



MONASH University

PhD Thesis

Adele Callaghan

**The skills required for junior doctors to competently
recognise, respond and manage the deteriorating
patient in an acute ward in a regional hospital**

September 2019

Supervisory statement

Adele Callaghan was a PhD candidate in the School of Rural Health, Monash University, who passed away in January 2019. This partial thesis reflects Adele's progress until her candidature was suspended due to deteriorating health 12 months before her death.

This manuscript is a modified version of Adele's 2017 mid-candidature report and represents her work and writing, including the addition of the Nominal Group Technique section (chapter 6). The additions to the mid-candidature report are further illustrations of Adele's progress, including the following appendices:

1. Ethics approval for interviews [redacted];
2. Annotated interview transcript [redacted];
3. Interview notes [redacted];
4. Table of responses (first three interviews) [redacted];
5. Ethics approval for Nominal Group Technique [redacted];
6. Nominal Group Technique pilot.

Adele's thesis was organised into three phases where ethics approval was received as required and data collection for each phase was completed. Her progress was as follows:

Phase 1: Integrative review was completed and published in a peer-reviewed journal;

Phase 2: Interviews with 12 junior doctors and 12 registered nurses were completed, transcribed and thematically structured;

Phase 3: Nominal Group Technique with key stakeholders was piloted and modified before being conducted. Scoring and ranking were completed.

None of the content in this manuscript has been altered from work provided by Adele, but the additional chapter and appendices will mean some references are missing from the final reference list. The annotated interview transcript [redacted] has deliberately retained mark-up so that Adele's approach and thoughts are demonstrated in the comments.

I have provided additional explanatory text on pages 14, 42 and 67 that have been highlighted in yellow.

Leigh Kinsman, Supervisor, 12/9/2019

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Glossary of Terms

Advanced life support: The practice of attempting to preserve or restore of life by the maintenance of a person's airway, breathing and circulation using invasive medical techniques, equipment and drug therapy (Australian Resuscitation Council, 2010; Koster, Sayre, & Botha, 2010)

Basic life support: The practice of preserving life by the instituting or maintaining a person's airway, breathing, circulation using cardiopulmonary techniques. In some situation it is also the use of a automated external defibrillator (Australian Resuscitation Council, 2010; Perkins, 2007).

Clinical Incident or adverse event: An event or circumstance that results from either a hospital process or health care practitioners practice which results in unintended and/or unnecessary harm to a patient.

Competency-based training: A method of training that highlights what a person can do in the workplace under supervision(Wass, Van der Vleuten, Shatzer, & Jones, 2001).

Critically Ill Patient: a person who has physiological instability progressing to potential organ failure (Puthuchear, Whitehead, & Grounds, 2002; Robertson & Al-Haddad, 2013) .

Deteriorating patient: a person who has physiological instability or decline whose status may be acutely or progressively declining (Carrington & Down, 2010; D. Jones, Mitchell, Hillman, & Story, 2013).

Early Warning Signs: physiological changes in vital sign parameters that represent significant risk to and decline in the patients' health status. These signs are given specific parameters in vital signs, levels of consciousness and urine output which health practitioners must report in order to escalate care (Alam, Hobbelink, Tienhoven, & van de Ven, 2014).

Health Care Environment: The overall surroundings where health care is being delivered. This can be in an acute, non-acute or community based setting (D. A. Jones, Dunbar, & Bellomo, 2012) .

Escalation of care: a medical response which provides further clinical expertise and medical management in response to recognised levels of abnormal physiological decline in a patient (Ludikhuize, Smorenburg, de Rooij, & de Jonge, 2012) .

Final Year Medical Student: medical undergraduate student completing their final year nationally and internationally

Junior Doctor: in this report any reference to junior doctors are considered graduate medical students in their first year of practice as a doctor in an acute care hospital. The literature referenced in this paper has been taken from national and international studies. The junior doctors from Australian articles are known as interns and in the UK they are known as house officers.

Medical emergency Team: When patient is recognised to meet specific EWS the health practitioner escalates care by calling the MET. The MET comprises of senior intensive care specialist both in nursing and medicine.

Modified Early Warning Signs: specific physiological signs and parameters that are not as extensive to those in the EWS. They represent potentially significant changes and decline in the patients' health status. These are considered more sensitive compared to EWS. These signs are given specific parameters in vital signs, levels of consciousness and urine output

which health practitioners must report in order to escalate care to the team doctors managing the patient (Fullerton, Price, Silvey, Brace, & Perkins, 2012).

Patient safety: hospital systems, practice and protocols which all employees follow to ensure and avoid any unintended harm to patients in hospital settings (McLoughlin et al., 2006; Stelfox, Palmisani, Scurlock, Orav, & Bates, 2006).

Protocol: An established set of rules used for the completion of tasks or a set of tasks (McLoughlin et al., 2006) .

Rapid response system: The system for providing emergency assistance to patients whose condition is deteriorating. The system includes the clinical team or individual providing emergency assistance, and may include on-site and off-site personnel (Considine, Jones, & Bellomo, 2013).

Recognition and response systems: Acute hospital systems that that help healthcare practitioners promptly and reliably recognise patients who are clinically deteriorating, and appropriately respond to stabilise the patient (Considine et al., 2013) .

Risk: The chance of something happening that will have a negative impact. It is measured by consequences and likelihood (McLoughlin et al., 2006; Runciman et al., 2009)

Risk management: The design and implementation of a program to identify and avoid or minimise risks to patients, employees, volunteers, visitors and a health care environment (Stelfox et al., 2006).

Training: The development of knowledge and skills applicable to the work place environment. In this contexts it is health care environment (Mezirow, 1985).

Vital Signs: quantifiable patient blood pressure measurement, respiratory rate, pule rate, temperature measurement and conscious level (Carrington & Down, 2010) .

Abstract

This research project aims to investigate the factors that influence junior doctors' ability to recognise, respond and manage the deteriorating patient in a regional hospital.

Training health practitioners to recognise and respond to clinical deterioration in acute care is essential to ensure patients are safe from preventable harm. This requires the health practitioner to accurately assess and interpret signs and symptoms and promptly escalate care for these patients. However, contextual skills for the junior doctor are not always made explicit, even though junior doctors are frequently called to review patients who are potentially unstable or deteriorating.

Graduating medical students and junior doctors have identified that they are uncomfortable, lack knowledge and experience anxiety when exposed to a deteriorating, or unstable patient in an acute ward setting. This research will use a mixed method approach to explore the factors that influence junior doctors' ability to recognise, respond and manage the deteriorating patient in a regional hospital ward. Data will be collected using semi structured interviews and patient chart reviews. Nominal group technique with clinical experts will determine competencies in this clinical context.

