The findings confirm that the cognitive task of early recognition of cues that signify the development of a complication is a key aspect of expertise and vital for the best outcome for the patient. The knowledge audit shows that in challenging situations experienced nurses use intuitive knowledge which is the knowledge they have gained from previous experience. This intuitive knowledge allows instant recognition of a problem. Klein (1997)

asserts that intuition is a practical method of decision-making in this situation. It is knowledge that less experienced nurses have not yet learned. Their response in dealing with surgical complications may therefore be delayed as they do not recognise critical cues that require immediate intervention to prevent further deterioration. They do not act as they have not experienced this problem before and do not recognise its significance or the warning signs of what is to come. Less experienced nurses need to gain this knowledge from experts in the field. They need to work alongside experts to learn how to recognise and manage these complications safely and effectively as this is knowledge that cannot be learned through formalised texts or theoretical instruction.

To explore the thought processes of experienced nurses and to capture the knowledge they have acquired to support the decisions they make in challenging situations, a simulation interview was subsequently conducted. A simple pen and paper simulation of a challenging postoperative complication was constructed based on cognitive demands identified in the knowledge audit. A real-life scenario provided the structure for the simulation exercise. The simulation interviews are the focus of the following chapter.

Chapter 7. Simulation Interview

This chapter presents the findings from the data generated by six individual simulation interviews which were amalgamated into a master simulation table (Table 16). The simulation interviews provided access to the thought processes of the participants and the decisions they make in a challenging situation following surgery. Using the same simulation scenario with several participants can produce information regarding the appropriateness of more than one action for the same situation. Furthermore, by conducting the same simulation scenario with participants of varying levels of expertise, contrasts in expert and novice perspectives can be exposed. Additionally the potential errors less experienced nurses are likely to make when dealing with the same situation can be identified.

7.1. Master Simulation Interview Table

The master simulation interview table (Table 16) presents the combined data from the six individual simulation interview tables (Appendix L). It provides an organising framework that details specific information of events, actions, situation assessments and critical cues relating to the participants' problem solving processes during the simulation interviews. The potential errors less experienced nurses make, as identified by the participants, are also presented. All participants were given the same scenario (Appendix J). Five major events were identified in the simulation by the participants:

1. The patient has a persistently high pain score
2. The patient is anxious
3. The patient is pale
4. The patient is restless and extremely tired
5. The patient states "I think I'm going to die"

Table 16: Master Simulation Interview Table

Events	Actions	Situation assessment	Critical cues	Potential errors
The patient has a persistently high pain score 5/10	Check the number of PCA attempts made by the patient and encourage further use if required Increase the frequency of pain assessment	The patient may require further instruction or encouragement to use PCA The patient may require a change of prescription	Few attempts at using PCA More than five PCA attempts per hour	Not checking how often the patient is attempting to use the PCA Not using pain assessment to determine the extent of pain or to understand the significance of excessive pain
	Verify setting, drug dosage and connection on PCA Check PCA prescription and administration chart	The pump may not be working or setup correctly Additional or alternative medication may be required	Excessive attempts at using PCA	Not keeping track of PCA usage or checking the PCA pump for patency and accuracy
	Consider other possible causes of pain and assess the patient's abdomen as inadequate analgesia may not be the problem	Patients are not normally in a lot of pain There may be bleeding, haematoma **or** perforation of a body organ causing pain	The pain is not being relieved by the prescribed analgesia The patient's body language such as the placement of hands across the abdomen to minimise pain	Not looking for other causes of pain as the patient's vital signs are stable Not picking up on body language or other cues from the patient

	Consider patient safety Call surgeon, anaesthetist and/or acute pain team for assessment and review	The patient's condition is deteriorating	The pain is excessive	Not calling for a medical review - is not recognising the significance of increasing pain Advising the patient to keep pressing the PCA button without assessing them
The patient is anxious	Reassure the patient to reduce their anxiety Remain calm and stay with patient Communicate with patient and family and keep them informed	The patient doesn't understand what is happening	The patient's behaviour changes The patient expresses a feeling of dread and is needing support Increased restlessness	Focussing on physiological factors and not recognising the significance of the patient's verbal and behavioural cues
	Understand the patient's perspective	Emotional or cultural factors may be causing anxiety	Anxiety increases and is evident in the patient's facial expression	
	Attempt to control the patient's pain	Anxiety persists	Pain is not controlled within an hour following surgery	
The patient is pale	Assess for signs of bleeding and assess oxygen saturation	The patient may have internal bleeding or haematoma	Increasing pallor and clammy skin	Failing to recognise pallor as a sign of bleeding
	Increase frequency of observation of all signs and	Consider physiological compensation		Concentrating on electronic monitoring equipment and

	symptoms of the patient			not touching the patient's skin
	Check intraoperative blood loss	Determine fluid replacement since surgery		Delaying a response and not realising the patient is compensating physiologically and could quickly deteriorate
	Seek a second opinion from a senior colleague			
	Request medical review			
Patient is restless and extremely tired	Anticipate medical intervention	A late sign	Restlessness may not be excessive because of the intensity of the pain	Not providing a calm and restful environment can make the patient more tired
	Keep patient calm	Consider hypovolaemic shock		
	Maintain accurate record of events			
	Observe patient's demeanour for changes in responsiveness and increasing restlessness	Changes in the patient's behaviour and appearance indicate there is a significant problem		
	Consider increasing IV fluids and oxygen			
The patient states "I think I'm going to die"	Listen to the patient, explore their comment and ask to explain why	Not a good sign	Patient has a sense of foreboding which is usually due to a major event	Not understanding the relevance of the patient's comment
	Secure assistance from surgeon and anaesthetist			Delaying a request for assistance
	Increase	May indicate		Perceiving the

	frequency of observations to every 15 minutes Check oxygen saturation and increase oxygen if necessary Provide one-on-one care Re-allocate workload Anticipate the patient will return to theatre; NBM, check availability of blood for transfusion Notify family of change in patient's condition Provide reassurance	further deterioration in the patient's condition and imminent cardiovascular collapse	 The patient no longer responds to reassurance	patient is being dramatic and not exploring their comment or assessing them

7.2. Events

Each event including the associated actions, situation assessment and the critical cues experienced nurses respond to will be presented together with the potential errors they perceived that less experienced nurse would make. Narratives drawn from the transcripts are used to illustrate key points.

7.3. The Patient has a Persistently High Pain Score

7.3.1. Actions

In this incident all participants identified the patient's high pain score and the difficulty with controlling the patient's pain as an atypical event for a postoperative patient. Participants suggested several actions in response to this event which focussed on gathering information and searching for a cause for the patient's uncontrolled pain.

After assessing the patient's pain all participants' actions were initially directed towards the frequency of the PCA use by the patient. They indicated they would specifically assess the number of PCA attempts per hour documented on the PCA chart. If too few attempts are observed then the patient would be encouraged to use the PCA more. More than five attempts an hour would indicate that the analgesia regime needs medical review. The frequency of pain assessment would be increased until the pain is controlled.

> Check how often she's been pressing her pain button and whether she's using it [PCA] regularly. (Participant A)

> I'd encourage her to press her pain pump more. (Participant E)

> Certainly monitor her pain score. Normally we do it four hourly, but in her situation I would do it maybe every half an hour, until it has slightly settled down and then maybe every hour. Well encouraging her to use her PCA as often as she was able to. (Participant D)

Other actions involved checking the documentation such as the prescription chart to determine whether the dose of medication was adequate or whether an additional medication could be administered. One participant explained that regardless of the cause of the pain it would need to be treated. The functioning of the PCA delivery device would be verified. This would include checking the settings and connections.

> See if there's anything else she could have for pain because regardless of what's causing the pain, you've got to treat the pain. (Participant E)

> I normally check the PCA machines too, see if it's functional … whether the pain button is connected to the pain pump. I've come across a few that's not functioning very well. Whether it's running according to the charting, you must always check the charting as well. (Participant A)

If these actions have not addressed the situation then the nurses would seek assistance from the acute pain team or the on-call doctor to assess the patient and change the dose and/or medication.

> If we see that she's been using it, and yet she's still in pain, then there's probably a need to increase the level. It's time to go back to the order of the doctors. (Participant B)

> Maybe it's not enough and might have to get the acute pain team to assess her … maybe changing the dosage, or whether they need to try something else. (Participant A)

Patient safety is a concern because of the potential side effects from the prescribed analgesia. The participants considered the impact their actions could have on the safety of the patient.

> You had to manage safe levels of pain relief, because you didn't want to cause any harm or other side effects of over management. (Participant D)

The participant's actions however, were also underpinned with thoughts relating to causes other than inadequate medication for the patient's high pain score. The participants indicated an assessment of the patient's abdomen was needed to look for evidence of other causes. If an abnormal finding was identified, then the surgeon would be called to review the patient.

> Maybe feeling around the abdomen or where the pain is and see whether there could be any hardening, whether there could be something brewing in there … If the patient is in a lot of pain I would definitely get the surgeon to come and review the patient. (Participant A)

7.3.2. Situation assessment

All the participants perceived that not being able to control the patient's pain was due to something other than inadequate analgesia. The findings suggested that the participants' situation assessment was guided by previous experience with a similar situation. Four participants suggested the intensity of pain was probably due to bleeding. They also thought about other possibilities such as a drug reaction or perforation of a body organ during surgery or fluid collection. Even though the surgeon was satisfied the patient could return to the ward, the nurses believed that the patient was discharged from PACU prematurely. They could see the development of further deterioration and the need for

prompt medical intervention. One participant indicated that knowledge of the patient before surgery would have assisted in more easily recognising if this was unusual behaviour for the patient.

> But there must be something causing this [pain]. Her observations had remained reasonably stable, that doesn't actually weigh a lot with me because she's still got a lot of post-op drugs on board which might be keeping her stable, even though there's an underlying bleed I would say going on. Internal bleeding's very painful. However, the surgeon was satisfied she could return to the ward. Can't fight against that. (Participant E)

> If the pain's getting worse despite having appropriate analgesia there's something else going on … they're probably bleeding, or have a haematoma or something like that forming … or they're reacting to the drug or if the laparoscope has perforated something else. I had a patient that had that happen and they developed a bowel obstruction. (Participant C)

> I think her pain is not well under control, but it's also possible she might develop a collection [of blood] … Although she has stable observations but the pain is still not under control, she could be needing a review by the surgeon. (Participant F)

> If I'd looked after this patient before surgery … then that would indicate something is definitely wrong here. But post-op it's hard to distinguish whether she's still recovering from her surgery or whether there is something else happening as well. (Participant A)

The other participants also knew it was atypical that the pain was uncontrollable and there was a reason for it, however they did not indicate what they thought it was. One participant considered other factors in addition to the pain, while another perceived that the pain indicated the patient was deteriorating.

> I think for a patient with a pain score of five over ten it's not too bad because you can encourage her to just continue with her PCA. But the fact that she's pale, anxious, restless and looks extremely tired is something else. (Participant B)

> I'm thinking that there is deterioration in her condition, her pain is uncontrolled, there has to be a reason. There was something causing the pain. (Participant D)

7.3.3. Critical cues

Excessive pain that is not being relieved by the prescribed analgesia within a reasonable timeframe is a critical cue. It indicates that something other than insufficient medication could be causing the pain and the patient needs a medical review.

> The first thing was the excessive pain. You should be able to get on top of it fairly quickly. Requiring a lot of analgesia to get the pain under control, could be a signal that something's going on. (Participant F)

> If you've had all the pain relief, it [pain score] should be down to two or three. She'd had a lot of pain relief and it still wasn't managing the pain. (Participant D)

> They can only have five per hour [Attempts]. If they've already attempted like 15 or 20. Then that's already too many … it's about the time to call the anaesthetist. (Participant B)

Body language was another significant cue. Sometimes patients will place their hands over a painful area to minimise the pain.

> Well definitely would be her body language. Sometimes that does give you clues, you know, if she's holding the area trying to minimise as much of that pain as she can do. (Participant A)

7.3.4. Potential errors

Less experienced nurses may not use pain assessment tools accurately to determine the patient's level of pain. They may encourage the patient to keep pressing the PCA button as they do not recognise the significance of excessive pain.

> Not using the pain assessment and the pain score to find out how bad the patient is experiencing this pain. (Participant A)

> Not realising the significance of excessive pain. Because that's an experience thing. They're taught just keep pressing your button without doing any other assessments, without any flags going up. (Participant F)

Less experienced nurses do not think of seeking a medical review and contacting the acute pain team or a doctor until a more experienced nurse picks up the problem and directs them.

> I think not getting the acute pain team to review her. They don't usually contact the surgeons until another nurse who's more senior would have picked up the problem. (Participant A)

They are often unfamiliar with the equipment they are using and may not keep track of the patient's use of it. They may not notice the patient's increased attempts at using the PCA or think to check the pump connections and patency of the lines.

> Not checking how often she's pressing the pump, you know just checking if there's been an increase. (Participant D)

> Possibly not reading the PCAs and making sure they're patent and the lines correctly attached. (Participant C)

Less experienced nurses are more likely to focus on the cues they are familiar with such as the elevated heart rate and not think to assess the patient's pain.

> They might look at the elevated heart rate without first looking at the pain. (Participant F)

7.4. The Patient is Anxious

7.4.1. Actions

Remaining calm, staying with the patient, communicating with her, and working competently, were considered the most important nursing actions when a patient is anxious. It was suggested that it is reassuring for the patient when the nurse's actions convey she is being cared for. As one participant explained:

> This is a major event in their life. They've been through a lot. Suddenly they have machines, oxygen and the feeling that you're the only one there. Even if you're a stranger to them, they still need someone. If you're experienced, you're calm you know what you're doing, you show it to the patient, you stay with her. She knows that someone is looking after her that knows what she's doing. (Participant B)

Experienced nurses know that patients react differently to the experience of surgery, and that communicating with the patient is necessary to gain an understanding of the cause of her anxiety. Personal factors and cultural factors are important. Without understanding the patient's experience, nurses' actions will be based on assumptions.

> But there's still guesswork without actually talking to her. I would probably find out why she is actually feeling anxious. (Participant F)

> People react differently to different situations. So it could be just the fact that's she's nervous about this operation. But again people have different views on the situation. It could be the culture. Some people really get anxious, because they're used to having people [family] taking care of them. (Participant B)

Letting the patient know that information has been conveyed to the surgeon and keeping her informed about what is happening in an open, honest manner were suggested as necessary actions for reducing anxiety.

> Try and reassure her and say that, we're getting somebody to have a look at this. You can't say everything is alright…You can't lie to them. (Participant E)

> Speaking realistically there's really a big difference when you stay with the patient and you show them that you're doing something. (Participant B)

Getting the pain under control was another action considered important for reducing the patient's anxiety.

> Often they're anxious because they're just not coping with the pain. Once you get the pain under control they come right. (Participant C)

7.4.2. Situation assessment

On its own, anxiety is not uncommon postoperatively. It may indicate that the patient does not understand what is happening, particularly if it is the first time they have had surgery. In this situation, the participants indicated that postoperative pain was a cause for the patient's anxiety. They reasoned if the anxiety is due to the pain, the patient's anxiety should settle within the first hour following surgery. However when the patient remains anxious and the pain is not being controlled this causes uncertainty and the nurse is concerned.

> We get a lot of patients that appear pale and anxious post op after that operation and it takes about an hour sometimes to get their pain under control and the side effects of the analgesia under control. (Participant C)

> Maybe it was her first surgical experience. So it could be just the fact that she's nervous about this operation. (Participant F)

> Very anxious…you wonder why the pain wasn't being controlled despite all the pain relief that she had. (Participant D)

7.4.3. Critical cues

The participants explained when patients are anxious because "something is not right" they notice that they look and behave differently than what is normally anticipated in postoperative patients. Their anxiety increases and this is evident from their facial expression. They verbalise a feeling of dread and need more of the nurse's support than other patients.

> But the critical thing is the look of the patient. Looking at the patient, her increased level in anxiousness and restlessness. (Participant D)

> The facial expression, and sometimes she'll voice how she's feeling too. (Participant A)

> Anxiety isn't just anxiety, it's feeling dread. (Participant C)

> She only needs your support, the whole shift she is needy for you but you have other patients. (Participant B)

7.4.4. Potential errors

Less experienced nurses may focus more on physiological factors rather than psychological factors and not consider surgery as a major event in the patient's life. They may not realise the significance of what the patient is saying, they therefore fail to notice the patient's anxiety and do not understand what it means.