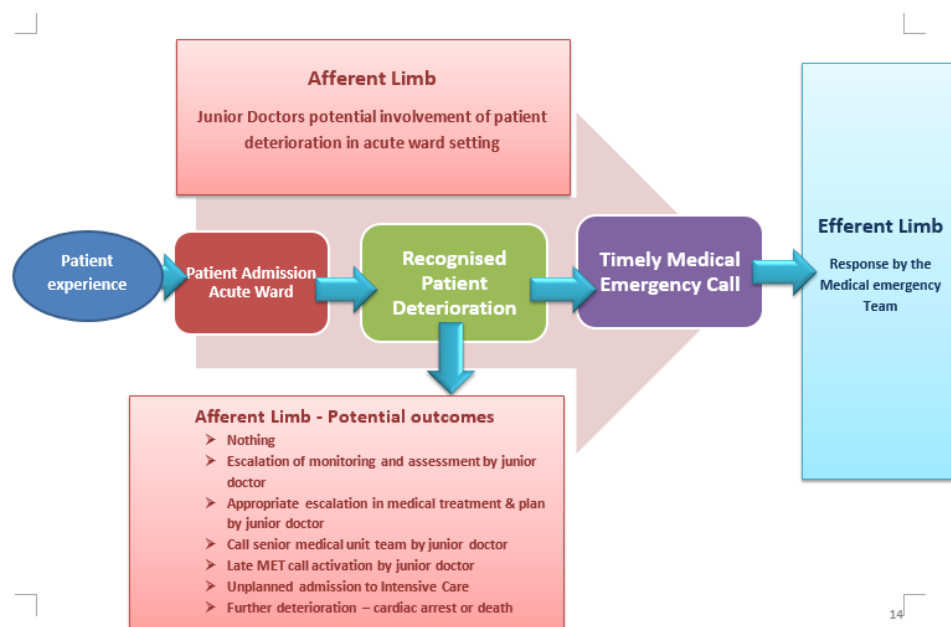
The competencies developed will inform policy and educational design of simulation programs for junior doctors to recognise, respond and manage the deteriorating patient in a regional acute hospital ward.

1. Background literature

The factors that influence junior doctors' ability to recognise patient deterioration are not understood (Rotella, Yu, Ferguson, & Jones, 2014). The introduction of Rapid Response Teams (RRT) has improved patient mortality rates and survival from cardiac arrest (M. D. Buist et al., 2002; Calzavacca et al., 2010). The composition of the responding RRT varies between hospitals. Larger hospitals generally include at least one critical care physician or fellow in their team which is identified as the Medical Emergency Team (MET) (D. A. Jones, DeVita, & Bellomo, 2011). Escalation of calling a RRT is triggered by identified criteria based on derangements in vital signs or if staff are concerned for their patient. However, significant delays still exist in staff responses to deteriorating patients in the afferent limb of patient deterioration. The afferent limb refers to patient events that occur prior to the arrival of the RRT (Figure 1) (M. Buist, 2008; Sandroni & Cavallaro, 2011). Junior doctors and nurses often do not follow RRT protocols specified by their hospital (Kenward, Castle, Hodgetts, & Shaikh, 2004; Shearer et al., 2012), lack requisite knowledge (Franklin & Mathew, 1994; Kenward et al., 2004; McQuillan et al., 1998), fail to appreciate clinical urgency or recognise critically ill patients (McQuillan et al., 1998), lack experience in managing deteriorating patients (McQuillan et al., 1998; Tallentire, Smith, Wylde, & Cameron, 2011), lack senior supervision (McQuillan et al., 1998), and fail to call for assistance (McQuillan et al., 1998; Tallentire, Smith, Wylde, et al., 2011) or initiate a MET response in a timely manner (Shearer et al., 2012; Tallentire, Smith, Skinner, & Cameron, 2011; Tallentire, Smith, Wylde, et al., 2011). Whilst nursing staff are usually the first to initiate MET, it is often the junior doctor who is called to review patients who become unwell (Rotella et al., 2014). Therefore, junior doctors can

expect to be the first medical practitioner to attend to patients who are deteriorating. Studies have identified that junior doctors are often reluctant to escalate care or are unaware of the seriousness of the patients' status (Baudouin & Evans, 2002; Folkestad, Brabrand, & Hallas, 2010; Kenward et al., 2004; Mitchell et al., 2010; Rotella et al., 2014; Subbe & Welch, 2013). This is compounded by the generalist nature of training, lack of emergency experience and the complexity of making time bound diagnoses (Baudouin & Evans, 2002; Chrimes & Harrison, 2013).

Figure 1. Afferent Limb of patient deterioration and the involvement of junior doctors.



2. Overarching aim of the project

This thesis aims to investigate the factors that influence junior doctors' capacity to recognise, respond and manage the deteriorating patient in an acute regional hospital ward.

This aim will be addressed through investigating the questions and objectives below.

Question: What does the literature attribute to the factors that influence junior doctors' primary recognition and management of patient deterioration in acute ward settings?

Objective:

To review the literature that identifies the factors that influence junior doctors' primary recognition and management of patient deterioration in an acute ward setting in the afferent limb of deterioration.

Method: Integrative Review

Question: What are the experiences of junior doctors in the recognition and management of the deteriorating patient in the regional acute context?

Objective:

To describe the experiences of junior doctors in the recognition and management of the deteriorating patient in the regional acute context.

Method: Interviews with junior doctors and acute ward nurses

Question: What are the technical and non-technical skills required for junior doctors to recognise and manage the deteriorating patient in the regional acute hospital setting?

Objective:

Identify the key technical and non-technical skills required to recognise and manage the deteriorating patient in the regional acute hospital setting.

Method: Nominal Group Technique with key stakeholders in medical education and clinical supervision

3. Design

A mixed method approach has been implemented to synthesise findings regarding the factors that influence the capacity of junior doctors to recognise, respond and manage the deteriorating patient. The study has three data collection stages;

Stage 1. Integrative review methodology was used to allow for the inclusion of broad research designs, summarising current knowledge from existing research and identify gaps in the literature regarding the factors that influence junior doctors to recognise, respond and manage deteriorating patients. An integrative review is a literature review method that allows for the combination of diverse methodologies (positivist and post positivist research) to be included in the review (Whittemore & Knafl, 2005). This method enabled the inclusion of a diverse range of primary research methods to be included and inform the aim of the literature review.

Stage 2. Interpretive constructionist approach using interviews to explore the experiences of junior doctors and registered nurses who work with junior doctors when recognising and managing the deteriorating patient in the afferent limb.

Stage 3. Nominal Group Technique (NGT). The technique aims to explore the technical and non-technical skills required for junior doctors to recognise, respond and manage deterioration in the afferent limb. NGT involves small face-to-face group discussions to reach consensus regarding a topic. The process gathers information by asking participants to individually respond to questions posed by a facilitator and then inviting them to prioritise the ideas (Bromley, 2014). NGT uses a five step process: generating ideas; recording ideas; discussing ideas; voting and ranking; and thematically grouping. The researcher invited clinical and academic experts, junior doctors and patients to participate in the technique.

The mixed method approach will utilise the convergent parallel design as described by Creswell and Plano Clark (J. Creswell & Plano Clark, 2011) in order to merge dissimilar but complimentary data from the same topic area.

3.1 Mixed method research

This section explains and justifies the science and techniques used to gather and analyse data founded from the research questions. Specifically, the researcher will articulate the research questions and describe the three stages of the thesis. The approach will utilise the convergent parallel design as described by Creswell and Plano Clark (2011, p. 77) in order to gain dissimilar but complimentary data from the same topic area. The researcher will justify the triangulation of methods to directly compare and contrast the qualitative and quantitative finding to provide rigour and validation of the research findings. A mixed methods approach facilitates greater depth of understanding of the factors which influence final year and junior doctors' ability to recognise, respond and manage the deteriorating patient (Johnson, Onwuegbuzie, & Turner, 2007). Three phases of research methods will be used; integrative literature review, interpretive interviews of junior doctors and registered nurses, and nominal group technique.