> They don't pick up on those [behavioural cues] or listen to what the patient is saying … because they focus more on the physiological …. Forgetting that it's an operation and it's a major event in a person's life. (Participant B)

7.5. The Patient is Pale

7.5.1. Actions

It is not uncommon for a patient's skin colour to look pale following surgery. When a patient's skin colour becomes increasingly pale, experienced nurses see this as a warning sign or "flag" and their actions focus on checking for blood loss and maintaining the patient's blood volume. They assess the patient's oxygen saturations and check the wound sites and wound drainage for any visible bleeding. The nurse feels the warmth of the patient's skin and feels for clamminess. Vital signs are checked and may be monitored more frequently. An abdominal assessment is carried out and the patient's abdomen is

checked for swelling, while the girth measurement is monitored for an increase in size. The patient's urinary output is checked. The estimated intraoperative blood loss is checked on the patient's operative record. When there is a concern regarding blood loss the nurse seeks a second opinion from another senior colleague and the doctor is contacted. A full blood count may be ordered to compare with the preoperative results.

> She's very pale, anxious, that's a flag. Re-do the recordings because sometimes there's just a minimal change, even if they're bleeding, Hopefully if she's just come back from theatre the doctor's still gonna be here. So I'd be, even at this stage, I'd be ringing for them to come around. The other obs would be the urinary output. (Participant E)

> Pale, if it's different from the post-op then it's a warning sign … we could check the blood loss in the operative record. In the recovery if the colour was fine, and then suddenly looks pale in the ward, then there's something that's impeding her. (Participant B)

> Check if it's patent, [wound drain] if it is draining, how much has drained and in what period of time, what does it look like? Is it thick blood or just washing? Look at the abdomen. The shape, how it feels, depress it … quite firm or hard, swollen, tight. Is it distended? Press on the wound or around the wound, see if that causes pain or you can feel pressure like a haematoma or something. (Participant C)

7.5.2. Situation assessment

The participants perceived the pale colour of the patient's skin was an indication that the patient was either bleeding or had developed a haematoma. Even though one of the classic signs of blood loss is hypotension, the normal blood pressure in this case did not sway their perception of the problem. They reasoned the normal blood pressure could be due to fluid volume replacement being given in theatre or to compensatory mechanisms. One participant explained when a patient is pale following surgery the first thing that comes to mind is blood loss.

> The assessment, well, I think there's a bleed going on there somewhere. A fairly brisk bleed or a haematoma forming because she feels so terrible. The reason why her blood pressure's still not concerning, is maybe she had a lot of fluid in theatre. (Participant E)

> The patient could be bleeding. She might've lost some blood but didn't show in her vital sign … her body could be compensating for that. That's what goes on. Because sometimes after surgery if they're pale the first thing that would come to mind would be loss of blood. (Participant F)

7.5.3. Critical cues

Increasing pallor together with clammy skin in postoperative patients is an early cue that may indicate bleeding and should not be ignored.

> Visually obviously pale, clammy, they're not really good signs. Pale and clammy, usually shows that something's going on physically. Yeah, it's not something that you want to ignore for too long. (Participant C)

7.5.4. Potential errors

Less experienced nurses may not recognise that pallor and clammy skin are early signs of bleeding and that a patient's condition can quickly deteriorate. They may concentrate on the vital signs and monitoring equipment and if vital signs are normal they do not look at or touch the patient. They delay responding as they do not think about compensatory mechanisms or the possibility that the patient could decompensate and seriously deteriorate.

> They may not recognise that it [pallor] might be a sign of bleeding and the body can be compensating for a while. They will look at the elevated heart rate. (Participant F)

> Not perhaps looking at the patient. Yes, just not as aware, not walking into a room and thinking oh, she doesn't look very well. Perhaps not picking up on that and just looking at the monitor. I think the most important thing is they've really got to touch and look. (Participant D)

> I think the recordings would put them off looking any further. Stable recordings would put them off quite easily and she [the patient] might go flat, She could actually go quite flat. If she [the nurse] hasn't picked up on it, she might go back in and find she's got an unconscious patient. (Participant E)

7.6. The Patient is Restless and Extremely Tired

7.6.1. Actions

When a patient is restless and extremely tired experienced nurses recognise this as a late sign that something is seriously amiss. They anticipate medical intervention will ensue. Their actions focus on calming the patient and talking to her, explaining what is being done and why. They ask the patient how she is feeling and reassure her. They observe her general demeanour and responsiveness. The patient is monitored more frequently to ensure

that a clear trend of events is documented. The patient's oxygen and fluid intake may need to be increased if restlessness progresses. Experienced nurses think ahead and anticipate the actions of the doctor or surgeon, such as a request for an x-ray of the patient's abdomen.

> So you increase her oxygen as she became more restless. Her IV fluids and site, you check that and increase the fluids. You monitor her more regularly so you have all that information on board. Reassure the patient. You're talking to her and explaining why you're doing these things and continually asking her how she's feeling, her general demeanour … less responsive. Also try and calm her down as much as we can. I think maybe the surgeon might decide to do an abdomen x-ray to find out the possibility of fluid collection maybe. (Participant B)

7.6.2. Situation assessment

Participants suggested that restlessness together with pallor and extreme tiredness is a late sign indicating there is a serious problem, such as hypovolaemic shock.

> But the fact that she's pale, anxious, restless and looks extremely tired is something else. I think it might be, hypovolaemic shock. I would assume it would be, being pale and also restless. (Participant B)

Even though the problem was not identified by physiological measurements at this point in time, one participant who questioned why not, was not deterred, as she had already determined there was a problem based on the patient's behaviour and appearance. The participant indicated she would conduct a more comprehensive assessment to look for further information to confirm her concerns.

> She's not so restless, and she looks very tired. That's a latish sign. There's something big going on there, but why isn't it showing up on her recordings? So you'd immediately do another big set of recordings. (Participant E)

7.6.3. Critical cues

Although the patient is very tired, the patient's restlessness may not be excessive. Experienced nurses recognise that is due to the intense pain which is preventing the patient from moving.

> So pain is the reason why … because she's got a lot of pain she won't be that restless. (Participant E)

7.6.4. Potential errors

Less experienced nurses do not understand the importance of a restful and calm environment when a patient's restlessness and extreme tiredness are due to physiological deterioration. In this situation less experienced nurses will be stressed themselves. They may panic as they try to analyse what is happening, as they cannot interpret the cues. When a nurse is stressed it can increase the patient's stress, tiring them even more.

> For me an inexperienced nurse usually makes the patient more tired…because you are stressed yourself, you are inexperienced and you panic with this situation. And instead of just giving the patient some rest, you will make the patient more tired. Usually that's what happens when you're new, you over analyse everything. (Participant B)

7.7. The Patient States "I think I'm going to die"

7.7.1. Actions

When a postoperative patient with intense pain, who is pale, anxious, restless and looks extremely tired says to an experienced nurse "I think I'm going to die," the nurse intuitively knows, regardless of physiological measurements, this statement is a grave warning of impending physiological deterioration that requires a prompt response. Experienced nurses know that patients themselves can "feel" physiological deterioration long before it is picked up in their vital signs or by monitoring equipment and they believe what the patient is telling them. They understand that urgent medical attention is needed to prevent a crisis. Securing assistance from the surgeon and anaesthetist is a priority. Vigilance is increased and the patient's vital signs, including oxygen saturation, are monitored more frequently. This provides a comprehensive record of the patient's progress so change in physiological status is quickly detected and treated.

Prescription orders are checked for volume expanders should the patient's blood pressure drop. The participants' actions focus on staying with the patient and providing one-on-one care. Re-allocating their patients to the care of another nurse would enable this. Reassuring the patient, particularly with pain management is important. The participants anticipate the patient will be returning to theatre to stop the bleeding. In preparation, the patient would be placed on nil-by-mouth. It is expected the patient would require a blood transfusion so the availability of blood is checked. The patient's family/*whānau* are informed of the change in the patient's condition.

"I think I'm going to die" is a pretty big warning sign. I'd be doing 15-minute recordings now and one-on-one. And even though you have nothing much to go on, except your gut instinct because your recordings are all stable, something's telling me that there's something to be very worried about here. You've got to accumulate a little bit more evidence. So we'd start documenting everything. Cold, clammy, this sense of impending doom and this tiredness isn't at all a good sign. I can't understand why her blood pressure hasn't dropped and she's tachycardic. But I would certainly notify the anaesthetist or the surgeon. And I would inform the clinical duty manager that you're concerned. You know, it's not all just recordings. (Participant E)

There's not very much you can do here, check there's a group and hold or blood in theatre. Just talk to her, check PV loss, check drains … looking if there's excessive drainage there. I'd put her on nil-by-mouth in case she has to go back to theatre. Sometimes on the fluid balance chart there are orders for volume expanders if the blood pressure drops below a certain level but unless it has dropped you can't give it. Well, it is a critical thing, it's quite a major event. It's a sense of foreboding, a feeling that something bad is looming. Also contact her husband. Contact the surgeon and the anaesthetist and request them to come to the ward. Ask for assistance, re-allocate your other patients to other staff members on the ward. And check her for signs of bleeding. I'm thinking that there's bleeding. (Participant D)

I think I'm going to die. When they say that, then we have to believe them. It's something there … I experienced … I'm not sure, 2 weeks ago. She really died too. (Participant B)

7.7.2. Situation assessment

In this situation the participants recognised the urgency of the situation. They could 'see' the patient's statement was primarily due to deterioration resulting from postoperative bleeding. From previous experience they recognised imminent cardiovascular collapse and the need to be proactive and plan their actions.

The thing that worries me is she was sent back like this. I think she was sent back too soon. I'd say that they've either left a vein bleeding; she'll need to go back to theatre. I don't think it's just a little seep, I think if she was feeling like that, and her pulse rate is 102 which is up a bit from the norm I'd say she should be going back to theatre. I mean tranexamic acid's not gonna work. Quite easily she might go flat, if that bleeding is severe enough. Because the difference between bleeding in recovery, where it might be slower because of the anaesthetic drugs keeping the recordings stable and in that couple of hours of being back in the ward they might actually bleed more. The fact that she said I'm going to die … we just had a patient not long ago who said that and she was bleeding, so. Bleeding obviously. If there's a bleed if she's at this stage, if she's feeling like this, I would say that very shortly those records are going to drop. She's going to

get tachycardic, she's going to start [de]compensating and it would be nice to get on top of it before she does. (Participant E)

7.7.3. Critical cues

In conjunction with the critical cues from other events, the participants understood that what the patient was saying to them was a late warning sign that she is having a large bleed. What stands out now is the patient has increasing anxiety and no longer responds to reassurance.

> Yeah, not responding to reassurance, visually, obviously pale, clammy, they're not really good signs. (Participant C)

> Well the critical things that stand out is the patient stating that she was going to die and her anxiousness. Like being restless, anxious, that's not normal. No, well that will go with this sense of doom that patients get when they're starting to bleed fairly heavily. (Participant D)

> That awful, I think I'm going to die, thing. And impending doom. Patients who are having MI's get that and it's a very significant late stage thing. She might be just over anxious and feeling grotty but that's certainly something that makes you very, very worried. The whole scene really. (Participant E)

7.7.4. Potential errors

In this situation less experienced nurses may not recognise the gravity of the situation. They may perceive the patient is being dramatic and disregard her comment or they may be alarmed by it, panic and lose the ability to respond. They do not understand the significance of the cue therefore they leave the patient without exploring the comment further and do not assess the patient as the vital signs are stable. They delay calling for assistance and wait for someone else to take control.

> Not taking them seriously, and think they're just being a bit dramatic. Communication wise, not getting them to explain themselves and instead just brushing them off. Probably too unwell to be able to explain themselves anyway. I've noticed inexperienced nurses panic so they freeze. They don't know what to do, so they just don't do anything. They probably do know, but they wait for someone else to take over. (Participant C)

> I would say they'd be overwhelmed by the statement. I think today they'd be frightened by it. They wouldn't act. Hopefully they would. But I think when someone makes that statement you would go and tell someone. She might fail to contact the surgeon, or request assistance as quickly as someone might who was more senior. She just might not know, what to do.

> I'd like to think that an inexperienced nurse, when someone makes a statement like that, goes and gets someone who's senior and then they can assess them together. If she doesn't, if she just looked at the blood pressure, the pulse, respirations, she may not think to look at her PV bleeding. She might not think to check her abdomen. She could be called away to her other patients and not realise the emergency. (Participant D)

> But they might leave her seeing as her recordings are stable and run off and have a look at all their other patients first, read their charts first… get side tracked. And by the time they did get to this patient their recordings may have changed dramatically. (Participant E)

7.8. Discussion

In this simulation the patient's vital signs gave no indication of the critical nature of the problem. What was transparent was the participants' skill in recognising the potential for further physiological deterioration and managing a critical situation without relying on objective physiological data.

In the simulation the participants were dealing with an uncertain and atypical postoperative situation, yet they quickly detected a postoperative bleed before it was evident in the patient's vital signs. They recognised from the way the patient looked and from what the patient said, significant cues described as "flags" or warning signs that they had previously seen in other patients. This approach conforms to the RPD model (Klein, 1993).

In the simulation table each categorised event can be described as a cue. The findings show that within each event, there are critical cues that shape its significance. Ultimately it was not a particular, individual event that was critical. It was the combination of events that together created a familiar pattern that alerted the participants to the nature of the problem. Recognising the pattern of events and understanding its significance enabled the participants to quickly identify a course of action that would potentially save the patient's life. This approach to decision-making is highly dependent on the level of experience of the nurse (Benner & Tanner, 1987) and is the basis of the RPD model.

When explaining their actions and the decisions they were making, there was evidence that the participants used intuition to gain an understanding of the problem. One participant described it as "gut instinct" and another participant stated "you just knew" when trying to explain how they recognised physiological deterioration without changes in objective data. The RPD model recognises that experience underpins intuitive decision-making and that

experts can utilise intuition to make decisions more quickly and accurately than novices. Intuitive judgement is what distinguishes experienced nurses' decision-making processes from those of less experienced nurses (Benner & Tanner, 1987). There is evidence that participants in this study also used an analytical process when they required more information to confirm their concerns and make decisions about a course of action in situations that were unfamiliar to them. This is the cognitive process less experienced nurses are more likely to use to problem solve as they cannot match information because they have limited previous experience (Benner et al., 1992),

The findings revealed that the picture of early haemorrhage seen by the experienced nurses looked different to that seen by less experienced nurses. Due to their lack of clinical experience less experienced nurses rely on protocols and theoretical knowledge for clinical decision-making. They may not recognise the seriousness of the situation and leave the patient while they attend to other routine tasks. They may not recognise the significance of critical cues and disregard them as not being important. When faced with an overwhelming situation less experienced nurses may panic and are then not be able to respond. Treatment for the patient is therefore delayed as they wait for someone more senior to intervene. They may rely on cues learned from textbooks or changes in a patient's vital signs to alert them to deterioration in a patient's physiological status. However, as the findings from this study show, vital signs recordings may be less sensitive than experienced nurses' intuitive knowledge in detecting early warning signs of postoperative bleeding following a laparoscopic hysterectomy.

The general surgical ward is a complex and emotionally demanding environment charged with relentless stress where nurses' decisions are often based on inconclusive and confusing information. The decisions nurses make will have an impact on the patient's recovery from surgery. When a patient develops a complication following surgery, decisions need to be made quickly. This depends on the nurses' ability to cope with uncertainty and rapidly identify problems and intervene appropriately. Focussing on the wrong cue may result in an incorrect decision being made and this could be potentially life threatening.

7.9. Conclusion

The findings have provided some insight into the acquisition of nurses' cognitive skills and revealed that experience is an essential component for their development. The findings have revealed that when they are confronted with a patient whose condition is deteriorating, experienced nurses are able to recognise particular patterns of cues that are meaningful to them. This enables them to predict what might happen and competently make rapid decisions to rescue the patient. This contrasts to the superficial knowledge of less experienced nurses which is less structured and more fragmented. When the same cues are viewed by less experienced nurses they do not recognise them as important because they have not yet learned the construction of the patterns or their significance (Benner et al., 1992). Consequently less experienced nurses are not able to react to atypical situations or make decisions under pressure.

The simulation interviews have shown that the accurate recognition of patterns of cues is an important aspect of intuitive clinical decision-making which aids recall of relevant information. This cognitive process enabled the participants to problem solve and intervene appropriately when a postoperative patient was deteriorating physiologically. Insight has also been provided into the differences in performance between experienced and less experienced nurses with respect to their cognitive processes when faced with the same situation.

To identify the cognitive demands nurses encounter when a postoperative patient is deteriorating physiologically and the cognitive skills they need to respond effectively, a cognitive demands table (CDT) was subsequently constructed using synthesised data from the task diagram, knowledge audit and simulation interviews. The CDT is the focus of the following chapter.

Chapter 8. Cognitive Demands Table

This chapter presents the findings from the final table in the ACTA. The CDT categorises the cognitive demands associated with a challenging situation for surgical nurses and identifies the knowledge they require to make appropriate decisions. Furthermore, it brings together the NTS identified in the observational study and the cognitive skills nurses used to respond to the cognitive demands identified in the ACTA. Understanding the cognitive demands of a challenging situation for general surgical nurses and how nurses apply their cognitive skills to respond to those demands is important for ensuring nurses are adequately equipped to provide safe and effective patient care in general surgical wards.

The three interviews (task diagram, knowledge audit and simulation interview) generated a vast amount of data that needed to be organised into a format that enabled relevant information to be extracted and common themes identified. As recommended by Militello and Hutton (1998) a CDT was constructed to summarise and synthesise the analysed results of the three interviews in order to identify the cognitive demands placed on nurses when a patient has a complex postoperative complication. The problem identified by the participants as one of the most challenging situations surgical nurses face in clinical practice is a postoperative complication which leads to physiological deterioration.

The CDT summarises information about the cognitive demands placed on nurses when managing the care of a patient with a complex postoperative complication. It explains how experienced nurses respond to these cognitive demands while detailing the specific cognitive elements of each cognitive demand. These cognitive elements include the unique difficulties of each cognitive demand, the cues attended to by experienced nurses and the strategies they use to ease the cognitive load for each critical decision they make. The CDT presents the factors that make the situation challenging and the types of information nurses need to support proficient decision-making. At the same time the common errors less experienced nurses make are exposed. Furthermore, the CDT sheds light on the significance of nurses' clinical expertise in decision-making when decisions need to be made rapidly.

Overall, five difficult cognitive demands were identified and summarised in Table 17. They are: early recognition of physiological deterioration, confirming physiological

deterioration, initiating rescue, securing medical assistance, and rescuing the patient. The CDT also explains the cognitive skills that nurses need to respond effectively to the cognitive demands associated with a postoperative patient who is deteriorating physiologically.

Table 17: Cognitive Demands Table

Difficult cognitive demands	Why difficult?	Critical cues and cognitive strategies experienced nurses use	Common errors less experienced nurses make
Early recognition of physiological deterioration	Initially body systems are able to compensate when compromised and may conceal or mask deterioration Requires rapid assessment	Observe for any changes in the patient's physical, behavioural or emotional status Ask patient how they are feeling and note what they say Do not rely solely on monitoring equipment to detect deterioration Listen to depth and pattern of breathing Feel patient's skin temperature and peripheral warmth Palpate strength, volume and regularity of radial pulse Evaluate vital signs Anticipate there could be further deterioration	Less likely to realise the significance of subtle changes in a patient's behaviour or appearance Less likely to rigorously assess the patient allowing deterioration to go undetected Continue the same care as the patient seems stable

		Keep in mind the safety of the patient	
Confirming physiological deterioration	Requires knowledge and awareness of possible factors that may cause, signify or contribute to deterioration Requires ability to interpret uncertain information	Look for any deviations from expectations of a normal recovery Consider the patient's history Check functioning of all equipment Consider accuracy of documentation Analyse all recent assessment data to determine trends Consider patient's concerns and comments May verify patient's behaviour with family/*whānau* Discuss any concerns with colleagues and medical staff	Do not know what to look for and do not delve deeply enough Do not think to regularly check the functioning of equipment May record an abnormal reading and not think to assess the patient physically May dismiss patient's comments as being dramatic or down play what they are saying Have tunnel vision and they do not understand what is happening or what they are seeing
Initiating rescue	Requires consideration of contributing factors Requires appropriate choice of response	Do not waste time Know the system, protocols, procedures, resources and who to call and when Prioritise and initiate actions depending on the nature of the situation	Tend to wait for further signs as they lack understanding of the problem Delay initiating care as they do not know what to do first or how to respond

		Consider and try alternatives to manage immediate concerns e.g. cooling measures, correct positioning	Rely on medication and do not consider alternative therapies
		Inform the patient of the situation	May be overwhelmed or frightened and do not know how to act or communicate with the patient
		Keep the patient calm	
		Know what to say to the patient and how to say it	
		Provide appropriate information with compassion	
		Inform colleagues and delegate tasks Inform patient's family/*whānau*	Do not delegate or ask for assistance with their other patients
		Increase frequency of observations	
		Provide one-on-one nursing care until medical review	Are unable to make autonomous decisions and may wait for someone else to take over
		Set up the work environment to suit the situation	
		Have all required equipment and documentation ready before assistance arrives	Rely on routine procedures as unsure of options
		Have emergency equipment at hand Maintain a quiet, restful environment	Are stressed, panic and not able to provide a calm and

		Work systematically and remain calm	restful environment
		Maintain accurate documentation of patient's progress and nursing actions	May not document events as they unfold
Securing medical assistance	Requires clear and concise transference of meaningful information that highlights the urgency of the problem	Prepare and have all relevant patient data at hand before calling for medical assistance	Are reluctant to request assistance from medical staff as they lack knowledge of the clinical area and fear making a mistake
		Communicate using accurate clinical language	
		Use a systematic approach to convey concerns about the urgent nature of the problem	
		State clearly what is needed and request/recommend the assistance required	
Rescuing the patient	Requires a common understanding amongst team members about what needs to be done	Collaborate with doctor to formulate the on-going plan of care	They freeze and do not know what to do as they lack experience with participating in critical situations
		Carry out and share tasks for management of the situation such as setting up and managing IV infusions, administering medications, increasing oxygen, checking the patient's	

		haemoglobin and sending requests for urgent bloods	
		Maintain frequent monitoring of the patient and observe for further deterioration	
		Keep team members informed of the patient's progress and promptly notify them of any changes	
		Keep the patient and their family/*whānau* informed about what is happening, what is being done and why	
		If required coordinate the transfer of the patient to either a special care unit, operating room or another tertiary facility	

The five difficult cognitive demands are now discussed in turn. The discussion will also include the differences in approach, between experienced and less experienced nurses, to the cognitive demands presented in the CDT and the NTS associated with each cognitive demand.

8.1. Early Recognition of Physiological Deterioration

Recognition of a patient's deteriorating condition is crucial for the general surgical nurse when providing care for a postoperative patient. This cognitive demand arises in the early compensated state of physiological deterioration when body systems are being maintained and vital signs are in the normal range.

8.1.1. Why it is difficult

The data from the ACTA interviews suggest early detection of physiological deterioration is difficult as its causes are variable and initially body systems are able to compensate which may conceal or mask the deterioration. For example hypovolaemia[11], due to haemorrhage or un-replaced blood loss following surgery, can progress to hypovolaemic shock resulting in organ damage and death if adequate blood volume is not restored. The adverse effects of low blood volume and impaired tissue perfusion are not immediately apparent in the patient's blood pressure, pulse rate or respiratory rate due to the body's compensatory mechanisms. When an imbalance occurs, the body is capable of auto-regulation through compensatory mechanisms which detect variations from normal limits and return them back to normal or homeostasis (Copstead & Banasik, 2010, p. 14). If the underlying problem is not resolved quickly enough the patient's condition can rapidly deteriorate as there comes a point when compensatory mechanisms can no longer maintain homeostasis and it is too late for organ systems to recover, resulting in irretrievable harm. Consequently when faced with a critical situation, health care professionals have a limited therapeutic window to prevent irretrievable harm, and therefore the choice of the correct action, and any decisions needs to occur quickly (St. Pierre et al., 2011).

8.1.2. The cues experienced nurses attend to and the strategies they use

The data revealed that nurses use a wide variety of information to inform their decisions about the management of patients' problems that arise. The experienced nurses recognised early physiological changes from subtle cues that indicated to them a problem was developing. For experienced nurses the initial recognition of physiological deterioration was 'the patient doesn't look right' which they described as a slight change in the behaviour or appearance of the patient. For example, a patient who looks pale and is swallowing frequently or spitting small amounts of blood following a tonsillectomy is a significant issue and warrants immediate attention. Without delay, the patient's vital signs are assessed and cooling measures are applied to control haemostasis. Meanwhile, the nurse gathers information about the patient's condition to discuss with the doctor.

The experienced nurses recognised that each patient has their own knowledge of his/her current situation. They listen to what the patient is telling them, as they know patients can

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[11] Hypovolaemia, an abnormally low circulating blood volume (Harris, Nagy & Vardaxis, 2010, p. 863).

'feel' physiological deterioration. In addition to patients 'not looking right', experienced nurses recognise the presence of physiological deterioration from the patient's description of how they are feeling, what they are feeling and how they are behaving. They know that each situation is different and that visual, auditory and tactile information is critically important for detecting emerging deterioration. Experienced nurses know that relying solely on electronic monitoring devices to gather information can be misleading as they are limited to displaying physiological data. As explained above, experienced nurses anticipate this data will stay within normal parameters in the early stages of deterioration.

Once early physiological deterioration is recognised, the nurses' actions centre on keeping the patient safe from potential harm, as they know the patient's situation can quickly evolve into further decline. The effectiveness of the nurses' actions initially depends on the accuracy of their pattern recognition and the detail they can recall from memories of previous, similar experiences.

8.1.3. Common errors less experienced nurses make

Detecting early physiological deterioration is often quite challenging for inexperienced nurses because they have had limited exposure to complex problems. They lack awareness of the situation and do not notice early patient cues such as restlessness. Even where changes in a patient's cues are recognised, the inexperienced nurses will often not interpret them as being significant, as the patient's vital signs may not have altered. Therefore, they are less likely to assess the patient but continue the same care as the patient seems stable to them. Consequently, early cues are missed and early deterioration is not detected.

8.1.4. Associated NTS

This difficult cognitive demand is associated with the NTS of situation awareness, decision-making and communication.

8.2. Confirming Physiological Deterioration

The data suggested that confirming early physiological deterioration is a difficult cognitive demand because it does not always present in the patient's EWS, and this is the tool used to call for expert help. Once physiological decompensation occurs and homeostasis is no longer being maintained, deterioration can proceed rapidly narrowing the opportunity for

therapeutic intervention. Therefore, confirming the problem, physiological deterioration as early as possible is vital and requires rapid decisions to be made, often with incomplete information.

8.2.1. Why it is difficult to confirm physiological deterioration

In the event of physiological deterioration, as mentioned above, the underlying pathology may be concealed and much of the information needed to confirm the problem is not available. The subtle cues are often unspecific and the information they provide is incomplete making it difficult to confirm that cues observed are due to the deterioration of a patient's physiological status. Confirming the problem is a time constrained situation and requires the nurse to be able to interpret uncertain information and make decisions under pressure. In this situation, because information is incomplete, the nurse relies on previous experiences of similar situations to guide his/her decision-making. Previous experiences develop knowledge and awareness of the expected progress of recovery from surgery and the possible factors that may cause, signify or contribute to deterioration.

8.2.2. The cues experienced nurses attend to and the strategies they use

When confirming physiological deterioration, the data show that experienced nurses look for any deviation from the expected path of recovery following surgery. This includes the technical and non-technical aspects of the patient's care. While still at the patient's bedside the experienced nurse checks the functioning of all equipment in use, such as intravenous infusion devices delivering fluids and medications, as he/she knows that malfunction of equipment can be a potential cause of physiological deterioration. Correct placement on the body of any monitoring equipment in use is verified to ensure accuracy of the data being recorded. A check of the patient's health history is made to look for significant cues such as medication interactions and co-morbidities. This information may be gained directly from the patient or from the documented clinical notes. The accuracy of all documentation relating to the patient's progress since surgery is confirmed and all assessment data examined for trends including preoperative and intraoperative information. Any concerns or comments the patient may have expressed to the nurse are considered. If there is concern about a patient's behaviour it is discussed with a member of the family/*whānau* where possible. If uncertainty persists an experienced nurse will

discuss his/her concerns with nursing colleagues and medical staff and request assistance before taking action to escalate the patient's care.

8.2.3. Common errors less experienced nurses make

Confirming deterioration is challenging for less experienced nurses. Experienced nurses reported it requires situation awareness to be able to think critically and process the patient's verbal and non-verbal cues to gain an understanding of the present situation. However, if the nurse has not had previous experience of the situation the meaning of patient cues may not be apparent. When a patient exhibits signs of early deterioration, less experienced nurses can display 'tunnel vision' as they do not recognise what they are observing and fail to comprehend the urgency of the immediate situation. Consequently they do not delve deeply enough to determine that there is a problem as they do not know what to look for. For example, they may record an abnormal reading of a vital sign and not think to assess the patient physically as they attribute it to a 'normal' response following surgery. Similarly they may not pay attention to what the patient is revealing through the feelings they express and may dismiss the patient's comments as being dramatic, or they may downplay what the patient is saying. Furthermore, less experienced nurses tend not to maintain awareness of the equipment such as intravenous lines and infusion pumps, as they are unfamiliar with the equipment and may not recognise if it is malfunctioning.

8.2.4. Associated NTS

This difficult cognitive demand is associated with the NTS of communication, situation awareness and decision-making.

8.3. Initiating Rescue

Once it is determined that the patient's condition is deteriorating, the patient's survival is threatened. The cognitive demand of 'Initiating Rescue' requires the nurse to initiate appropriate actions so treatment can be implemented as quickly as possible to address the problem and minimise the potential for further physiological decline.

8.3.1. Why it is difficult initiating rescue

Initiating rescue requires cognitive skills that include an in-depth understanding of the factors that may be contributing to the patient's physiological deterioration. These skills are necessary to determine the appropriate choice of response.

8.3.2. The cues experienced nurses attend to and the strategies they use

The data show that once the experienced nurse has confirmed that the patient's condition is deteriorating, a plan of action is determined and time is not wasted. Experienced nurses know they have a limited window of opportunity in which to intervene. They know the resources available to them and the protocols and procedures to follow. They know who they need to call and when to call for medical intervention. Appropriate interventions are prioritised and initiated depending on the nature of the situation. For example, in a patient experiencing increasing abdominal pain and breathing difficulties an experienced nurse firstly positions the patient to reduce discomfort and promote chest expansion before initiating other interventions.

The patient is informed about the situation. Experienced nurses have mastered therapeutic communication techniques and know what to say to help the patient understand what is happening without alarming them. They have an empathetic understanding of the patient's experience and know it is important that the patient feels supported to reduce their stress, and how imperative it is to keep the patient calm to minimise their stress response. The patient's family/*whānau* is informed of the change in the patient's condition and their questions are responded to.

As teamwork is important, other nursing colleagues are informed of the situation. To maintain continuity of care, tasks are delegated. For example the nurse's other patients are assigned to another nurse to enable one-on-one nursing care to be provided to the deteriorating patient until medical review is undertaken and the situation is resolved.

The frequency of nursing observations of the patient is increased and on-going documentation of the patient's progress and nursing actions are maintained. The patient's clinical notes are maintained at the patient's bedside.

The work environment is set up to meet the requirements of the situation. Needed equipment is prepared and brought to the bedside ready for use before medical assistance arrives. Maintaining a quiet and restful environment is important for preserving calm.

8.3.3. Common errors less experienced nurses make

The experienced nurses reported that when less experienced nurses are concerned about a patient, but do not have a deep understanding of the potential problem, they tend to wait and see if the patient's condition changes and thus delay initiating rescue. They may be overwhelmed or frightened and this can result in them failing to intervene as they cannot articulate their concerns to medical and senior nursing staff. Because they are unfamiliar with the situation, less experienced nurses cannot project into the future and anticipate events or plan for them. They do not know how to respond or what to do first and they rely on protocols to guide their practice instead of finding the best solution based on their assessment of the patient. Because they are not able to make autonomous decisions, less experienced nurses continue the same plan of care and wait for someone else to take over and escalate care of the patient. They cannot inform the patient about the change needed with their care as they have limited experience using therapeutic communication skills in complex situations and this makes it difficult for them to know what to say.

Stress becomes a factor in unfamiliar situations and less experienced nurses may panic and not be able to provide a calm restful environment for the patient. They may lack confidence with teamwork skills and not delegate or ask for assistance with their workload. Consequently, they may not think to maintain documentation of events as they unfold.