The assumption that the epistemology and method are synonymous can cause controversy amongst many researchers. There is a long standing debate that methodology cannot be mixed due to problems with epistemology (Johnstone, 2004). However, if methodology refers to the science of the methods and the philosophical assumption informs and provides rationale for the methods using a mixed method approach should be easily justified if scaffolding occurs and that each methodological perspective is clearly linked to the philosophical underpinnings (M Crotty, 1998). In this study the epistemology will inform both the methods of data collection and its analysis (Johnson & Onwuegbuzie, 2004).

The theoretical constructionist foundation in mixed methods provides direction and a framework for each phase of the research process. The data collected will be qualitative of each research questions (J. Creswell & Plano Clark, 2011, p. 47). The researcher will draw on

interpretation and understanding of the qualitative findings and search for key factors from the interpreted concepts and quantitative statistical trends in-order to answer the mixed method research questions.


In mixed methods design models usually follow a sequential model. The sequential models usually apply to two phase approaches to identify the sequence of methods. The exploratory sequential method is recognised by using two phase method approach using qualitative methods to explore the topic before building on the research using the second phase being qualitative (J. Creswell & Plano Clark, 2011; Creswell, 2003). This mixed method approach will begin with the interpretive exploration of the experiences of junior doctors and registered nurses with the deteriorating patient. The researcher works with a constructionist lens to explore the multiple perspectives of participants and develop a deep understanding from their socially constructed lens. The finding from this will not only identify new knowledge on the phenomenon but also inform the second qualitative phase (J. Creswell & Plano Clark, 2011; Creswell, 2003). Essentially the researcher will expand on what the qualitative findings uncover that can be used to inform the nominal group technique panel.

The overarching aim of this research is to explore the factors that influence junior doctors' ability to recognise, respond and manage the deteriorating patient in a regional hospital during the afferent limb of the deteriorating patient experience. Using a mixed methods approach provides the researcher with a framework to construct the enquiry process and incorporate rigour in order to improve the validity and reliability of the research. It is in this process that enables researchers to examine links whilst understanding the research process has fit for purpose. This sequence of construction identifies structure and clarity of the research framework in explaining the research design decisions.

Chapter 4: Integrative review

The candidate's integrative review was published in the peer-reviewed 'Australian Critical Care' and is provided on the following pages.

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Review Paper

The factors that influence junior doctors' capacity to recognise, respond and manage patient deterioration in an acute ward setting: An integrative review

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ABSTRACT

Objectives: Junior doctors are frequently the first doctor to be called by a nurse to review patients whose clinical status has declined in hospital wards, yet little is known about how well prepared they are to deal with this situation. This paper aims to identify the factors that influence junior doctors' early recognition and management of patient deterioration in an acute ward settings.

Method: Integrative review methodology was used to allow for the inclusion of broad research designs, summarising current knowledge from existing research and identify gaps in the literature. Quantitative, qualitative and mixed method studies were included. An electronic database search including PubMed, Medline and Scopus was performed. Research articles, exploring junior doctors' skills specific to critically ill, or deteriorating patients, technical and non-technical skills and failure to rescue were included.

Findings: Thirty-three articles were included, of which eighteen were quantitative, six qualitative and nine mixed methods. The majority of the studies, eighteen out of thirty-three, were from the United Kingdom. The evidence showed that the capacity for junior doctors to effectively deal with patient deterioration was influenced by: educational models that incorporated non-technical skills; the integration of high quality clinical simulation into education; and the level and type of supervision in the clinical environment.

Conclusion: The factors that influence junior doctors' capacity to recognise, respond and manage patient deterioration in an acute ward settings are complex. This review indicates that there is substantial room for improvement in junior doctors' capacity to deal with patient deterioration. Evidence suggests preparation of junior doctors in the recognition and management of the deteriorating patient is influenced by effective simulation education and clinical experiential exposure over time. More accessible supervision for junior doctors in acute wards is recommended to avert error and delays in the appropriate escalation of care in the deteriorating patient.

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1. Introduction

Physiological deterioration is relatively common in the acute hospital ward setting and, if deterioration progresses, may lead to unplanned admission to intensive care (ICU) or cardiac arrest.^{1–6} Nurses are frequently the first health professionals to detect signs of deterioration and respond by using their clinical judgement or by following hospital protocols to either prompt a clinical review of the patient or to call the rapid response team (RRT). Commonly,

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the nurse seeks the support of the on-call junior doctor to provide a clinical review in the very early phase of deterioration. At this point the response and skills of the junior doctor is influential to prevent worsening deterioration.^{4,5,7–11}

RRT were introduced to support more effective team-based management of deterioration,^{12–14} and provide improvement in mortality rates and survival from cardiac arrest.^{12,15,16} The capacity to manage deterioration by the RRT depends on prompt identification and escalation of care for acutely ill patients by ward staff.^{5,17}

In terms of how the response is implemented, many hospitals utilise a tiered rapid response system (RRS). A RRS consists of an afferent and efferent limb (Fig. 1). The afferent limb has four categories which rely on nurses to identify specified physiological changes in their patients.¹⁹ The observation chart specifies the parameters of physiological changes that require specific responses. The first trigger level requires increased surveillance by the nurse and to report changes to their senior nurse. The second trigger level specifies the patient should receive a medical review by either a senior nurse or junior doctor within thirty minutes. The third response requires the nurse or junior doctor to call a senior doctor (registrar level). The fourth and final trigger is the activation of the RRT due to a breach in physiological parameters or if the ward staff are concerned and believe the patient requires expedient and expert medical assistance. The efferent limb is the arrival of the RRT (ICU and/or medical consultant or registrar and an ICU nurse) who provide expert medical management and appropriate resources for the deteriorating patient (Fig. 1).^{17–19}

Ward nurses play a critical role in recognising and initiating response to deteriorating patients within the RRS. They are also the most frequent health professional to activate the RRS at each category. Many studies have explored the barriers to hospital nurses recognising and responding to patient deterioration.^{20–23} Few have reviewed the factors that influence a junior doctor's ability to recognise and respond to patient deterioration in the acute hospital setting, once they are called by the nurse. Working alongside the nurse, the junior doctor's clinical capacity to manage early patient deterioration can be crucial to prevent further physiological decline.^{4,24–26} Studies indicate that junior doctors are sometimes unable to promptly attend the patient for review, fail to call for help or are not sufficiently trained to deal with patient deterioration.^{5,27,28,29,30} The focus of this paper is to review the evidence of the factors influencing their capacity to recognise, respond and manage the deteriorating patient in the acute hospital ward context.

2. Aim

The aim of this paper is to identify *what factors* influence junior doctors' capacity to recognise, respond and manage patient deterioration in an acute ward settings.

2.1. Purpose

Following a patient review request from the ward nurse junior doctors play a role in the management of patient deterioration in acute ward settings.^{5,7} Therefore this review will explore the factors (barriers and facilitators) that influence their capacity to recognise, respond and escalate care to deteriorating and critically ill patients in the afferent limb.