8.3.4. Associated NTS

This difficult cognitive demand relates to the NTS of planning, decision-making, communication, situation awareness, and teamwork.

8.4. Securing Medical Assistance

The data show when management of the problem is ascertained to be outside of the RN's scope of practice, medical intervention is requested by the nurse. This cognitive demand

requires the nurse to be an advocate for the patient and make the medical team aware that prompt medical review and assistance is needed.

8.4.1. Why it is difficult securing medical assistance

The data revealed that early physiological deterioration is not always accompanied by changes in objective clinical signs which doctors respond to. Nurses, through their close contact with patients, have learned to recognise patterns of subjective cues that suggest deterioration and therefore medical attention is required. Doctors, however, do not afford the same level of importance to these cues and may delay responding until there is evidence of deterioration in patients' objective data such as vital signs, urine output or wound drainage.

Securing medical assistance requires a shared understanding of the problem to be established through effective communication between the nurse and the medical team. This necessitates the transference of clear, concise meaningful information and recommendations from the nurse that are easily interpreted and understood by the doctor(s). A dysfunctional pattern of communication can lead to a delay in securing medical assistance.

8.4.2. The cues experienced nurses attend to and the strategies they use

Prior to contacting the medical team, experienced nurses reported they assess the patient and have available all relevant patient information. This includes their assessment findings, knowledge of the patient's clinical progress and treatments, observational data trends, recent diagnostic test results, current medications and any other pertinent information.

To secure the response they are seeking experienced nurses provide a detailed and systematic account of the problem to inform the doctor(s) of their concerns. They clearly and concisely state what they think the problem is, what is needed, and request or recommend the assistance they require.

8.4.3. Common errors less experienced nurses make

The experienced nurses indicated that less experienced nurses are reluctant to request assistance from medical staff as they lack knowledge of the clinical area and fear making a

mistake. They may not have an adequate understanding of clinical terminology, making it difficult for them to clearly articulate their concerns to the other health professionals.

8.4.4. Associated NTS

This difficult cognitive demand relates to the NTS of patient advocacy, situation awareness, decision-making and communication.

8.5. Rescuing the Patient

The data revealed that a patient who is showing signs of physiological deterioration requires increased therapeutic intervention from the nursing and medical teams. This cognitive demand necessitates that nurses and doctors work collaboratively to provide safe and effective care and that they have a common understanding of the goals they are trying to achieve.

8.5.1. Why it is difficult rescuing the patient

Rescuing the patient requires effective teamwork which necessitates a sharing of information amongst team members of what the problem is and what needs to be done. A clear flow of information and active participation in decision-making by individual team members are necessary actions. Difficulties can arise in this situation when nurses and doctors have not been taught the interprofessional teamwork skills and the communication skills they need to work together effectively. Furthermore, team members may lack sufficient experience in the situation they are dealing with and need guidance with their role.

8.5.2. The cues experienced nurses attend to and the strategies they use

During rescue of the patient, the experienced nurses indicated that it was necessary to work collaboratively with other team members and contribute to the decision-making process regarding the on-going plan of action. This requires utilising leadership and management skills and delegating tasks, or sharing tasks specific to the problem, to promote the well-being of the patient. In addition to caring for the patient and ensuring frequent monitoring was being maintained, the nurses carried out interventions such as managing intravenous infusions, administering medications and oxygen, and sending requests for urgent blood tests, such as a full blood count, to the laboratory to assess the patient's haemoglobin level.

The experienced nurses indicated they communicated with other team members to keep them informed of the patient's progress and notified them of any changes. They also kept the patient informed of the situation and supported the patient's family/*whānau*. If required they co-ordinated the transfer of the patient to a special care unit such as an ICU or the OR.

8.5.3. Common errors less experienced nurses make

According to the experienced nurses less experienced nurses 'freeze' and do not know what to do as they lack experience with participating in critical situations. A consequence of their lack of experience is they do not initiate interventions independently or contribute to team decision-making.

8.5.4. Associated NTS

This cognitive demand is associated with the NTS of communication, teamwork, decision-making, situation awareness and leadership and management skills.

8.6. Discussion

The CDT has presented the specific cognitive demands required of nurses in general surgical wards when a patient has a surgical complication and his/her condition deteriorates. In addition, the CDT identifies the knowledge and skills nurses need to respond safely and effectively to those demands. Specifically it has identified the important cognitive skills and strategies that form the core of effective decision-making by experienced nurses. It has also illustrated the limitations in knowledge and strategies of less experienced nurses. While the ACTA focussed on cognitive skills, the study has shown that nurses use both social and cognitive aspects of the NTS identified in Chapter Four.

As the CDT has shown, the nurses used a combination of cognitive skills and processes to manage the safe and effective care of a surgical patient who is deteriorating. Situation awareness is one cognitive skill that was shown to have a key role in the decisions the nurses made. It enabled them to initiate appropriate interventions aimed at preventing further deterioration while restoring the patient's physiological functioning. As shown in the findings above, situation awareness is a cognitive skill that nurses required to respond

to each cognitive demand. Situation awareness enabled the nurses to gain information from the patient's cues and understand the patient's progress so that timely decisions could be made to initiate a safe response to the situation.

The CDT shows that nurses also used decision-making skills to respond to each cognitive demand and that they used both RPD and analytical decision-making processes, depending on the nature of the cognitive demand they were responding to. The cognitive demand of 'early recognition of physiological deterioration' exposes the ability of experienced nurses to recognise and understand the meaning of subtle subjective cues when a patient's progress is beginning to deviate from what is expected. The cues are context specific and the nurses reported that they recognised patterns of cues from previous similar experiences that signalled the patient was deteriorating. Some participants described this initial recognition as intuition. This is consistent with Benner and Tanner (1987) who described the ability of expert nurses to make effective decisions based on pattern recognition as "intuitive judgement" (p.23) or "understanding without rationale" (p.23). This, the nurses explained, is learned from experience. This also aligns with Klein and Calderwood's (1991) assertion that in naturalistic environments proficient decision-makers use recognitional processes to generate an effective response to a problem. Likewise Klein (2008) emphasised the role of experience in enabling people to make effective decisions and he explained that the ability to rapidly match learned patterns of cues to a situation enables decision-makers to rapidly make decisions about a course of action without comparing options.

Once physiological deterioration was recognised it was important for the nurses to correctly identify the underlying cause of the problem and to initiate a plan of action. This required the nurses to use an analytical decision-making process to verify their intuition and ascertain if the pattern of cues they had observed was for the reason they suspected. As shown in the CDT the experienced nurses responded to the cognitive demand of 'confirming physiological deterioration' by conducting a clinical assessment of the patient and critically analysing the trends of data presented in the patient's clinical records where they looked for deviations from a typical postoperative recovery. While this is a slower decision-making process than pattern recognition it was important that the nurses had information available that supported their choice of response and enabled them to communicate their concerns to other team members.

The CDT illustrates that the nurses also used analytical decision-making processes to meet the cognitive demand of 'initiating rescue' as they considered the patient's response to alternative measures used to address immediate concerns. The nurses also made analytical decisions when they selected relevant patient data to respond to the cognitive demand 'securing medical assistance'. 'Rescuing the patient' was a cognitive demand that required the nurses to work collaboratively with the medical team and share in the decision-making process for the on-going plan of care for the patient.

The CDT has revealed that participants used two different types of thinking: intuition and analysis when they made decisions. Moreover, it shows the type of thinking the participants employed was dependent on the characteristics of the cognitive demand.

The CDT shows that in addition to situation awareness and decision-making skills, efficient planning was another important cognitive skill required for 'initiating rescue'. The nurses were required to think ahead and work promptly to develop a plan of action appropriate for the situation.

The cognitive demand of 'rescuing the patient' also required leadership and management skills. This was a necessary NTS for delegating responsibilities to other team members and ensuring the work environment was set up safely with essential resources readily available.

Patient advocacy was required to respond to the cognitive demand of 'securing medical assistance. Gaining timely medical intervention was critical for maintaining the safety of the patient

The CDT shows that communication was also a key NTS that nurses required to respond to each cognitive demand. Effective communication skills were essential for promoting the transfer of information with team members and also the patient and his/her family/ *whānau*.

As already noted experienced nurses' cognitive skills enable them to problem solve and respond adeptly when they notice early signs of physiological deterioration and this can significantly influence the potential outcome for the patient. The CDT demonstrates that experienced nurses develop and implement strategies that enable them to facilitate effective management of the cognitive demands they are facing. In contrast, less experienced nurses rely on the guidance of more experienced nurses during cognitively

demanding situations. The difficulty for them is that they are still developing the cognitive skills they need to intervene appropriately. They have had fewer relevant experiences to learn from, and therefore need to work alongside experienced nurses to acquire the necessary knowledge and skills. This finding supports other work that shows experts are proactive and collect a number of cues to explain anomalies, whereas novices are reactive and tend not to look beyond the immediate problem (Hoffman, Aitken, & Duffield, 2009).

The findings from the ACTA have clearly highlighted that experienced nurses and less experienced nurses respond to cognitive demands differently, with less experienced nurses more likely to make errors, as they have less well-developed NTS. This finding has implications for the safety of patients and what needs to be included in nursing education.

8.7. Conclusion

The three previous chapters have presented the findings from the ACTA. In Chapter Five task diagrams were presented and provided an overview of the elements of safe and effective care of a deteriorating surgical patient, as reported by the participants. Where cognitive skills predominated in the elements of the task diagram, these were highlighted as the focus for the subsequent knowledge audit chapter and were probed further. Chapter Six presented the findings from the knowledge audit which explored the cognitively challenging elements identified in the task diagram. The knowledge audit emphasised where expertise was required and probed the challenging elements for specific examples, based on the participants' experiences. For each difficult situation, the participants provided examples of the critical cues and strategies they used. The knowledge audit also explored potential errors that less experienced nurses would make in the same situation and provided explanations of why the situation was challenging for them. Chapter Seven reported the problem solving processes of the experienced nurses explored in the simulation interview. This was achieved by asking the participants how they would think and act within the context of a scenario based on a real life situation which involved a patient following a laparoscopic hysterectomy. The scenario selected for the simulation interview related to physiological deterioration in a surgical patient as this was the problem identified earlier by the participants as one of the most cognitively challenging situations surgical nurses face in clinical practice.

This chapter has presented the synthesised data from the three previous chapters in the form of a CDT and identified the key elements of expertise required for safe and effective care of patients in a general surgical ward. The ACTA has provided an opportunity to understand the cognitive aspects of the NTS identified in the observations in Chapter Four. It has extracted specific cues and strategies related to early recognition of physiological deterioration which is tacit knowledge participants in this study could not readily explain. Furthermore, it has revealed that in challenging situations nurses use different approaches to decision-making according to their levels of experience and the characteristics of the cognitive demand they are dealing with. Likewise the ACTA has exposed the safety concerns that result from inexperienced nurses being responsible for the care of critically ill/compromised patients. The implications of the ACTA findings for nursing practice are discussed in the following chapter in conjunction with the NTS identified in the observation study.

Chapter 9. Discussion

The overall aim of this study was to identify the NTS required of general surgical nurses for safe and effective patient care. This led to the development of a taxonomy of general surgical nurses' NTS, both social and cognitive, attained from non-participant observations of general surgical nurses' practice. In addition the study applied ACTA to gain an understanding of the cognitive elements of the NTS. The ACTA explored nurses' cognitive skills in challenging situations and the differences in level of performance of those skills between expert and less experienced nurses. To do this it investigated how experienced nurses applied those skills when a surgical patient presented with a challenging postoperative complication. Specifically it explored the cognitive processes employed by experienced nurses and the cues and strategies they use to respond to the cognitive demands in such situations. Furthermore, the difficulties for less experienced nurses in applying these NTS and the likely sources of error in their decision-making, as perceived by experienced nurses were also identified

Key findings from the observations and ACTA were analysed and compared with recent HF literature. This chapter discusses the contributions to knowledge this study makes and the practical implications of the research findings. It concludes with a discussion on the strengths and limitations of the approach used.

The chapter begins with a discussion highlighting the study's contribution to knowledge pertaining to NTS required of general surgical nurses. It then describes the importance of these NTS for safe and effective patient care.

The general surgical ward team is made up of health professionals who need to work together as an effective and efficient interprofessional team to achieve safe patient care. It is important therefore, that the NTS required of individual team members be identified. Discovering the cognitive as well as the social elements of nurses' NTS was an important focus of the study. Nurses are key members of the ward surgical team and thus it is important to examine the NTS they require for effective team performance and maintaining safe patient care. This examination enables the identification of appropriate educational processes for developing and enhancing nurses' proficient performance of these skills.

9.1. Contribution to Knowledge

The main contribution this research makes is identifying the NTS required of general surgical nurses and the cognitive skills they use to provide safe and effective care of patients during challenging situations. Another significant contribution is identifying the cognitive demands placed on nurses in challenging situations and the cognitive elements of the NTS they need to meet those demands. Additionally the study identifies the differences between expert and less experienced nurses' practice in challenging situations. A further original contribution is the finding that nurses are concurrently members of two different teams with their different responsibilities: the nursing team and the MDT. Finally, this study is the first study to apply a HF methodology to explore and analyse the NTS used by nurses in a ward setting. This approach has, for the first time, provided an understanding of the specific interactions between nurses and MDT members, patients and their families/*whānau* and other elements in the general surgical ward environment. This information is essential for ensuring nurses are prepared adequately for their roles and to reduce preventable errors in health care.

Previous research identifying nurses' NTS has only been conducted in a hospital OR (Mitchell, 2011) and an ICU (Reader et al., 2006). This study differs from Mitchell's and Reader et al.'s work in that it not only identifies the NTS required of nurses working in a ward setting, but it used ACTA to uncover the cognitive demands associated with those NTS. It is the first study to do this.

The following section begins with a discussion of the categories of NTS identified. The discussion integrates the overall contributions this study makes to existing knowledge.

9.2. Non-technical Skills

This section explores the new knowledge gained from the study and the implications of the findings for the development of general surgical nurses' practice. To do this it compares the study findings with current nursing and HF literature. As discussed in Chapter Two, no literature could be found that focuses directly on nurses' NTS in a surgical ward setting. There are studies that have explored communication in more general terms (Andrews & Waterman, 2005; Chung et al., 2011; Donohue & Endacott, 2010; Eagar et al., 2010; Fernandez et al., 2010; Kalisch et al., 2009; Redding & Robinson, 2009; Vandenkerkhof et al., 2009), teamwork (Donohue & Endacott, 2010; Eagar et al., 2010; Kalisch et al., 2009;

S.Thomson, 2007), and decision-making with nurses in surgical wards (Lockwood, 2009; Redding & Robinson, 2009; S.Thomson, 2007). None of the studies used a HF approach nor focussed on error prevention.

Flin et al. (2008) explained that although there are generic NTS that can be identified across occupations, it is not recommended they be transferred without exploration of specific work settings, as the specific NTS required may differ for each occupational group. Furthermore not all roles within a team require the same NTS or level of skill to meet the professionals' responsibilities (Kodate et al., 2012). Therefore in order to teach and develop NTS for nurses it is necessary to firstly identify the specific skills required in the different clinical specialty settings as each will require NTS unique to the demands of that environment.

The observational study found there are seven essential NTS that nurses require for safe and efficient practice within the general surgical ward team. Four of these: communication, situation awareness, decision-making and teamwork, have previously been identified by Flin et al. (2008) as generic NTS that are important for safety in high-risk work settings. This study uncovered a further three NTS: leadership and management, planning, and patient advocacy.

The ACTA revealed that nursing management of a physiologically unstable patient involves five difficult cognitive demands: recognising physiological deterioration, confirming physiological deterioration, initiating rescue, securing medical assistance and rescuing the patient. The NTS associated with each difficult cognitive demand were determined by means of the ACTA. Communication was shown to be the predominant NTS used in nursing practice and a fundamental requirement for meeting all cognitive demands.

9.2.1. Communication

The non-participant observations and the ACTA have shown that communication is a complex skill, both social and cognitive, and underpins all the other NTS. While it is recognised in the literature that nurses require efficient and effective communication skills to maintain patient safety (Kalisch et al., 2009), the evidence associating nurses' communication skills with patient safety in the surgical ward team has not been well documented. Nor does existing literature explore the cognitive elements of this NTS.