2.2. Design

This integrative review was informed by the framework developed by Whittemore and Knafl.³¹ The methodological approach allows concurrent synthesis of experimental, non-experimental,

qualitative and quantitative studies.³¹ Similar data from all methods are extracted, synthesised and grouped for analysis into a thematic matrix. The template of synthesised literature is then used to identify patterns, commonalities, inconsistencies and emerging themes.³¹ Conclusions are extrapolated from each theme and integrated into a brief account of the main points.³¹ This broad perspective is intended to enhance the understanding of the aim of this review.^{31,32}

2.3. Search strategy

The search strategy targeted primary literature. Electronic databases searched were PubMed, OVID MEDLINE and Scopus. The following MeSH terms were included: critical illness; emergencies; medical error; physicians, physician, and junior; clinical competence; clinical skill; education, medical, graduate. These search terms were used in Boolean combinations using "AND" and "OR". Four search combinations were employed: (1) critical illness, physicians, junior; (2) clinical competence, critically ill, physician, junior (3) clinical skills, education, medical, graduate/methods, clinical competence, physicians, junior; (4) error, junior physician, clinical skills. Reference lists from retained research publications were manually searched by title relevance and additional studies were identified.

2.4. Screening

2.4.1. Inclusion criteria:

All research methods, primary research articles and reports were included. No date limit was applied. For the purpose of this review, studies were included where medical staff were classified as: graduate entry doctors; interns; first year internal medicine; medical graduates; internship programme doctor; Post Graduate Year one (PGY1); Pre-Registration House Officer (PRHO); and first year junior doctors.

Purposive sampling included studies of junior doctors that focused on the following features:

1. Level of competence or confidence to perform clinical skills in acute surgical or medical hospital ward settings; AND
2. The barriers and facilitators in the recognition and management of patient deterioration, critical illness and acute medical emergencies in acute care ward environments.

2.4.2. Exclusion criteria

Papers or reports that were not research articles (e.g. editorial or opinion pieces) were excluded. Studies that were limited to post graduate doctors in their second year of practice (PGY2) were not included. The following hospital settings were excluded to ensure consistency of focus on acute ward settings:

1. Psychiatric
2. Paediatric
3. Aged care or rehabilitation
4. Obstetrics
5. Intensive care
6. Emergency department
7. Palliative
8. Day procedure; post anaesthetic care unit.

Studies focused on cardiac resuscitation were also excluded:

1. Cardio pulmonary resuscitation skills—basic life support, and/or;
2. Advanced cardiac life support

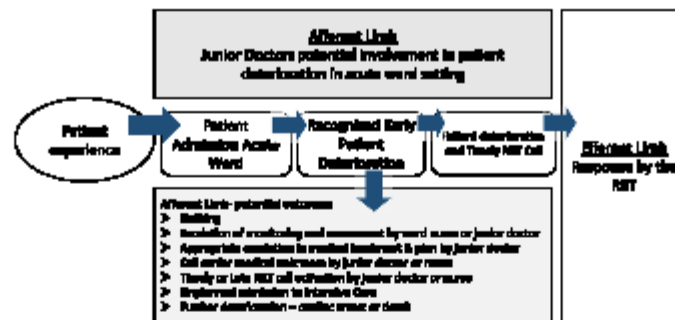


Fig. 1. Afferent and efferent limb of patient deterioration and rapid response team call activation.

2.5. Data management

Titles and abstracts were reviewed for relevance to the aims, inclusion and exclusion criteria by two authors. Full-text articles were screened against the inclusion criteria by two authors before studies were included. Where disagreement occurred a third author adjudicated on the inclusion or exclusion of the study. A data construct template was used to record text and results that related to key concepts of interest in this review. The data were categorised according to quantitative, qualitative or mixed method studies. Data was extracted and ordered under headings by author, year, country, study description, design, sample, outcome measures and main findings. Two co-authors cross-checked included studies and independently verified the results summarised.

2.6. Analysis and appraisal

According to Whittemore and Knafl³¹ there is no absolute standard for assessing methodological quality. The Critical Appraisal Skills Program (CASP)³² was used as a framework to systematically analyse and appraise the chosen quantitative and qualitative primary research articles. Guidelines developed by O’Cathain et al.³⁴ informed analysis of the mixed method studies. Thematic analysis was undertaken³⁵ to identify patterns and relationships in the dataset. An integrated summary enabled further comparative analysis within and across the studies. Synthesis of study data evolved from the combined processes and recurrent themes verified by all authors.^{31,35}

3. Results

The electronic search produced 3690 studies. Removal of duplicates produced 2286 potential studies. Fifty-three articles were included following analysis of title and abstracts. A manual search of the references of included articles produced a further twelve potential studies. Sixty-five full text articles were read to ensure relevance and alignment with the inclusion criteria. Thirty-two articles were excluded as they did not meet the inclusion criteria, leaving thirty-three included articles (Fig. 2). No paper was rejected based on methodological quality.³²

The majority of studies used quantitative approaches ($n=18$). Six represented qualitative designs and nine used mixed methods. Questionnaires were the most frequent data collection method ($n=15$) (Table 1).

Most studies were from the United Kingdom ($n=18$) followed by United States of America ($n=7$), Australia ($n=6$), Denmark ($n=1$) and Ireland ($n=1$).

Sample sizes varied from a national survey of 11,610 junior doctors;⁴⁷ a qualitative study that included interdisciplinary focus groups and interviews with three junior doctors;⁵⁵ and mixed methods: studies incorporating chart audits and interviews with five doctors⁶⁴ (Table 1).

Five themes were identified:

1. Preparedness for practice
2. Technical and non-technical skills
3. Health professional knowledge
4. Clinical supervision
5. Learning from experience

3.1. Preparedness for practice

Ten studies explored the preparedness for practice of junior doctors to manage deterioration in the acute ward setting.^{41,47,49,51,59,60,62,63,65,66} Many of these studies identified that junior doctors felt they did not have sufficient knowledge and skills for aspects of this role.^{41,47,51,59,62,65,66} Studies typically explored preparedness through self-reported questionnaire and interviews. Two studies compared junior doctors and their supervisors’ perceptions of preparedness to manage acutely unwell patients. Supervisors rated junior doctors relatively low but junior doctors rated themselves significantly higher than their supervisors.^{62,66} However, both studies identified that junior doctors were less prepared for clinical and practical skills when treating acute illness and decision making, and best prepared for history taking and communicating with parents and relatives. Iling et al.⁶⁵ used data triangulation to explore the preparedness of medical graduates for clinical practice from three different medical schools. Management and making decisions about acutely unwell patients was an aspect of clinical practice where all respondents (nurses, supervisors and junior doctors) identified junior doctors as less prepared. However, some studies recognised that junior doctors were prepared for aspects of the early recognition and management of patient deterioration with efficient use of history, examination and communication skills but not for complex situations.^{51,59,62}

Two studies were designed as educational programs (incorporating the deteriorating patient) to prepare graduate doctors for transition to practice.^{40,63} Berridge et al.⁶³ developed a two-week preparation for practice course that included management of deteriorating patients and shadowing of out-going junior doctors in the hospital. While the study was conducted in a single hospital with a small participant group, shadowing outgoing junior doctors was reported as the most highly valued aspect of the program by junior doctors for prescribing and initiating treatment

Table 1
Summary of research articles used in integrative review of junior doctors' acute care skills for acutely ill patients/deteriorating patients.

Authors	Year & country	Brief description	Study design	Participants	Outcome measures	Quantitative studies (n=18) Main findings
Marek et al. ³⁶	2000 Australia	Explored the confidence and experience of patient management and skills	Cross sectional survey	JDs n=36; plus 3 PGY2 & 3 n=56	Management of cardiac arrhythmias, myocardial infarction, asthma, pulmonary oedema, acute renal failure and shock	Significant differences between year 1 and year 2 confidence and experience in most skills. Confidence levels increased at the end of the 2nd year
Rolfe et al. ³⁷	2002 Australia	Established the type of conditions JDs should be competent to manage	Cross sectional survey	JDs n=99	Initial management and treatment of patient deteriorations: drug and alcohol abuse, endocrinological, gastroenterology, geriatric, neurological	Perceived that they can initiate treatment without supervision but not without supervision as deterioration continued
Smith and Poplett ³⁸	2002 UK	Measured seven acute care skills and knowledge	Questionnaire	JDs n=108	Knowledge of airway obstruction, non-rebreather oxygen masks, pulse oximetry, capillary refill time, hourly urine output & management of unconscious patient	Significant gaps in knowledge and understanding of the deterioration and the basic care required to support life were evident
Wu et al. ³⁹	2003 USA	Analysed adverse patient outcomes due to mistakes by JDs	Questionnaire	JDs n=114	Errors regarding diagnosis, evaluation of treatment, prescribing, procedural complication and communication	Significant errors were reported in misdiagnosis, assessment skills and clinical management of deteriorating patients
Featherstone et al. ⁴⁰	2005 UK	Investigated the Acute Life Threatening Events, Recognition and Treatment course (ALERT) and impact on course participants	Uncontrolled pre and post course comparison survey questionnaire	JDs n=18 Interdisciplinary n=315 pre & 131 post	Knowledge, experience, team work ability to recognise and manage critically ill/deteriorating patient	A significant increase in post course knowledge & confidence in ability to recognise and manage a critically ill/deteriorating patient
Dent et al. ⁴¹	2006 Australia	Perceived preparedness for 13 technical and non-technical skills and effectiveness of prior education	Cross-section cohort Survey questionnaire	JDs n=216 Year 2 & 3 n=254	Skill levels for communication, theoretical knowledge, procedural skills, emergencies, medico-legal, time management and exposure to consultants, registrars, simulation, supervisors	55% of PGY1 felt prepared for their role. Significant lack of confidence in management of critically ill/deteriorating patients was evident
Logan-Collins et al. ⁴²	2008 USA	Assessed junior doctors ability to recognise and manage common ward surgical emergencies	Cohort observational study	n=16	Communication skills, basic patient assessment, apply monitoring and medical management for pneumothorax, atrial fibrillation and septic shock scenarios	Only 50% of JDs introduced themselves to patients. 13% delegated tasks appropriately and 67% did not call for help when deterioration worsened. Generally skills were rated as poor
Antonoff et al. ⁴³	2009 USA	Assessed knowledge acquisition following a simulation curriculum for managing post-operative emergencies	Uncontrolled Pre and post-test questionnaire	JDs n=15 pre & post-test & n=20 evaluation	Relevance and value to clinical practice simulations for hypoxia, shock and metabolic disturbances, and confidence in the management of acute, life threatening post-operative emergencies	Post test scores for knowledge acquisition increased. Simulation scenarios were highly relevant to learning needs and high level confidence in performing skills during the simulations was identified

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Table 1 (Continued)

Authors	Year & country	Brief description	Study design	Participants	Outcome measures	Quantitative studies (n=18) Main findings
Shekhter et al. ⁴⁴	2009 USA	Assessed behaviours & competence during deteriorating patient simulations	Observational & questionnaire	JDs n=131	Calling for help, teamwork and communication, hand hygiene compliance, preventing medication and systems errors & manage a deteriorating patient	Communication and accepting responsibility for an unstable patient without adequate hand off were suboptimal. Course improved patient safety knowledge and skills confidence. Poor hand hygiene
Fernandez et al. ⁴⁵	2010 USA	Analysed effects of 12 high fidelity simulations of perioperative complications	Observed performance assessment	JDs n=10 Total year 1-3 n=39	Medical knowledge, diagnosis, management, communication and escalation of care during simulated scenarios of shock, trauma and perioperative complications	Detected improvements in patient management skills across the successive post graduate years 1-3 as well as deficiencies in managing shock presentations
Folksestad et al. ⁴⁶	2010 Denmark	Explored admission and follow-up of patients with clinical deterioration on acute wards	Cross sectional questionnaire	JDs n=88	Acute admissions management, level of responsibility for deteriorating patients during the day and evenings and frequency of calling for senior assistance	JDs are frequently the first doctor to attend acutely ill patients with minimal senior supervision. JDs consult or call for assistance from senior physicians in 6-10% of cases
Goldacre et al. ⁴⁷	2010 UK	Explored perceptions of preparedness for practice variances over time	National cross sectional survey	JDs n=11,610 & 3 years after graduation n=8427	Clinical knowledge, managing stress, confidence in basic clinical skills and procedures, prescribing drugs, acute emergencies and illness presentations	JDs feel underprepared for administering warfarin, insulin and fluids, inserting chest drains, central lines and lumbar punctures, dealing with confused, hypertensive or breathless patients
Gordon et al. ⁴⁸	2010 USA	Prospective trial to evaluate clinical performance in simulated settings under varied sleep conditions	Observational study-score 8 Likert scale	JDs Cohort 1 n=17 cohort 2 n=8	Simulation performance of deteriorating patient scenarios following sleep deprived states and medical errors	Clinical performance was significantly better working a shortened overnight shift compared to an extended shift managing simulated deteriorating patients
Bleakley and Brennan ⁴⁹	2011 UK	Retrospective perceptions of preparedness for practice	Comparison of cohort x 2 via questionnaire	JDs n=146	Skills in time management, airway management, arterial puncture, spirometry, naso-gastric tube insertion and use of nebuliser	The new JD cohort identified significant benefits due to structured experiential learning and patient experiences, especially early management of emergency patients
Fernandez et al. ⁵⁰	2012 USA	Analysed the impact on clinical performance of JDs following a 9 week surgical skills and patient management course	Uncontrolled pre and post-tests modified Objective Structured Assessment & supervisor assessments	JDs n=30 (4 year review 2007-2010)	Simulated scenarios – hypovolaemia, surgical emergencies and respiratory distress and adverse reactions. Clinical procedural skills – instrument identification and use, knot tying, suturing, basic laparoscopy skill, airway management, central venous catheter and chest tube insertion	Positive learner assessment in both comprehension and confidence levels were reported. Pre-test and post-test scores improved. Simulation based performance scores for deteriorating patient presentations

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Table 1 (Continued)

Authors	Year & country	Brief description	Study design	Participants	Outcome measures	Quantitative studies (n = 18) Main findings
Morrow et al. ⁵¹	2012 UK	Perceptions of preparedness of JD's to practices from graduating cohorts from 3 medical schools & work colleagues	Cohort & triangulation questionnaires to 3 medical school	JDs n = 480 Nurses, doctors & pharmacists n = 80 Identified significant differences between medical schools cohort perceptions. Preparedness for: history, examination & teamwork	Complex communication, practical procedures, time management, professionalism, multi-professional working, documentation, examination skills, clinical judgement, professional development, leadership, respiratory care	Lack of perceived preparedness by all cohorts for; clinical judgment in recognising and managing acute illness, handover, prescribing, practical procedures & knowledge application.
Tallentire et al. ⁵²	2012 UK-Scotland	Explored the errors in team-based acute care in deteriorating simulated patient scenarios	Observational study-simulation, debrief and field notes	JDs n = 38	Skill based slips, rule-based mistakes and violations during simulation of sepsis, respiratory distress, post-operative haemorrhage & hypoglycaemic coma	Significant skills based mistakes and omissions. Patient assessment mistakes leading to misdiagnosis, knowledge gaps, and violations of basic safety protocols with deteriorating patient simulations were observed
Green and Curry ⁵³	2014 UK	Explored the effect of a major haemorrhage (MH) simulation on junior doctors knowledge	Controlled pre and post-test questionnaire	JDs non simulation group n = 28 Simulation group n = 15	Confidence regarding the management of a MH, knowledge of and awareness of protocol for MH, ability to prioritise	Simulation group demonstrated significant improvement compared to the non-simulation group in post-test scores