Previous studies of surgical nurses' communication skills have identified factors that impair communication such as communication breakdowns between team members (Andrews & Waterman, 2005; Donohue & Endacott, 2010), poor understanding of team members' roles and responsibilities (Eagar et al., 2010; Kalisch et al., 2009), environmental factors (Redding & Robinson, 2009), different models of care delivery (Fernandez et al., 2010), variability in the standard of clinical handovers (Chung et al., 2011), and inefficient communication systems (Vandenkerkhof et al., 2009). The non-participant observations in this study showed communication, both verbal and non-verbal, was central to nursing practice and vital for patient safety. The observations revealed that communication was both a planned and unplanned activity for nurses. Planned communication, such as the change of shift handover, involved a structured process using SBAR and occurred with minimal interruption. This enabled the efficient transfer of important information about patients' current health status and plan of care. This finding supports the literature that suggests a systematic approach to the exchange of information, which enables a shared mental model, increases the quality of handovers (Kalisch et al., 2009; Manser, Foster, Flin, & Patey, 2013; Staggers & Jennings, 2009) and is critical for patient safety (Flin et al., 2009).

The observations revealed that unplanned communication arose as a result of frequent interruptions where nurses were expected to make a response. These included telephone calls, and visitors and co-workers seeking information and/or assistance. Frequent interruptions are known to increase the cognitive workload of nurses, with the possible outcome being a threat to patient safety (Kliger, 2010; Kreckler et al., 2008; Potter et al., 2005; Redding & Robinson, 2009). Other research in complex work environments such as aviation, determined that interruptions have contributed to pilot error (Loukopoulos, Dismukes, & Barshi, 2001). Similarly in nursing, research has provided evidence that distractions and interruptions during medication administration contribute to medication errors (Gladstone, 1995).

It is important to note that not all unplanned exchanges of information had negative consequences for patients. The study showed that while managing patient care, the nurses recognised when a patient required guidance and teaching during their recovery from surgery and took advantage of teachable moments to educate and support patients and their families/*whānau*.

This study also uncovered another important issue concerning communication and patient safety: the need for a dedicated time for nurses and doctors to formally handover information to each other about the progress of the patients they are responsible for. Implementing changes made to a patient's plan of care can be delayed or easily missed by nurses when doctors do not communicate changes directly to the nurse responsible for the patient's care. This finding is consistent with previous research that found inefficiencies in communication and poor transfer of information between team members was a contributing factor to adverse events for patients (Badihi & Gopher, 2013; Lingard et al., 2004).

The ACTA uncovered the connection between the cognitive demands and the cognitive strategies experienced nurses used to achieve effective communication in challenging situations. Securing medical assistance to escalate care when a patient was deteriorating was the most difficult cognitive demand involving communication. To secure timely medical assistance nurses had learned to highlight the urgency of the problem by using assertive and formal clinical language in a structured way and having other relevant information at hand. In contrast, less experienced nurses' communication was more prone to error. They use a less direct approach and have difficulty communicating their concerns to doctors. According to experienced nurses, this is because of their limited clinical vocabulary and the fear of making a mistake due to their lack of knowledge of the situation. This finding is consistent with Andrews and Waterman (2005) who suggested that less experienced nurses need to gain confidence with discussing 'biological knowledge' when seeking medical review of a patient. Their study revealed that less experienced nurses were more likely to use social language rather than medical language which could be misinterpreted making it difficult for doctors to understand the urgency of the situation.

This study revealed a number of different human factors that contribute to inefficiencies in communication and threaten patient safety in the surgical ward. For example, poor quality transfer of information between health professionals, lack of a common lexicon between nurses and doctors, incomplete documentation in clinical notes and lack of nursing involvement in MDT discussions and decisions. This finding is consistent with previous research undertaken in the OR (Awad et al., 2005; Lingard et al., 2004; Manser et al., 2013).

9.2.2. Leadership and management

The study found that leadership and management was a critical NTS required of nurses who practise in a surgical ward setting. This was an important finding as it is a NTS not traditionally included in the nursing curriculum, and it challenges the idea that leadership in nursing is the realm of nurses who work in a managerial role (Tomey, 2009).

The non-participant observations revealed that the nurses used leadership and management skills when there was a threat to patient safety. The importance of this skill was revealed when the nurses reinforced compliance of, or role-modelled, best practice when safety standards were at risk of being breached by others.

There were clear indications that nurses' leadership and management skills extended to teaching and guiding junior doctors as well as less experienced nurses. This finding supports recent work in both the UK and the US where it is argued that patient care will improve when ward nurses apply leadership and management skills in the workplace (Committee on the Robert Wood Johnson Foundation Initiative on the Future of Nursing, 2011; Cook, 2001; Davidson, Elliott, & Daly, 2006; Kalisch et al., 2009; Sorensen, Iedema, & Severinsson, 2008).

When a surgical patient is deteriorating, the ACTA revealed there is increased demand for the nurses to use their leadership and management skills to ensure the safety of their patients. It is a critical NTS associated with the cognitive demands of 'initiating rescue' and 'rescuing the patient'. An important cognitive strategy, the experienced nurses had learned from previous encounters with deteriorating patients, was prioritising and delegating tasks to enable them to focus on the challenging situation at hand.

This study has revealed that experiential knowledge is an important factor for the development of nurses' effective leadership and management skills. This was more obvious in critical situations where the experienced nurses had the cognitive skills to initiate rescue by envisioning how events were likely to unfold, and the knowledge base to devise appropriate interventions to rescue the patient. When a patient is physiologically unstable less experienced nurses tend to wait to see what develops rather than take the lead and respond immediately. They have difficulty managing the problem as they cannot initiate the necessary action to resolve it. This puts the patient at risk of further deterioration.

This study has illustrated that for safe and effective care in challenging situations leadership and management is an essential NTS for nurses. This has implications for nursing education as there is a need to teach this NTS in ways that provide students with sufficient experiential learning as well as providing them with a knowledge base.

9.2.3. Situation awareness

As discussed in the literature review there were no previous studies that explored this essential NTS for nurses in the surgical ward setting. The non-participant observations revealed nurses required this skill to proactively monitor the ward environment and the people within it, to be aware of what was currently going on around them, and to anticipate unexpected events. The nurses are the only health professionals who are continuously with the patients on the surgical wards day and night. It is therefore important that nurses are proficient with this NTS for the safety of the patients and the ward environment.

The ACTA revealed that when there was an unexpected change in a postoperative patient's condition, situation awareness was the NTS that alerted experienced nurses. When a challenging situation arose, effective situation awareness enabled the experienced nurse to act promptly and determine an appropriate course of action for the safety of the patient. The study showed that vigilant monitoring of the patient's progress and keeping other team members informed about what was happening with the patient were strategies that experienced nurses used. In contrast less experienced nurses have not usually developed this NTS. Less experienced nurses usually have 'tunnel vision' and fail to comprehend the urgency of the immediate situation. This finding has implications for patient safety.

Other studies in high-risk industries have found that poor performance of this NTS has been a contributing factor in adverse events (Endsley & Robertson, 2000; Jones & Endsley, 1996; Sneddon, Mearns, & Flin, 2006). Given the dynamic nature of the surgical ward environment and the complexity of patients' health problems this is an essential NTS that has been identified as significant for surgical nurses.

9.2.4. Decision-making

Decision-making was an important NTS required of the nurses in the study. The non-participant observation revealed the nurses' work entailed constant attention to many patients and numerous decisions needed to be made throughout the shift. When providing

care to surgical patients it was important for the nurses to recognise any variances to the accepted clinical pathway of a patient's surgical recovery. When a variance was identified that was not a critical situation, as discussed in the ACTA, all of the nurses observed initiated an appropriate intervention for the safety of the patient. In most instances the nurses recognised and resolved the problems quickly and autonomously. In situations where a change in a patient's condition required intervention beyond the nurses' scope of practice, experienced nurses did not hesitate to seek a second opinion from nursing colleagues to confirm their concerns before collaborating with medical staff to address the problem. This finding is consistent with previous research that shows the quality of intra- and interprofessional relationships and workplace culture influences nurses' decision-making and has a direct impact on patient care and patient outcomes (Lockwood, 2009; S.Thomson, 2007).

The findings from this study draw attention to the decision-making processes experienced nurses use in challenging situations. While it was evident during the observational study that nurses frequently made decisions about patient care, it was not apparent how they made those decisions and the cognitive processes they used. The ACTA provided access to that information by exposing the tacit knowledge that underpins nurses' clinical decision-making. It revealed that when nurses recognise that a postoperative patient is physiologically unstable there is increased demand on the nurses' decision-making skills. In these situations, nurses take action as quickly as possible to minimise harm to the patient, and in doing so use two decision-making processes: intuition and analytical reasoning. The experienced nurses in this study were able to make effective decisions rapidly with limited information. They could recognise physiological deterioration before objective changes appeared in the patient's EWS. This is explained by the RPD model of naturalistic decision-making (Klein, 1993), which asserts that people can make decisions quickly by matching the current situation to patterns they have learned from previous experiences. The research also found that once significant cues were recognised, the nurses used an analytical process during their decision-making and were expedient in initiating a course of action.

The study also revealed that developing competence in clinical decision-making requires extensive clinical experience. To become proficient in this NTS less experienced nurses need guidance from senior nurses when dealing with challenging patient situations. During

their undergraduate education, nurses are taught to use evidence-based tools to assist their analytical decision-making (Levett-Jones et al., 2010; Tanner, 2006). The findings from this study suggest they also need to be taught in ways that promote development of their intuitive knowledge base. Furthermore, they need to learn to make decisions in an intra- and interprofessional team environment.

9.2.5. Teamwork

This study found that teamwork was an essential NTS required of nurses in the general surgical ward. The non-participant observation revealed nurses are members of two different teams: the nursing team and the MDT. The nursing team is hierarchical in structure and nurses engage in individual 'task-work processes' and 'teamwork processes' (Salas & Rosen, 2008). Ideally, the nursing team operates cooperatively and is responsible for the smooth running of the ward 24 hours a day, seven days per week. In contrast, the nurses' role in the MDT is less explicit.

Within the MDT, nurses work alongside team members of other disciplines and interact with them as needs arise for their patients. Even though the nurses have the most contact with the patients, the observations revealed the nurses' role in the MDT provided limited opportunities for them to share in the decision-making about care-planning with the other MDT members. The nurses were often unclear about their responsibilities as members of the surgical ward team and this created difficulties when collaborating with other team members and participating in shared decision-making. This finding correlates with McCallin's (2005) assertion that it cannot be assumed health professionals have the skills or attributes to collaborate effectively. She argued they need to learn together before they can develop closer interprofessional work relationships.

The ACTA revealed that teamwork was an essential NTS for meeting the cognitive demands of initiating rescue and rescuing the patient. Experienced nurses anticipate the busyness of the ward will intensify during times of increased cognitive demand and they seek back-up and support from other nursing team members as a strategy to maintain continuity of patient care. In contrast, a source of error for less experienced nurses during periods of high cognitive demand is they delay seeking assistance which leads to poor decision-making and performance.

During challenging situations the nurses' role in the MDT changes from their usual role during routine care. When a patient is deteriorating and the situation escalates, nurses and doctors are required to work together to find solutions. The findings from this study showed that although the nurses initiated strategies within the nursing team to manage the situation, they were not always involved in determining solutions with the doctors. Often the nurses' role centred on providing relevant information about the patients to the doctors and providing them with knowledge of ward procedures and how to access resources.

This finding is consistent with other studies that have identified role clarity in the MDT as problematic not only for nurses but for all team members (Atwal & Caldwell, 2006; Callaghan et al., 2008). Furthermore, it has implications for patient safety, as analysis of teamwork in other high risk industries has found poor role clarity contributes to teamwork failure and error (St. Pierre et al., 2011). It is critical therefore that team members know what each other's roles and responsibilities are within the team to minimise the risk of patient harm. Human Factors research has revealed shared decision-making by team members enhances teamwork over decisions being made by individual team members, and this has relevance for the MDT.

The findings suggest that it is crucial for MDT members to receive formal team training together and learn teamwork skills which can improve team performance for the safety of patients. This would require a change in the education of nurses as currently, teamwork in the MDT environment is assumed and is not part of the nursing curriculum. As discussed below, education related to teamwork skills for all potential members of surgical ward teams could be enhanced by interprofessional learning. It also challenges the traditional 'siloed' or segregated models of health professionals' education.

9.2.6. Planning

In the HF literature, 'planning' is an element of the generic NTS category of leadership (Flin et al., 2008). In contrast, in the nursing context, planning of patient care is an integral part of the 'nursing process'. This study found that planning is an important NTS for nurses, and its importance extends beyond its application to the nursing process. The nurses frequently used this NTS to manage the constraints imposed by complex patient problems and a demanding workload. Nurses utilised this NTS as they needed to think ahead and organise their actions to ensure patient care was delivered in a timely manner.

This included being prepared to deal with unexpected events and ensuring they had the resources they required, both physical and human, to deliver nursing care safely.

The ACTA revealed nurses require this NTS to meet the cognitive demands of 'initiating rescue' and 'rescuing the patient'. As mentioned previously, experienced nurses have the ability to anticipate potential problems. Experienced nurses plan for the events they anticipate will arise when a patient deteriorates. A common error less experienced nurses make is failing to plan sufficiently for potential problems. Their lack of exposure to challenging situations results in them not having the ability to foresee the events that can develop in such situations. To date there are no empirical studies specifically investigating 'planning' as a NTS required of general surgical nurses.

9.2.7. Patient advocacy

Advocacy has not previously been identified as a generic NTS or an element of a NTS category as described by (Flin et al., 2008). This is the first study to categorise 'patient advocacy' as a required NTS for general surgical nurses. The study found nurses use this NTS to promote patients' well-being and to protect patients' rights and maintain their safety. The importance of this NTS was revealed in the observations when the nurses spoke up on behalf of vulnerable patients or provided emotional support for patients who were seeking answers to questions about their surgical treatment.

The ACTA revealed nurses use patient advocacy skills when faced with the cognitive demands of 'initiating rescue' and 'securing medical assistance'. In a life threatening situation nurses are responsible for garnering the resources required for rescuing the patient and making sure that the very best is being done for them. In time constrained situations it is critical that nurses are successful advocates for the safety and well-being of the patients. The findings show experienced nurses are assertive and clear in communicating the patients' needs to others. In contrast less experienced nurses lack the confidence needed to speak up on behalf of patients. They have difficulty articulating their concerns to other health professionals. Because of their limited exposure to critical situations they are unsure of what to say, as they lack knowledge of what is required to address their concerns.

The next section of the discussion considers the implications of the study for nursing practice. It is followed by a discussion of the implications of the findings for nursing education.

9.3. Implications for Practice

This research shows that in the wards in the study hospital, there was a dearth of expert nurses working in direct contact with patients at the 'sharp end' of the surgical ward team. In the current climate, a delay with initiating appropriate interventions for the physiologically unstable patient can be expected and is partly attributed to the lack of a strong presence of expert nurses in the ward nursing team. The expert nurses in the study hospital work in specialised units, such as ICUs, which limits ward nurses' exposure to mentoring and supervision from expert nurses. Currently there is a move in hospitals in New Zealand towards the MET being deployed to attend physiologically unstable patients, with the ward team tending to step-back. Expert nurses, usually from the ICU, are members of the MET team, however their role provides little opportunity for them to offer high-quality mentorship for less experienced nurses in critical situations.

It is not always immediately obvious which patients are emerging as complex, as each patient has a unique set of problems. This is why it is so important that less experienced nurses work alongside experts who can provide the mentoring, supervision and support they need to develop the necessary knowledge and NTS they need to determine when clinical deterioration is developing in a patient.

This study shows that in clinical practice less experienced nurses rely on hospital protocols and procedures to solve problems without considering the context and limitation of the tools they are using. This in turn can result in an inaccurate 'measurement' or assessment of the situation they are dealing with. By contrast, expert nurses do not refer to voluminous protocol and procedure manuals to solve problems in time-constrained situations. Instead, they can quickly focus on emerging problems. They have an intuitive grasp of the situation because of the vast experience they can draw on from previous similar events.

To progress to the level of expert decision maker, requires opportunities for experiential learning to enable the transfer of knowledge and skills needed for managing complex problems. This transfer of knowledge and skills is acquired from repeated exposure to challenging situations. Experiential learning opportunities focussing on physiological

deterioration of a surgical patient cannot be scheduled as this is a problem that occurs randomly at any time during the day or night. It is therefore important for hospitals to provide high-quality mentoring, supervision and experience for less experienced nurses. It is also important for hospitals to value expert nursing practice and provide greater incentives and career opportunities to retain expert nurses as part of the skill mix at ward level for the safety of patients.

9.4. Implications for Education

This study shows that NTS are critical in nursing practice for improving and maintaining high levels of clinical performance and enhancing the safety of patients. Teaching NTS, both the social and cognitive elements, needs to be integrated into the curriculum in nursing education along with the teaching of technical skills to promote safe and effective nursing practice.

Effective communication is an essential NTS required of all health professionals. As previously mentioned it underpins all other NTS and influences the quality of care patients receive. It is vital for the transfer of information that nurses are taught how to communicate with other nurses, other health professionals and with patients and their family/*whānau.*

Situation awareness is a critical NTS that is not formally taught in nursing education. But it is a skill that needs to be incorporated in the nursing curriculum as it is vital for decision-making across the spectrum of nursing specialities.

Although decision-making is a NTS taught in nursing education, using various teaching strategies, nurses also need to learn to make decisions collaboratively within the MDT. Consequently this NTS should ideally be learned alongside other health professionals in an interprofessional learning environment.

The concepts of leadership and management are included in the nursing curriculum but nurses are not formally taught how to utilise leadership and management skills at the 'sharp end' of clinical practice. Planning and patient advocacy skills also need to be formally introduced into the nursing curriculum as they are critical for patient safety.

Teamwork is another NTS that needs to be integrated into nursing education. As the majority of nurses will work in hospitals for at least part of their working life, it is

important that they are adequately prepared to actively assume their concurrent roles as members of at least two different teams – the ward nursing team and the MDTs related to their assigned patients. Teamwork is a NTS that is vital for both these roles but to date recognition of nurses' dual roles has not been established in either education or the clinical environment.

The nursing team is responsible for the safe running of the hospital wards and units 24 hours a day and is the last line of defence for preventing patient error. Therefore nurses need to be taught the NTS they require to ensure the safety and protection of the patients in their care. As discussed above, nurses are also key members of the MDTs in the wards. Because they are the only members of the MDTs that provide 24 hour care for the patients it is imperative for safety purposes and positive outcomes for their patients that nurses are prepared adequately for these roles. One way to do this is through interprofessional learning facilitated by an experienced MDT faculty.

It is contended that a greater emphasis on NTS in the nursing curriculum is needed. This would require the design of courses to promote nurses' acquisition of the NTS required for safe practice.

9.5. Strengths and Limitations

A real strength of this research is that it is the first study to use a HF approach to explore the practice of general surgical nurses in a ward setting. It is also the first time that nurses' NTS in a general surgical ward have been identified and the first time in that environment that an ACTA has been applied to nurses' clinical practice. It provides a unique and comprehensive view of the NTS required of general surgical nurses to ensure they provide safe patient care. It has used qualitative, HF techniques to add to the dearth of HF research in the general surgical ward setting. This approach enabled methodological triangulation, and data triangulation to be applied and this enhanced the credibility of the study.

A major strength of this study was observing participants' actions in a natural setting. This enabled the researcher to pay close attention to the NTS the nurse participants actually used in their everyday practice, rather than merely from their own construction based on a self-report. The observations provided clear insight into the nurses' role and the NTS nurses commonly used during every shift in different situations. In addition, the three

interview techniques used in the ACTA provided a comprehensive understanding of the cognitive elements of the NTS observed.

The interpretation of the observations was further strengthened by the researcher being an experienced surgical nurse who was aware of the professional, legal and ethical boundaries of the registered nurse scope of practice, as well as being familiar with the jargon nurses use in their everyday practice. Although the observational study did not include expert nurses, and it is possible that expert practice differs to that observed, an additional strength in this study was the independent review of an expert general surgical nurse who checked the results of the study to confirm that the information presented was a credible representation of the practice of general surgical nurses.

Another strength of the study was the use of the ACTA method which provided a structured approach for identifying the critical cognitive demands placed on nurses when a patient is deteriorating clinically, and the cognitive skills they used to respond to those demands. A set of predetermined probes specifically designed to extract the knowledge characteristic of expertise, enabled the differences between experienced and less experienced nurses' practice to be elicited and the potential for clinical error to be identified. Having nurses with different levels of experience as participants further strengthened the study, as this contributed information about the NTS the nurses had gained through their years of clinical experience.

Following the researcher's attendance at ward handovers where she explained the study and invited voluntary participation, the nurse participants were aware that the researcher was an experienced surgical nurse. Also as the research progressed the nurses became accustomed to the researcher's presence on the wards and this helped to counter any 'Hawthorne' effect (Roethlisberger & Dickson, 1956).

A further strength of this study was using independent coders to identify the NTS categories that were then used to create the coding frame for the analysis of the observation data.

While it could be argued it was a limitation recruiting only six nurses for the ACTA Militello and Hutton (1998, p.1635) stated that three to five experts are sufficient for an ACTA.

9.6. Conclusion

Chapter Nine highlights the contribution of this study to existing knowledge in nursing. This has been accomplished by demonstrating how the research aims of this study have been achieved and discussing the significance of this research for the nursing profession. Observation of nurses' practice and the ACTA have enabled the specific NTS nurses require for safe and effective care of surgical patients to be identified and the differences in performance of these skills between less experienced and experienced nurses to be exposed. It has shown that currently nurses acquire NTS mainly through work experience in the clinical environment. Nurses' proficiency in these skills can only be assumed, as currently there are no tools for assessing nurses' NTS.

This chapter has discussed the implications of the findings for nurses' clinical practice and education. It has also set out the strengths and limitations of the methods used for the study. The following chapter provides the conclusion to this thesis.

Chapter 10. Conclusion

This research was the first study to use a HF approach to explore nursing practice in a general surgical ward setting. The contribution of this research has been to identify three critical components of general surgical nurses' clinical practice that are vital for safe patient care: NTS; the cognitive demands and cognitive processes pertaining to challenging events; and understanding the differences in decision making between novices and experts in challenging situations. The study identified gaps in nursing practice and nursing knowledge that can compromise the safety and effectiveness of the healthcare provided to patients experiencing challenging situations. These insights have provided the foundation for recommendations for future nursing research, education and practice.

It is important that nurses' NTS have been identified as there is increasing evidence that poor performance of these skills by health professionals at the 'sharp end' of health care is a significant factor contributing to preventable adverse patient events (Rutherford, Flin, & Irwin, 2015; Sharma, Mishra, Aggarwal, & Grantcharov, 2011; Wahr et al., 2013; Youngson & Flin, 2010). This study has shown that general surgical nurses use many of the generic NTS professionals in other high risk industries, such as aviation, use. While aviation professionals receive intensive training in these skills, in contrast they are not taught formally in nursing education programmes. Instead nurses learn these skills indirectly from each other and other health professionals through role modelling and clinical experience. In commercial aviation, training in NTS for pilots is mandatory as proficiency in these skills has been shown to be effective in reducing human error (Flin et al., 2003; Helmreich, Merritt, & Wilhelm, 1999).

In health care the concept of NTS has only recently been introduced with a growing body of literature providing evidence that poor performance of these skills is a threat to patient safety (Bromiley & Mitchell, 2009; McCulloch et al., 2009; Morey et al., 2002). With no provision of formal NTS training, nurses may not be aware they are putting the patients they care for at risk of unintentional harm.

Current health care literature indicates that proficiency with NTS is a requirement for safe practice to prevent patient harm (Siu, Maran, & Paterson-Brown, 2014) and that training in NTS can improve health professionals' performance (Flin, 2014; Yee et al., 2005). Prior to

this study, within the surgical care context, the impact of poor performance of these skills had been explored mainly in the operating room. Taxonomies of NTS with behavioural markers have previously been identified for anaesthetists, surgeons and scrub nurses, and used for training and assessment of these specific health professionals. This study has identified a taxonomy of key NTS required of general surgical nurses. It provides the foundation for future research to identify the specific behavioural markers that demonstrate proficiency of these NTS. It also provides direction for training initiatives in nursing education that target these skills.

The overall findings of this study strongly indicate that the current skill mix on general surgical wards needs to include expert nurses to enable less experienced nurses to work alongside them to improve proficiency in their NTS and consequently reduce preventable error. The overall findings also suggest the teaching of NTS should be included in the nursing curriculum. In addition, in preparation for working in MDTs, nursing students would benefit from being included in interprofessional education with the other team members they will be working with.

 For the safety of patients, formal handover of changes to patient care needs to occur between those MDT members responsible for their care. Attention should also be given to environmental factors such as management systems, workspaces and communication technologies that enable safer work practices and free nurses from interruption to their critically important work.

It is evident that nurses work hard to provide the health care patients require to recover from surgical interventions. The participants in this study gave many examples that illustrate the complex and pressured nature of their work and how these aspects impose on them many social and cognitive demands. It is imperative therefore that the NTS required of nurses in surgical wards are fully understood to ensure nurses are adequately prepared to provide safe care and reduce preventable error.

10.1. Recommendations

In light of the findings from this thesis the following recommendations are made for research, education and clinical practice.

10.1.1. Research

- Research in other clinical settings is needed to identify the NTS required of nurses providing care to patients in those settings. This is critical for safe practice as each clinical setting has its own challenges for safe patient care (Kodate et al., 2012).

- Investigation of the organisational and management factors that impact on nurses' NTS. This is necessary as factors at the 'blunt end' of health care can influence the quality of care delivery at the 'sharp end' (Reason, 2000; Wiegmann & Shappell, 2003).

- Further investigation to identify the core competencies for interprofessional collaborative practice. This will enable a coordinated approach to the education of health professionals that is more responsive to the health needs of patients and their families/whānau.

- Further research to investigate and develop simulation training programmes designed to increase interprofessional teamwork and decision-making in the context of a general surgical ward. This would enable the development of the cognitive skills MDT members require for collaborative practice that will enhance patient safety.

- Further research to identify the behavioural markers that can be used to train and assess performance of surgical nurses' NTS. This will enable clinical competence to be determined.

10.1.2. Education

- Include NTS training as a compulsory component   in   undergraduate and postgraduate nursing programmes and include this training as a component of nurses' professional development programmes. This would raise awareness of the importance of NTS and provide the knowledge required for their development.

- Develop strategies designed to promote nurses' situation awareness. To avoid tunnel vision and distractions during demanding workloads nurses need to be taught viable responses to events and to be proactive in dealing with them for the safety of patients and their families/*whānau.* This is especially important for less

experienced nurses to enable them to think ahead and respond safely in acute situations.

- Design training modules to incorporate a range of technical and NTS critical for competent performance in acute situations that may otherwise be infrequently practised.

- Design training modules that provide instruction in assertive and open communication skills. This is necessary to empower nurses to interact more effectively with all MDT members. Specifically, nurses need to be competent to speak up for the benefit of the patient or to challenge another's behaviour when the patients' safety is at risk.

- Design education modules that provide interprofessional training of effective handover between nurses and doctors to reduce communication difficulties. Of particular importance is learning a common lexicon for sharing of information required for the safe care of patients and their families/*whānau.*

- Provide practical learning modules designed to give nurses the opportunity to develop nursing teamwork skills through professional team training. Continuous professional development of the skills required to enhance nursing teamwork performance is necessary for the safe running of hospital wards and units and for nurses to respond to specific care situations safely and effectively.

- Design training modules for MDT members to learn teamwork skills in an interprofessional learning environment. This will enable professional groups to understand each other's roles and responsibilities within their scopes of practice and promote the use of the teamwork skills health professionals need to work together effectively.

- Design training modules that enable MDT members to learn how to solve problems and make decisions collaboratively. This has the potential to improve patient care and enhance patient safety.

- Provide learning strategies that enable the development of less experienced nurses' intuitive knowledge and critical thinking. This would accelerate nurses' recognition of emerging physiological deterioration and facilitate the early management of this problem to minimise the risk of an adverse event.

- Design learning modules for nurses of all levels to develop the leadership and management skills they require for effective participation in the ward nursing team

and the MDT. This would empower nurses to be proactive in addressing situations in the ward that have the potential to negatively impact on patient care and ultimately patient safety. It would also strengthen the professional role of the nurse in the MDT

- Provide instruction for nurses on the strategies that can be implemented for effective planning in a complex work environment. This would enable nurses to maintain patient safety while meeting the demands of rapidly changing situations.

10.1.3. Practice

- Less experienced nurses need to work alongside expert nurses. This would enable less experienced nurses to learn their roles and responsibilities within the nursing team and how to manage unexpected patient problems through the mentorship of experts.

- Ward nurses need ready access to expert nurses to seek the mentorship they require when facing complex problems that challenge their levels of experience.

- Nurses of all levels need to have a clearly defined role in the MDT. This would enable them to share their professional knowledge and skills with other MDT members. Of particular importance is each nurse's contribution to the decisions that are made concerning the care of the patients they are responsible for.

- Nurses and doctors need to provide a formal and structured handover to each other about the patients they are both responsible for. This would provide effective transfer of information and minimise potential error that may arise from poor communication between MDT members.

Appendix A. Permission for Access from Director of Nursing

Research Application Form C

Credentialled Status of Principal Investigator

DATE: 25   August   2009
         Day   Month   Year

PROJECT DESCRIPTION:

The aim of this descriptive research project is to identify the non-technical skills, such

as decision making, clinical judgement, communication and team working that are

required of nurses working in general surgical teams. The target population is all

registered nurses working in wards ·   ;. Data will be collected using

non-participant observation and semi-structured interviews. The study will not

include any personal or clinical data relating to patients at (

Principal Investigator (Clinician)   _Dianne Marshall_____
                                           (please print)

CREDENTIALLED STATUS:

Has the named Principal Investigator (Clinician) provided evidence of being
credentialled within their appropriate discipline's framework?

        Yes   ☑   No   ☐

     _____
Principal Investigator (Clinician) Signature

CREDENTIALLED STATUS VERIFIED BY:

Directorate of Nursing .
Name of the Department/Service   Name of Clinical Director, Clinical
                                            Nurse or Professional Leader

_____   _27/08/09___
Signature   Date

CONFIDENTIALITY DEED

1.   **The Parties**

This Deed is between ·   and [Name] **(You)**.

AGREEMENT

2.   You are undertaking a research project which will require access to personal and clinical information held by
              ·garding patients ot   You confirm that the proposal for this research project has
      received ethics approval from the appropriate New Zealand Health and Disability Ethics Committee.

3.   You agree that any and all information observed or obtained by you while performing research at (is
      confidential information **(Confidential Information)** and may only be used in accordance with your research
      proposal. Identifiable information may only be disclosed with patient consent. Confidential Information
      includes, but is not limited to, information and health information relating to ·   or to past, present or
      future patients or clients.

3.   You agree to abide by the following conditions:
      - You will only use Confidential Information in accordance with your research proposal, as approved
        by the relevant Ethics Committee.
      - You will, at all times, manage Confidential Information in accordance with requirements of the
        Health Information Privacy Code 1994, the Privacy Act 1993, and ·   iolicies and
        procedures.
      - Except in accordance with legislation and your research proposal, you will not disclose or duplicate
        Confidential Information to or for any person, corporate entity, firm or organisation, unless you
        have prior authorisation from   Identifiable information will only be disclosed with patient
        consent.
      - If you believe that Confidential Information needs to be disclosed without patient authorisation, you
        must notify the ¡   Research Officer. You are aware that the (Research Officer
        must be consulted before any disclosure occurs.
      - You will ensure that printed copies of Confidential Information are destroyed through confidential
        waste disposal.
      - You will notify the ·   i Research Officer if you have or intend to have electronic access to
        clinical information, and have or intend to obtain a log-on for the   clinical information
        systems. You will ensure that you log-off when you have finished electronically accessing
        information, and you will not leave a computer unattended while you are logged-in.
      - You acknowledge that security of passwords and other identifiers are the responsibility of
        individuals. You will not share your log-in password with any other person.

4.   You agree that:
      4.1   These obligations of confidentiality will survive the terms of your research project; and
      4.2   The obligations of confidentiality imposed by this deed are in addition to obligations of
             confidentiality imposed by law, and you are expected to have an understanding of obligations
             imposed by the Privacy Act 1993 and the Health Information Privacy Code 1994.
      4.3   You understand that your use of Confidential Information and electronic systems will be monitored
             and audited and that any inappropriate access to, or use of, information may be reported to your
             employer, your registering body, the Privacy Commissioner and other agencies.

EXECUTION

You have read, understood and agreed to be bound by the above provisions of this Confidentiality Deed.