Table 1 (Continued)

Authors	Year & country	Brief description	Study design	Participants	Outcome measures	Qualitative studies (n=6) Main findings
Lempp et al. ⁵⁴	2005 UK-England	Evaluated the educational and clinical effectiveness of a new undergraduate program	Retrospective semi structured interviews	JDs n = 17	Participants' perceptions of competence using the Scottish Medical School competencies framework	Dealing with common medical and surgical emergencies, knowledge and competence in acute care patient management skills were only partially met
National Patient Safety Agency ⁵⁵	2007 UK	Explored the factors that influence management of critically ill patients	Ethnographic/focus groups & interviews	Senior doctors n = 2, JDs n = 3, nurses n = 11	Communication, working conditions, task, education & training, patient, team, organisational, equipment & resources	Limited ability to communicate urgency with acutely unwell patients, high working work load, task competency limitations, limited educational exposure and complexities of team structures were factors that limited JDs to manage the critically ill patient effectively
Kroll et al. ⁵⁶	2008 UK-England	Explored experiences and responses to error	Qualitative interviews	JDs n = 38	Experiences of errors made or witnessed what they learned, perceived challenges and support offered	Prescribing errors were identified and resistance to seek senior assistance and timely intervention from nurses. Poor communication, incomplete handovers, overlooking test results and suboptimal recognition of patient deterioration with unfamiliar patients
Carling ⁵⁷	2010 UK-England	Perceptions of preparedness to recognise assess and manage acute illness plus effective teaching	Interviews using thematic analysis	JDs n = 7	Most effective teaching received to equip them to manage critically ill patients and type of teaching methods used	Simulations of acute illness were the most effective teaching experience. Preparedness to use the 'ABCDE' structured assessment approach was identified
Tallentire et al. ⁵⁸	2011 UK-Scotland	Explored the factors that affect JDs behaviour and preparedness when managing acutely unwell patients	Focus groups with grounded theory	Senior Doctors n = 6 JDs n = 36	Factors perceived to affect JDs behaviour when caring for acutely ill patients, how they coped, and how prepared they were in these situations	Six themes were identified: challenges with transference of knowledge to practice: decision making and uncertainty: acts of omissions of care: identity and expectations of others: challenges with medical hierarchy and situational awareness under stress were evident
Illing et al. ⁵⁹	2013 UK-England	Examined JDs preparedness for practice after four months and 12 months	Focus groups and interviews using Constructivist grounded theory	JDs n = 60	Role perception of JDs, preparedness, strengths in performance in the first four months of employment and recommended changes to undergraduate curriculum	JDs felt less prepared for areas of practice that are based on experiential learning in clinical practice: ward work, being on call, management of acute clinical situations, prescribing, clinical prioritisation and time management and dealing with paperwork JDs were the first doctor to respond to acutely ill patients throughout the year

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Table 1 (Continued)

Authors	Year & country	Brief description	Study design	Participants	Outcome measures	Mixed methods (n = 9) Main findings
Hannon ^[2]	2000 Ireland	Perceived preparedness for practice	Questionnaire & semi structured interviews	JDs n = 84	The experiences of being a JD and perceptions of the support program	Lack of preparedness with dealing with emergencies, managing confused or agitated patients and performing diagnostic procedures. They did not consider management skills (coping with stress, prioritizing and managing time) were well taught. Over fifty percent of JDs thought they were adequately prepared to manage patients on their own
Paice et al. ^[3]	2002 UK	Explored stressful incidents that JDs encountered in the first year of practice	Cross sectional survey and Questionnaire with open ended questions	JDs n = 1435	Responsibility, sense of inadequacy, dealing with death and terminal illnesses, workload and hours, inter-professional relationships, lack of support, treatment failures, decision making, and mistakes, ethical and legal issues	Lack of supervision to manage unstable patients in the first few weeks of clinical practice was a significant stressor due to perceived lack of competence. Learning from mistakes was suboptimal
Wall et al. ^[4]	2006 UK	Perceived self-preparedness and perceptions of consultant supervisors	Questionnaire including qualitative responses	JDs n = 193 Consultant supervisors n = 212	Examination, diagnosis, treatment and prescribing and practical skills, communication, teamwork, awareness of limitations, response in emergency, patient safety, time management	JDs rated their preparedness significantly better than their consultant supervisors in 13 of the 17 skills (technical and non-technical). Both groups identified that new doctors are least prepared in acute skills: responding effectively to emergencies, decision making, prescribing, treatment and practical skills
Berridge et al. ^[5]	2007 UK-England	Transition from student to JD following a two week preparation practice course and shadowing outgoing JDs	Uncontrolled pre and post 17 item Questionnaire & focus groups	JDs n = 53	Anxiety levels and confidence in technical and non-technical clinical skills and preparedness for clinical practice	Confidence increased following the shadowing program and initiating treatment for ill patients. High levels of anxiety were experienced on commencement of work. JDs lacked confidence in their preparedness for practice especially technical and non-technical clinical skills and workload management
Endacott et al. ^[6]	2007 Australia	The cues that ward nurses and doctors use to identify, communicate and assess patient deterioration	Case study design using interviews & chart audit	Nurses n = 11; Doctors n = 14; JDs n = 5; Chart audit n = 1736	What triggers participants used to identify deterioration, what they look for and if they changed patient management following recognition. Chart audit measured; documentation of vital signs and indicators prior to escalation of care	Alterations in vital signs were the significant trigger. JDs demonstrated resistance to call senior assistance. Poor documentation was noted prior to unplanned ICU admission. Lack of familiarity with patient reviews after hours and acceptance of the assessment of experienced nursing staff

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Table 1 (Continued)

Authors	Year & country	Brief description	Study design	Participants	Outcome measures	Mixed methods (n = 9) Main findings
Illing et al. ⁶⁵	2008 UK	Preparedness of JDs from three different medical training schools before and after their first year of work	Focus groups, uncontrolled Pre and Post questionnaire	JDs n = 60	Clinical and practical skills, communication skills, teaching and learning, understanding the work environment and team work	Findings: consistent between three schools and educational supervisors. Preparedness for some aspects of practice but limited preparedness for working on call, paperwork, hospital policies, managing acutely ill patients, prioritising and workload management
Tallentire et al. ⁶⁶	2011 UK-Scotland	Perceived preparedness of JDs and their educational supervisors (ES)	Questionnaire and open-ended responses	JDs n = 107 ES n = 85	Ability to provide immediate medical emergency care, assess clinical presentations, order investigations, differential diagnosis, management plan, perform clinical procedural skills, and prescribe drugs ES reported JDs to be less prepared for managing acutely unwell patients, prescribing and clinical procedural skills	JDs felt their undergraduate training preparing them for work was good to average in the technical and non-technical skills
Carr et al. ⁶⁷	2014 Australia	Described the performance of JDs in the workplace using the Junior Doctor Assessment tool (JDAT)	Cohort study supervisors assessment of JD/questionnaire (JDAT) and qualitative responses	JDs n = 200	Clinical assessment & management, procedural skills, emergency management, adverse event identification, communication, team work & professionalism	Very few JDs were identified as having an overall borderline or less performance assessment. Lowest mean scores were observed procedure performance, response to an emergency, adverse event identification & management
Rotella et al. ²⁴	2014 Australia	Explored the factors that influence JDs ability to escalate care for acutely ill patients	Questionnaire including qualitative comment	JDs n = 50	Factors influencing escalation of care: confidence and competence, logistical factors, fear of criticism, conflict and effects on career prospects	Lack of confidence and familiarity with the patients and their condition. Poor communication and documentation were more likely to influence their decision to call for senior help. Many were unsure or unclear if they were able to recognise clinically deteriorating patients

⁶⁵JDs = junior doctor, ⁶⁶ES = educational supervisors, ⁶⁷ECG = electrocardiogram, ¹CPR = cardiopulmonary resuscitation.

^a PGY = post graduate year.

^b ABCDE = airway, breathing, circulation, disability, exposure.

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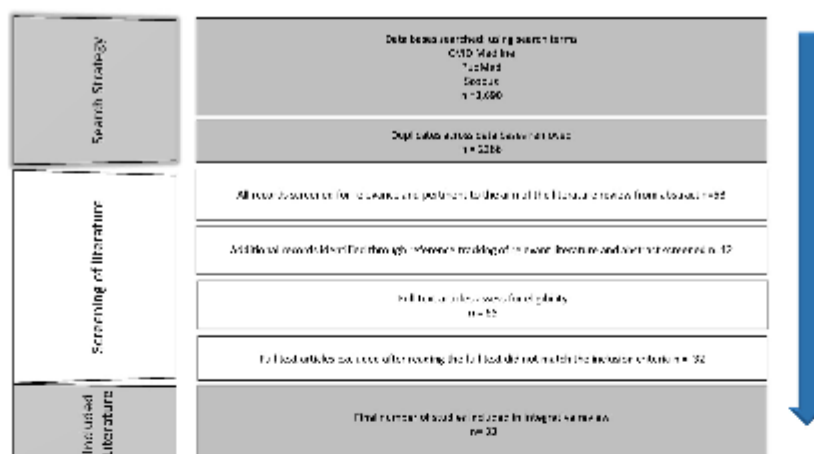


Fig. 2. Search strategy results.

for acutely ill patients. However, value was also dependent upon clinical practice opportunities during the shadowing period. In contrast, an evaluation of an Acute Life-threatening Events, Recognition and Treatment (ALERT) course from a larger cross-site cohort study reported significant improvements in participant knowledge, confidence and interdisciplinary teamwork when caring for deteriorating patients.⁴⁰

3.2. Technical and non-technical skills

Lack of confidence or competence in procedural skills was the most common theme.^{36,47,49,51,54,58–63,66,67} Non-technical skills were a common term referred to communication, prioritisation, workload management, decision-making, situational awareness, leadership, and teamwork.^{34,41,42,44,51,55,56,59,62,63,65} These skills are nationally recognised elements for training and competencies in the recognition and management of the deteriorating patient.⁶⁸ Many studies identified that communication skills between junior doctors and ward nurses needed improvement in handoff, requesting additional assistance and delegation of tasks.^{42,44,55,64} Some studies identified effective communication skills but did not clearly specify communication between nurses and junior doctors.^{45,51,62} Two studies rated junior doctors' ability to communicate with nursing staff as high base on self-perceptions and supervisors rating scores.^{41,62} Two studies did not explore interaction between nurses and junior doctors.^{39,56} Three studies included clinical teams (nurses, doctors' allied health) perceptions of junior doctors' communication skills.^{51,65,67} All three studies rated junior doctors as high for communication.

3.3. Health professional knowledge

Ten studies identified gaps in requisite professional knowledge required to provide basic acute care in patient deterioration.^{38,40,44,47,51–53,58,59,69} These ranged from difficulties with scientific foundational knowledge, translation of knowledge to practice and knowledge gained from acute care presentation in simulation-based learning. Junior doctors acknowledged that they knew what to do but did not know how to do it.⁵⁸ One qualitative study recognised that deteriorating patient simulations prepare them for practice and improved knowledge by identifying their

knowledge gaps.⁵⁷ Four studies identified improvements in pre- and post-test knowledge of junior doctors following deteriorating patient simulations.^{40,50,53,69} Five studies used deteriorating patient simulations to measure the practical performance of junior doctors.^{42,44,45,48,52} Through a controlled trial, Green and Curry⁴³ reported that clinical simulation contributed to a significant increase in knowledge regarding major haemorrhage (MH). Although this study was small and from a single site, the simulation group had not received training for MH whereas significant numbers had in the control group. Carling's⁵⁷ qualitative study reported that junior doctors perceived simulation as effective in the management of the simulated deteriorating patient. While skills-based mistakes, knowledge gaps and resistance to call for help were identified during simulation assessment, confidence and quality of clinical performance improved over time.^{42,44,45,48,52} However, none of the studies evaluated the translation of knowledge gained in simulation setting to the real clinical practice setting.

3.4. Clinical supervision

Seven studies reported a lack of supervision for junior doctors by senior physicians that contributed to mismanagement and delays in treatment of deteriorating patients.^{37,46,56,60,61,63} One study reported that junior doctors felt they could manage deteriorating patients initially but needed supervision as the patient's deterioration progressed.³⁷ Paice et al.⁶¹ reported that lack of supervision when managing unstable patients was a significant stressor for junior doctors. A questionnaire of eighty eight junior doctors identified that they were frequently the first doctor to manage deteriorating patients, especially after hours.⁴⁶ More than half the cohort did not receive education in managing deteriorating patients and received minimal supervision.⁴⁶ Studies identified that junior doctors made medical errors in medical management and did not follow protocols.^{39,52,56,58,66} Lack of supervision, stress, anxiety and sleep deprivation were found to influence quality of clinical performance and increased error when medical problems arose with surgical patients.^{48,61} This highlights the potential risks associated with after-hours clinical care of deteriorating patients by junior doctors.

3.5. Learning from experience

Significant improvement in perceived confidence and experiences in patient deterioration between first and second year junior doctors were reported.³⁶ A large multicentre study identified an increase in confidence in the role of junior doctors over time in clinical skills, prescribing, working in interdisciplinary teams.⁵⁹ However, junior doctors reported that at the end of their first year they continued to question their confidence when making decisions after-hours, specifically with managing acutely unwell patients before senior help arrived. A separate large cohort questionnaire identified perceptions about doctors' ability to manage these situations improves substantially over time.⁴⁷

4. Discussion

The results suggest the factors that influence junior doctors' ability to recognise, respond and manage deteriorating patients are diverse. Studies identified that junior doctors lacked knowledge, were inadequately prepared to deal with complex critically ill patients, lacked senior supervision, and failed to call for timely assistance.⁵⁷ The introduction of RRT was designed to mitigate delays in appropriate treatments and provide specialist advice by appropriately qualified and experienced practitioners. Many studies in this review conceded that, when managing patient deterioration in an acute ward, junior doctors experienced confidence and competence deficits in technical and non-technical skills, had limited experience and difficulties applying requisite knowledge with minimal supervision.^{24,37,59} While junior doctors report they can initiate care, complexity and progression of deterioration becomes challenging and increases the likelihood of error.^{39,52,56} The vast knowledge base of clinical practice makes full preparation challenging. Interpretation of findings from this review should be tempered by these considerations.