Marshall   _25/8/09_
(Signature)   (Date)

WITNESSED BY:

_____   _____
(Signature)   (Address)

                                        _26/8/09_
_____   (Date)
(Full Name)

Appendix B. Maaori Research Review Committee Approval

24/08/2009

Dianne Marshall,
School of Nursing,
Faculty of Medical and Health Sciences,
University of Auckland,
Private Bag 92019,
Auckland 1142.

di.marshall@auckland.ac.nz

Teenaa koe Dianne
Ngaa mihi rangatira mo ouu whakaaro ki teenei kaupapa rangahau hauora.

Re: Professional Competence: the role of the nurse in the general surgical team using a human factors approach.

The Maaori Research Review Committee would like to thank you for addressing our concerns as discussed in our previous correspondence and we are now able to approve this research to be conducted in the auspices of

The   : Maaori Research Review Committee has appreciated the opportunity to engage with you regarding this research for Maaori in our DHB and we do wish you every success.

Kia piki te ora,

Chair, Maaori Research Review Committee,

Appendix C. Locality Assessment Approval

LOCALITY ASSESSMENT – by Locality Organisation

Refer to pp10-12 of the Guidelines for Completion of the National Application Form
for Ethical Approval of a Research Project

Full Project Title :   Professional competence: The role of the nurse in
the general surgical team using a human factors
approach

Short Project Title :   Non-technical skills of the general surgical nurse

Brief outline of study: The specific aim is to identify the non-technical skills, such as
communication and decision making, required of nurses who work in the general surgical ward
setting. Being able to identify non-technical skills will enable performance indicators to be developed
to allow these aspects of nursing practice to be made more explicit for assessment and ultimately
patient safety. The study will use non-participant observation and interviews to collect data which
will be analysed using a cognitive task analysis approach.

Principal Investigator: Dianne Marshall

Contact details: Senior lecturer, School of Nursing, University of Auckland
                                                               di.marshall@auckland.ac.nz
                                                               Phone 9235159

Local Investigators: Nil

Contact details: N/A

Locality Organisation signoff
Ethics committees review whether investigators have ensured their studies would meet
established ethical standards, if conducted at appropriate localities; each locality
organisation is asked to use the locality assessment form to check that the investigator
has also made the appropriate local study arrangements.

**Ethics approval for study conduct at each site is conditional on favourable
locality assessment at that locality.**

Locality issues: *(see guidelines for more information and examples)*
Identify any local issues and specify how they will be addressed.

1.   **Suitability of local researcher**

For example, are all roles for the investigator(s) at the local site appropriate (eg has any conflict the investigator might have between her or his local roles in research and in patient care been adequately resolved)?

Answer:

Yes. The investigator who is a registered nurse, will be in a non-participant role throughout the study. There will be no patient data collected or recorded in the study.

2. **Suitability of the local research environment**

    For example, have the resources (other than funding which is conditional on ethical approval) and/or facilities that the study requires locally been identified? Are they appropriate and available?

    Answer:

    **Yes. The study is descriptive study which will be conducted on wards   ,
    at   Hospital.**

3. **What are the specific issues relating to the local community?**

    For example, are there any cultural or other issues *specific* to this locality, or to participants for whom study recruitment or participation is primarily at this locality? If so, how have they been addressed?

    Answer:

    **There are no cultural or other specific issues relating to potential participants who will be registered nurses currently working on wards '
                    Hospital.**

4. **Information sheet/consent form contact details:**
    Contact details for Health & Disability Consumer Advocates:

    N/A
    Contact details for any other important local services:

I understand that I may withdraw locality approval if any significant local concerns arise. I agree to advise the Principal Investigator and then the relevant ethics committee should this occur.

Signature: Date: 27/08/09 .

Name: ı   Position: Acting Director of Nursing .

Contact Details:

Appendix D. Flyer posted on notice boards in the study wards

PARTICIPANTS NEEDED FOR RESEARCH

I am looking for volunteers to take part in a study in your ward about

Non-technical skills of the general surgical nurse

The purpose of this research study is to identify the non-technical skills surgical nurses use in their practice, particularly during stressful and challenging situations; for example an EWS 5 situation.

Q. What are non-technical skills?

A. They are the skills you use every day to help you cope with the demands and challenges of your work. They include skills such as decision making, team leadership and communication and they complement your technical skills.

Q. What do I have to do?

A. Your participation would involve you being observed during one shift. During the observation there will be no judgements recorded or made about your practice. There will be no information recorded about any patient in your care.

For more information about this study, or to volunteer for this study, please contact:

Dianne Marshall (RN, MA.) Email: di.marshall@auckland.ac.nz

This study has been reviewed by, and received ethics approval from Northern Y Ethics ref: NTY/09/07/059

Appendix E. Participation Information Sheet

School of Nursing

Faculty of Medical and Health Sciences

Participant Information Sheet

Project title: Non-technical skills of the general surgical nurse.

Dear Staff Nurse

My name is Dianne Marshall and I am a post graduate student in the School of Nursing, at The University of Auckland and am carrying out a research study for a Doctor of Philosophy degree in Nursing. The Northern X Regional Ethics Committee has approved this study and given me permission to invite you to participate because you are a Registered Nurse currently practising in a general surgical ward at Hospital. This project has received approval from the ▮▮▮▮▮▮ District Health Board Research Committee.

The aim of this project is to identify the key non-technical skills such as decision making, clinical judgement, communication and team working that nurses use in their everyday practice. Being able to identify the non-technical skills will enable performance indicators to be developed to allow these aspects of performance to be made more explicit for future nursing education and assessment and ultimately patient safety.

The project will be carried out in two parts:

Part A

To identify the non-technical skills required of nurses in the surgical team I will be observing for an entire shift the decision making that is required of the nurse, the clinical judgements that are made, the communication the nurse is involved in and her/his overall participation in the surgical team. During the observation I will take notes recording how and what non-technical skills are required. There will be no judgements made or recorded about any nurse's practice nor will there be any information collected or recorded about any patient in the nurse's care.

Part B

Following the observation I will conduct three short interviews with experienced and skilled nurses from wards ▮▮▮▮▮. The interviews are designed to help further the understanding of the non-technical skills required of nurses in surgical teams. The interviews will be conducted and audio taped by the researcher. The total time for the three interviews will be no longer than 1 ½ hours. The interviews will be later transcribed by a professional transcriber who will sign a confidentiality agreement.

The decision to participate is entirely voluntary. If you agree to participate in either the observations or the interviews, confidentiality of any information collected is guaranteed and you will not be identified in any report or publication relating to this study.

You can become involved in this study by completing and returning the enclosed consent form. You have the right to withdraw from the study at any time without having to give a reason, however once audio tapes are transcribed you will not be able to withdraw data as it will not be traceable to you. The decision to participate or not, will not affect your employment in any way. You may benefit as a participant by knowing that you have contributed to nursing knowledge and patient safety.

Collection use and storage of information will be in accordance with the Privacy Act 1993. Data will be stored securely in a locked cabinet at the University of Auckland for six years and then professionally destroyed. Following transcription all tapes will be "electronically wiped".

I will be available to discuss any questions you may have concerning this study and will be pleased to provide a summary of the findings of this study upon request.

My supervisors for this project are:

Dr Mary Finlayson, PhD
Associate Professor
School of Nursing,
Faculty of Medical and Health Sciences,
The University of Auckland
(09) 3737599
email m.finlayson@auckland.ac.nz

Dr Kathleen Callaghan, MB ChB., PhD
Director,
Human Factors Group,
Department of Surgery,
Faculty of Medical and Health Sciences,
The University of Auckland,
phone on (09) 3737599
email k.callaghan@auckland.ac.nz

Thank you for taking time to read about this research project.
Sincerely,
Dianne Marshall, RN,. MA.
PhD Candidate
School of Nursing
Faculty of Medical and Health Sciences
The University of Auckland
Telephone 64 9 373 7599 Ext 85159
Facsimile 64 9 367 7158
Email di.marshall@auckland.ac.nz

This study has received ethical approval from the Northern Y Regional Ethics Committee.

This study is registered with the ▮▮▮▮▮▮ District Health Board Ethics Committee

Appendix F. Consent Form: Observations

SCHOOL OF NURSING

Faculty of Medical and Health Sciences Private Bag 92019

THE UNIVERSITY
OF AUCKLAND
NEW ZEALAND
Te Whare Wānanga o Tāmaki Makaurau
1142

New Zealand

Part A

CONSENT FORM

Consent to Participate in Research

Project title: Non-technical skills of the general surgical nurse

I have read the Participant Information Sheet, have understood the nature of the research and why I have been selected. I have had the opportunity to discuss the study, ask questions and have them answered to my satisfaction.

- I understand that taking part in this study is voluntary (my choice) and that I may withdraw from the study at any time and this will in no way affect my future employment
- I understand that my participation in this study is confidential and that no material which could identify me will be used in any reports on this study.
- I understand that I am free to withdraw participation at any time, and to withdraw any data that is traceable to me at any time.
- I agree / do not agree to be observed for an entire shift
- I wish / do not wish to receive the summary of findings.
- I understand that data will be kept for 10 years, after which they will be professionally destroyed.

I _____ (full name) hereby consent to take part in this study.

Name   _____

Signature _____   Date _____

The project has been explained to me by _____

Project role _____

Name   _____

Signature _____   Date _____

Dianne Marshall RN., MA.

PhD Candidate

Principal Investigator

This study has received ethical approval from the Northern Y Regional Ethics Committee.

This study is registered with the ▮▮▮▮▮▮ District Health Board Ethics Committee.

Appendix G. Consent Form: Interviews

School of Nursing

Faculty of Medical and Health Sciences

Centre 1142
New Zealand

Part B
Consent to Participate in Research

Project title: Non-technical skills of the general surgical nurse

I have read the Participant Information Sheet, have understood the nature of the research and why I have been selected. I have had the opportunity to discuss the study, ask questions and have them answered to my satisfaction.

- I understand that taking part in this study is voluntary (my choice) and that I may withdraw from the study at any time and this will in no way affect my future employment
- I understand that my participation in this study is confidential and that no material which could identify me will be used in any reports on this study.
- I understand that I am free to withdraw participation at any time, and to withdraw any data that is traceable to me at any time.
- I agree / do not agree to be interviewed
- I agree / do not agree to be audio taped if interviewed
- I agree / do not agree to have notes taken if interviewed
- I understand that a third party who has signed a confidentiality agreement will transcribe the audio tapes from the interviews
- I wish / do not wish to receive a summary of the findings.
- I understand that data will be kept for 10 years, after which they will be professionally destroyed.

I _____ (full name) hereby consent to take part in this study.

Name   _____

Signature _____   Date _____

The project has been explained to me by _____

Project role _____

Name   _____

Signature _____   Date _____

Dianne Marshall RN., MA.
PhD Candidate
Principal Investigator

This study has received ethical approval from the Northern Y Regional Ethics Committee.

This study is registered with the ████████ District Health Board Ethics Committee.

Appendix H. Transcriber Confidentiality Agreement

THE UNIVERSITY
OF AUCKLAND
NEW ZEALAND
Te Whare Wānanga o Tāmaki Makaurau

SCHOOL OF NURSING
Faculty of Medical and Health Sciences

The University of Auckland
Private Bag 92019
Auckland Mail Centre 1142
New Zealand

Telephone 64 9 2256 159
Facsimile 64 9 367 7158
Email marshall@auckland.ac.nz

TRANSCRIBER CONFIDENTIALITY AGREEMENT

Project Title: Professional Competence: The role of the nurse in the general surgical ward using a human factors approach.

Researcher: Dianne Marshall, RN., MA.
                        PhD Candidate
Supervisor: Associate Professor Robyn Dixon and Dr Kathleen Callaghan

I agree to transcribe the audiotapes for the above research project. I understand that the information contained within them is confidential and must not be disclosed to, or discussed with, anyone other than the researcher and her supervisors.

Name: _____

Signature: _____

Date: _____

Appendix I. Knowledge Audit Interview Probes

Knowledge audit interview questions for each task step.

1. **Past and future: Experienced nurses can figure out how a situation developed and they can think into the future to see where the situation is going. Among other things this can allow experienced nurses to head off problems before they develop.**
   Is there a time when you walked into the middle of a situation and knew exactly how things got there and where they were headed?

   Can you tell me about a time when a patient you cared for experienced a particularly challenging or serious situation that was difficult to manage?

2. **Big picture: New nurses may only see bits and pieces. Experienced nurses are able to quickly build an understanding of the whole picture. This allows experienced nurses to think about how different elements fit together and effect each other.**
   Can you give me an example of what is most important about the big picture for this situation? What are the most important factors you need to know and keep track of?

3. **Noticing: Experienced nurses are able to detect cues and see meaningful patterns that less experienced personnel may miss altogether**
   Have you had experiences where part of a situation just popped out at you where you noticed things going on that others didn't catch? What is an example?

4. **Job Smarts: Experienced nurses learn how to combine procedures and work in the most efficient way possible. They don't cut corners but they don't waste time and resources either.**
   During this situation are there ways of working smart or accomplishing more with less – that you have found particularly useful?

5. **Opportunities/Improvising: Experienced nurses are comfortable improvising- seeing what will work in this particular situation: they are to shift directions to take advantage of opportunities.**
   Can you think of a time when you have improvised or noticed an opportunity to do something better?

6. **Self-monitoring: Experienced nurses are aware of their own performance: they check how they are doing and make monitoring adjustments.**
   Can you think of a time when stress, fatigue or workload impacted on your management of a challenging situation?

7. **Anomalies: New nurses don't know what is typical so they have a hard time identifying what is typical. Experienced nurses can quickly spot unusual events and detect deviations**
   Can you think of an instance when something unusual happened or you spotted a deviation from the norm or knew something was amiss?

8. **Equipment difficulties: Equipment can sometimes mislead. New nurses usually believe whatever the equipment tells them. They don't know when to be sceptical.**

   Can you think of a time when equipment you were using was telling you one thing but your own judgement told you something else? Or you had to rely on your experience to avoid being led astray?

Is there anything else you would like to add about managing challenging patients that we haven't discussed?

Appendix J. Simulation Scenario

As you read the scenario imagine you are the nurse in the scenario. Afterwards I am going to ask you some questions about how you would approach this situation.

You are working on an afternoon shift and just finishing handover.

You have been allocated 5 patients. Four of them are 1-2 days post op and stable. The other patient is a 36 year old Caucasian female, Jodie, who had a laparoscopic hysterectomy today for endometriosis. She returned to the ward just before handover.

At handover you were informed the PACU nurse had expressed concern that Jodie had required a lot of analgesia to get her pain under control. The PACU nurse had spoken to the surgeon about it. However there were no new orders and the surgeon was satisfied she could return to the ward, as her observations in PACU had remained reasonably stable when compared to baseline parameters.

On return to the ward her EWS score was O. Her pain score was 5/10.

It is 3.55pm and you have just entered Jodie's room to take her ½ hourly vital signs. You immediately notice she is very pale, anxious, a little restless, and looks extremely tired. You are very concerned that she "doesn't look quite right". You immediately ask her how she is feeling. She indicates that she has a lot pain and responds in a soft voice saying "I think I'm going to die". She has a PCA, oxygen via nasal prongs, IV fluids, and urinary catheter in situ. You check her vital signs. Her EWS score is 1 as her heart rate is 102. Her pain score is 5/10.

Appendix K. Simulation Interview Questions

Simulation Interview Questions

Now think back over the scenario you have just read …

1. What are the major **events** that occurred during the incident?

2. As the nurse in this scenario, what **actions** if any would you take at this point in time?

3. What do you think is going on here? What is your **assessment of the situation** at this time?

4. What **pieces of information** led you to this situation assessment and these actions?

5. What **errors** would an inexperienced nurse be likely to make in this situation?

Appendix L. Individual Simulation Tables

Simulation Interview Table: Participant A				
Events	**Actions**	**Situation assessment**	**Critical cues**	**Potential errors**
PACU - a lot of analgesia	Recheck vital signs Consider other pain relief Request surgical team or acute pain team review Assess hourly urine output Observe for any changes Check IV fluids Check PACU charting and dosage of analgesia	Possible anaesthetic reaction or side effect of medications Possibly inadequate analgesia during operation and recovery Possible fluid collection	Body language e.g position of hand across abdomen if a lot of pain Check PCA and pain assessment more regularly - every half hour until pain somewhat decreased	Do not pick up body language Do not listen to patient Do not use pain assessment to find out extent of pain and frequency of use of PCA Do not recognise cues from patient
Surgeon	After assessing the patient contact the surgeon for review			Do not contact surgeon and wait for senior nurse to pick up the problem
Pale, anxious, restless, tired	Minimise pain and reassure the patient to reduce their anxiety Check results of blood tests if they have been done	Possibly blood loss	Facial expression Voicing that she is feeling "I think I'm going to die" Underlying concerns such as fear	May not reassure patient May not check laparoscopic sites
PCA- acute pain,	Check PCA pump see if it	Consider pain and type of	Pain assessment	May not get acute pain

	connected and running as charted Consider increasing the dosage or other analgesia Request acute pain team to review patient	surgery	Pain score Frequency of PCA attempts	team
Oxygen	Administer oxygen Monitor oxygen saturations Reassess once pain settled May need to increase oxygen flow rate	Possibly inadequate oxygenation	Is oxygen being delivered by mask or nasal prongs	
IV fluids	Consider increasing IV fluids Assess vital signs	Patient may be hypovolaemic	Signs of hypovolaemia include low urine volume	
Increased heart rate	Monitor heart rate ½ hourly until stable Remain with patient as much as possible Check wound sites for bleeding	Possibly due to pain Possibly due to anxiety	Monitor vital signs and look for trends such as a decreased systolic pressure or increased temperature	May not increase frequency of observations to ½ hourly May not think about a reduced blood pressure – think it's normal

Simulation Interview Table: Participant B				
Events	**Actions**	**Situation assessment**	**Critical cues**	**Potential errors**
Pale	Further assessment Check dressing	Possibly bleeding Need to find the cause	Physiological status Look for bleeding such as soaked pads Total blood loss in OR Blood results if available	Make a wrong conclusion right away
Anxious/Restless	Ask patient how they are feeling. Ask if they feel any different from PACU	Possibly because of increased pain	5/10 pain score	May forget to check attempts with PCA
Extremely tired	Continue observations	Consider physiological, emotional or cultural factors		Do not pick up cues other than physiological Inexperienced nurse will make the patient more tired
Pain	Encourage use of PCA Watch for increase in PCA attempts Inform anaesthetist if more than 5 PCA attempts per hour	A major event having surgery		

	Continue ½ hourly assessment			
EWS 1	Follow protocol and continue vital sign recordings ½ hourly If respiratory rate is increased or decreased then inform house officer	Increased heart rate possibly due to restlessness and anxiety		May not relate changes in the EWS to what is happening
"I think I'm going to die"	Using open ended questions, ask patient why they think this	Patient is feeling different than normal	The patient's comment indicates they need someone there and they need support	They forget the basics and may panic as they may not know how to respond

Simulation Interview Table: Participant C				
Events	**Actions**	**Situation assessment**	**Critical cues**	**Potential errors**
Pale	Assess vital signs and oxygen saturations Increase oxygen if indicated Assess urine output Flush IV line to make sure it is patent for administration of fluids Perform head to toe assessment; check wound, inspect for abnormal bleeding, check abdomen for swelling, distension and firmness	Possibly bleeding internally if not visible by inspection Possibly a haematoma	Behaviour – restless, anxious Not responding to reassurance Pale, clammy to touch Appearance of the patient Hypo- or hyperventilation Deteriorating vital signs	May not understand what this means and delay responding
"Think I'm going to die"	Listen to the patient as something might be going to happen Give reassurance Increase oxygen: consider mask instead of nasal prongs Assess urine output, wound drainage, PV loss	Possibly going into shock or shutting down if bleeding	Urine output	May not communicate with the patient May not take them seriously and think they are being dramatic They panic and freeze and do not do anything as they are unsure of what to do They may wait for someone else to takeover
Pain	Determine if adequate analgesia is being given: pain assessment, check PCA Consider alternative medication Consider if it is the best medication for the patient	May be bleeding , a haematoma or possibly perforation of "something" during the procedure Possibly reacting to the drug	Increasing pain despite maximum analgesia Deteriorating observations	Inexperience with PCA May not check patency of PCA May not check connections of PCA

Simulation Interview Table: Participant D				
Events	**Actions**	**Situation assessment**	**Critical cues**	**Potential errors**
Patient thought she was going to die	Reassurance Monitor vital signs Contact surgeon and anaesthetist. Advise them of occurrence and request they come to the ward Ring for assistance Reallocate patient load to other staff Check patient's girth for sings of bleeding Contact husband	This is a major event and something is happening to cause this Deterioration in condition due to bleeding	Despite vital signs being reasonably stable the pain is unrelieved Sense of foreboding	May be overwhelmed by statement, frightened so they do not act They do not know what to say or how to respond
Vital signs	Monitor vital signs more frequently Increase IV fluids Check PV loss Measure the patient's girth Observe colour, feel skin for temperature Stay with the patient Check blood pressure and urine output Compare preop and postop haemoglobin	Deteriorating or unwell May have been bleeding	Vital signs changing from healthy to ill	They just look at vital signs and may not think to check the patient's abdomen or PV loss May not realise the emergency
Contacting surgeon	Contacted in recovery room Stay with the patient as she has a feeling of doom	The patient doesn't look	The patient's general well being Pain increasing and on	Might fail to contact surgeon or request assistance from someone

	Suggest the surgeon come to the ward straight away Wait further orders		movement despite use of PCA Reduction in blood pressure and increase in pulse Anxiety and restlessness	more senior Might not know what to do
Maintaining pain relief	Encourage use of PCA to manage safe levels of pain relief	Why wasn't pain being relieved The pain is getting worse It is uncertain why the pain is not resolving		May not check the patient's use of the pump
Deterioration – less responsive	Contact the anaesthetist and surgeon Increase vital signs recordings May need IV gelfusion Check abdomen and girth Check for PV bleeding Increase oxygen Check IV fluids Monitor more regularly Reassure patient –ask patient how she is feeling. Note general demeanour and assess level of consciousness Inform other staff members Organise clinical notes Assist relatives on site Surgeon to speak to relatives	This is an issue of a major surgical event; the patient is bleeding internally and needs transfer to HDU	The patient's statement and her pain, pale appearance and anxiety Vital signs The patient doesn't look right - look at the whole person	They do not look at the patient. They focus on the monitor They do not listen to the patient They lack awareness They may not documentation events as they unfold

Simulation Interview Table: Participant E				
Events	**Actions**	**Situation awareness**	**Critical cues**	**Potential errors**
Back to ward short time after surgery	Review recordings for any change	Patient bleeding brisk bleed or haematoma	Excessive pain Pale and anxious	Recordings would put them off looking any further
Requiring a lot of analgesia for pain	Encourage patient to press pain pump more Check what else she could have to treat the pain Ring doctor	15 min recordings One-on-one nursing care	I think I'm going to die, "impending doom" and very significant at late stage	They prioritise wrongly e.g. will leave her because her recordings are stable
Recordings stable	Inform clinical duty manager	Regardless "know something going on" Possibly a bleed	Very significant and late stage	Recordings may change dramatically before they respond
Pain score not resolving- why?	Ask surgeon to assess patient Document everything that is going on	Check group and hold. May need blood sent Check PV loss May have been sent back to the ward too soon	Patients are not normally in a lot of pain	Laparoscopic surgery with limited vision is more likely to bleed than they realise May not know the significance of increasing pain May tell the patient to keep pressing the button without doing any other assessments or any flags going up
Pale, anxious and looks tired	Reassurance Nothing by mouth Check blood results Request an order for a volume expander if the patient's blood pressure drops	The patient may need to return to theatre	Clammy skin Swollen abdomen, though may not necessarily see this with good drainage	Not picking up on pale anxious and tired. May not realise significance of what that patient is saying and what it means

"I think I'm going to die" -	Inform anaesthetist Check abdomen for swelling – ask the patient if it is normal size Check for wound ooze Look at wound drain for excessive drainage	Not a good sign There isn't anything showing up She may be compensating and recordings will indicate this Patient may go flat Anaesthetic drugs are keeping the patient stable Cyclocapron is not going to work as it's not a seep	Saying she feels like she is going to die Pulse going up	Not realising the patient is restless and not moving much because of pain Not recognising internal bleeding is painful Not recognising patient could quickly go flat

Simulation Interview Table: Participant F				
Events	**Actions**	**Situation assessment**	**Critical cues**	**Potential errors**
Pain	Check PCA pump to determine how much morphine is being given and how often Encourage the patient to use the PCA Consider giving panadol Check the patient's wound to determine if the dressing is intact and if any bleeding Check the patient's heart rate Call the house officer as pain relief may need review	The pain is not under control Possibly a collection of blood	PCA is not giving adequate analgesia	May look at the patient's heart rate before pain
Anxious and restless	Get pain under control first Ask the patient what is making her feel anxious.	This may be the patient's first surgery experience This may be a reaction to anaesthesia	Look at assessment on admission and compare to current situation	They overlook anxiety
Pale	Keep checking vital signs every ½ hour Check dressing and wound site for bleeding Check blood loss in theatre	Possibly compensating Possibly bleeding	Had surgery and bleeding is a risk Tachycardia Expanding ooze on dressing	May not recognise pale as a sign of bleeding May not realise the patient is compensating and dismiss it as anxiety

| I think I'm going to die | Explore the comment
Ask patient to explain why
Give encouragement
Assess pain | Anxiety causing patient to feel like they are dying.
The patient may have a history of anxiety disorder
Possibly a paranoid disorder | Look at the admission to discharge for the patient's health history | They may tell the patient to relax and calm down and then continue what they are doing
They focus on vital signs |

Appendix Ma. Health and Disability Northern Y Regional

Ethics Committee Approval

Health
and
Disability
Ethics
Committees

Northern Y Regional Ethics Committee
Ministry of Health
3rd Floor, BNZ Building
354 Victoria Street
PO Box 1031
Hamilton
Phone (07) 858 7021
Fax (07) 858 7070
Email: northerny_ethicscommittee@moh.govt.nz

15 October 2009

Dr Dianne Marshall
School of Nursing
The University of Auckland
PB 92019, Auckland

Dear Dianne

Professional Competence: The role of the nurse in the general surgical team using a human factors approach.
Investigators: Dianne Marshall. Supervisors: Dr Mary Finlayson and Dr Kathleen Callaghan.
Ethics ref: NTY/09/07/059
Locations:

The above study has been given ethical approval by the **Northern Y Regional Ethics Committee.**

Approved Documents
-Knowledge audit probes
-Simulation interview probes
-Information Sheet and Consent Form for participant
- Information Sheet and Consent Form for director of nursing
-Transcriber confidentiality agreement
-Advert

Accreditation
The Committee involved in the approval of this study is accredited by the Health Research Council and is constituted and operates in accordance with the Operational Standard for Ethics Committees, April 2006.

Progress Reports
The study is approved until **23 December 2013.** The Committee will review the approved application annually and notify the Principal Investigator if it withdraws approval. It is the Principal Investigator's responsibility to forward a progress report covering all sites prior to ethical review of the project in **15 October 2010.** The report form is available at http://www.ethicscommittees.health.govt.nz. Please note that failure to provide a progress report may result in the withdrawal of ethical approval. A final report is also required at the conclusion of the study.

Amendments
It is also a condition of approval that the Committee is advised of any adverse events, if the study does not commence, or the study is altered in any way, including all documentation eg advertisements, letters to prospective participants.

Please quote the above ethics committee reference number in all correspondence.

It should be noted that Ethics Committee approval does not imply any resource commitment or administrative facilitation by any healthcare provider within whose facility the research is to be carried out. Where applicable, authority for this must be obtained separately from the appropriate manager within the organisation.

Yours sincerely

Amrita Kuruvilla
Northern Y Ethics Committee Administrator
Email: amrita_kuruvilla@moh.govt.nz

Appendix Mb. Health and Disability Northern Y Regional

Ethics Committee Amendment Approval

Health and Disability Ethics Committees

16 April 2010

Dr Dianne Marshall
School of Nursing
The University of Auckland
PB 92019, Auckland

Dear Dianne

Professional Competence: The role of the nurse in the general surgical team using a human factors approach.
Investigators: Dianne Marshall. Supervisors: Dr Mary Finlayson and Dr Kathleen Callaghan.
Ethics ref: NTY/09/07/059
Locations:

List of approved amendments
-Approval is given to extend the location of the study to
at   ; Hospital.
-Approval is given to amend the inclusion criteria to stipulate 'all registered nurses' as participants.

Thank you for submitting the above amendment, which was considered by the **Chairperson** of the **Northern Y Regional Ethics Committee** under delegated authority and approved.

Please quote the above ethics committee reference number in all correspondence.

Yours sincerely

Amrita Kuruvilla
Administrator
Northern Y Ethics Committee
Email: amrita_kuruvilla@moh.govt.nz

Appendix N. District Health Board Research Committee

Approval

Research Officer

██

12 November 2009

Dr Dianne Marshall
School of Nursing
University of Auckland
Private Bag 92019
Auckland

Dear Dianne

Thank you for the information you supplied to the Research Committee regarding your research proposal:

NTY /09 /   Professional competence: The role of the nurse in the

07 / 059   general surgical team using a Human Factors approach

I am pleased to inform you that the ███████ District Health Board Research Committee has approved this research with you as ██████ investigator.

We wish you well in your project and require an update on how it is progressing. A copy of the progress report that is required by the Ethics Committee is sufficient, and should be submitted to the Research Officer by 12 November 2010.

Please note failure to submit the progress report may result in the withdrawal of ethical approval.

Yours Sincerely,

Research Officer

Appendix O. Development of the Coding Frame

Development of the coding frame

For the PhD students, six peers sorted the first review of the data which resulted in a total of 57 categories that were to be used in the second sort. For the second sort two PhD peers combined the 57 categories into meaningful groups. Once again, no restrictions were placed on their coding or how they grouped the categories together. This second sort resulted in six categories. Another sort of the categories by two different PhD peers was undertaken and compared. This resulted in one category being expanded into two and two categories being re-categorised. The final sort resulted in seven categories. These were:

- Communication

- Leadership

- Planning

- Situation awareness

- Decision-making

- Teamwork

- Patient advocacy

For the class of US HF students 10 students sorted the first pass which resulted in a total of 120 behavioural categories. For the second sort, six HF graduate students were employed to combine the 120 categories into meaningful groups. Once again, no restrictions were placed on their coding or how they grouped the categories together. This second sort resulted in 31 categories. Finally, two teams of two people were used to consensus sort the 31 categories. This final sort left seven behavioural categories. These were:

- Communication with patient/non-medical caregivers

- Communication with medical personnel

- Documentation

- Situation Awareness

- Decision-making

- Back up and assist

- Patient advocacy

The total 14 categories from both groups were compared by the researcher for consistency and showed that events had been interpreted the same from the data source in four categories: Communication, decision-making, situation awareness and patient advocacy. Five categories that were similar were synthesised and recoded. The category *communication with patient/non-medical caregivers* was recoded as *communication with*

patient/family/whānau and caregiver and included as a sub-element of *communication.* *Communication with medical personnel* was recoded as *communication with health professionals* and included as a sub-element of *communication.* *Documentation* was included as a sub-element of *communication.* The category *back up and assist* was recoded as a sub-element of *teamwork.* One category—*leadership*—was unique and identified by the PhD students and not the HF students. This may be due to the PhD students having previous knowledge and experience of the general surgical ward environment to draw on, unlike the HF students. This process resulted in seven NTS categories and four sub-elements being established from the independent data analysis of the two initial observations. They were:

- Communication
    - Communication with health professionals
    - Communication with patient/family/*whānau* and caregivers
    - Documentation
- Leadership
- Planning
- Situation awareness
- Decision-making
- Teamwork
    - Back up and assist
- Patient advocacy

Subsequent to the non-technical skill categories being determined, the coding frame was further developed and definitions for the categories and their elements and sub-elements added with criteria for recognition. The definitions for coding were adapted from the component elements of the major non-technical skill categories important for safety in high-risk work settings described by Flin et al. (2008). Those NTS are situation awareness, decision-making, communication, team working and leadership. In addition to Flin et al's categories a further two categories identified from the initial coding were added to the coding frame. They were planning and patient advocacy. The definition for the NTS category of planning was adapted from Flin et al. (2000). The definition for patient advocacy was derived from the Code of Conduct for nurses (NCNZ, 2012b). The coding frame was then populated with data from the remaining 13 observations. Following analysis of all the observational data a further category: *management* was identified and incorporated with the *leadership* category to complete the taxonomy of NTS identified. The definition for the *leadership and management* category was adapted from Flin et al.'s framework and the competencies for RNs (NCNZ, 2012a).

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