4.1. Educational preparation

This review identifies that junior doctors do not feel adequately prepared for the broader range of technical and non-technical skills required to recognise and manage deteriorating patients. Clinical skills laboratories and experiential practice were recognised as the main means of acquiring skills. Using part-task training manikins to teach procedural skills only focuses on the technical aspect of the skill. Human factors are innately required to perform a procedure on a real-life patient, including communication and situational awareness.⁷⁰ Better models of undergraduate and post-graduate educational laboratory, simulations and experiential models would contribute to improve technical and non-technical skills for the management of the deteriorating patient.

Alternative models of simulation to teach clinical skills using trained simulated patients inclusive of part-task mannequins or virtual reality are also potentially effective for learning and assessment within the medical education continuum.^{71,72} Engaging junior doctors in structured bedside clinical skill training and shadowing experienced junior doctors has also been shown to strengthen practical experience and improve confidence.^{73–75} However, shadowing is reliant on opportunistic patient encounters and not deliberate practice of less frequent ward patient events.

This review identified a strong relationship between exposure to skills, experiential exposure and confidence to enable effective performance in managing the deteriorating patient.^{36,45,76} Exposing junior doctors to high acuity environments like intensive care and emergency departments improves exposure and confidence in recognising and managing critical ill patients with accessible supervision.^{9,77,78}

4.2. The role of simulation

Junior doctors indicated that simulation was an important component of knowledge acquisition and skills practice.^{41,57} Performance scores and knowledge improved over time for junior doctors when exposed to the afferent limb of deteriorating patient simulations.^{37,38,43–45} The findings from this review suggest that simulations be a core component of the education continuum rather than a recommendation only.^{79,80} Inter-professional simulation can incorporate the concepts of communication, prioritisation, workload management, decision-making, situational awareness, leadership and teamwork to escalate care exponentially. These skills are important for junior doctors to enable optimal interaction with ward nurses in patient deterioration.

4.3. The clinical environment

Studies that focused on interactions between nurses and doctors identified that junior doctors' communication with nursing staff required improvement. These findings support nursing studies which identified challenges with nurse and junior doctor communication regarding deteriorating patients.^{20,21,23,64} Ward nurses provide twenty four hour care to their patient and junior doctors depend on nurses to communicate patient problems effectively. Inadequate communication between clinicians could contribute to inadequate medical review being performed, delayed response, failure to rescue, suboptimal patient care or late activation of the RRT.^{24–26}

Findings from this review highlight significant challenges experienced by junior doctors in the transition to the practice and managing acutely ill patients independently. The gap between theoretical knowledge, and clinical practice and changes in responsibility and accountability are evident and underlie many of the factors identified. Time and practical support is needed to make the transition from only being a learner to being a junior doctor and learner.⁸¹ They encounter new responsibilities, tasks and performance expectations embedded in a hierarchical and protocol focused system when reviewing a deteriorating patient. The complexity of the clinical environment itself can have an effect on the performance of junior doctors.⁸²

The perceived lack of adequate supervision for junior doctors was a repeated theme with the potential to affect patient safety, particularly when patients are rapidly deteriorating.^{37,46,61,63,66} The model of supervision requires further clarification in order for junior doctors and their supervisors to have a shared understanding of how the concept of supervision translates to patient management in the clinical environment.⁸³

Junior doctors reported uncertainties in medical decision-making compounded by stressful clinical environments and challenges with navigating medical hierarchy.⁵⁸ Difficulties synthesising relevant information to respond to patient deterioration subjected them to omissions in patient management including misdiagnosis, medication prescribing errors, procedural complications and communication omissions.^{39,52,56,58,66} This may be compounded by the generalist nature of medical training, lack of emergency experience and the complexity of making time-bound diagnoses, inexperienced clinicians without direct supervision.^{39,80,84,85} A correlation between the lack of senior supervision of junior doctors and clinical error are associated with adverse patient events.^{86,87} Lack of supervision and medical errors demonstrate that a more supportive clinical environment is needed to guide junior doctors in the process of care and to improve patient outcomes and prevent error.^{39,44,48,52,56}

While junior doctors can lack the ability to recognise patient deterioration or initiate a RRT response in a timely manner,^{24,26,29,38,56,58,66} it is important to acknowledge that ward

nurses working with junior doctors have the capacity and skills to assist them and initiate the RRT to provide the appropriate expertise and resources in a timely manner.^{21–23}

4.4. Strengths and limitations of this review

Despite the apparent lack of generalizability of many studies, consistent themes were identified between studies, suggesting that the findings from this review are ecologically valid. Many questionnaires did not describe a validation procedure.^{37,38,44,45,47} Others failed to declare inter-rater reliability when assessing the effects of simulation on junior doctors' performance in simulations.^{44,45} Qualitative studies in this review frequently did not declare data saturation when using focus groups or interviews.⁸⁸ However, transparency of the participant's voice provided qualitative credibility to the identified codes and themes in most of the studies.

5. Future research

Effectively interacting with other health care professionals under pressure is an important aspect of a junior doctor's role in patient deterioration. Models for simulation and supervision that include interdisciplinary teamwork and learning activities that effectively enhance competence and confidence in the teaching of technical and non-technical skills are critical to develop. Alternative supervision frameworks also require further exploration and research. Based on the lack of agreement between studies regarding the specific skill-set required to manage deterioration, it would be useful to develop an agreed set of appropriate and targeted skill descriptors. These recommendations have important implications for curriculum development and training of junior doctors to improve their capacity to care for deteriorating patients.

6. Conclusion

The factors influencing junior doctors' capacity to recognise, respond and manage patient deterioration in an acute ward settings are complex. This review indicates that there is substantial room for improvement in junior doctors' capacity and confidence for managing patient deterioration. Evidence suggests preparation of junior doctors in the recognition and management of the deteriorating patient is influenced by effective simulation education and clinical experiential exposure over time. More accessible supervision for junior doctors in acute hospital wards is recommended to avert error and delays in the appropriate escalation of care in the deteriorating patient.

Author declaration

All authors have made a substantial contribution to the concept, design and drafting of the paper and approved the final version to be published.

Ethics

Not applicable

Acknowledgement

Nil.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at <http://dx.doi.org/10.1016/j.aucc.2016.09.004>.

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Chapter 5: Interpretive interviews

5.1 Philosophical Perspective, Research Methodology and Methods

Research is one way of understanding an event and studying how things work; a process of systematic inquiry in which data is collected, analysed and interpreted. How data is collected, analysed, described and interpreted is influenced by the research question and the paradigmatic view of the researcher (Weaver & Olson, 2006). Qualitative research is an attempt to “understand, describe, predict or control an educational or psychological phenomenon or to empower individuals in such contexts” (Mertens, 2005, p. 2). Not only is the process of acquiring knowledge deemed research it is also about the constructive learning process (Rossman & Rallis, 2003). These two perspectives highlight the dual nature of this research: it is a focus of inquiry that seeks to address the research questions that have been posed; as well as a process of learning as experienced by myself as a researcher endeavouring to make meaning of qualitative research. The purpose of this chapter is to describe the methodology used, and to justify the methodology as the best approach to address the research question. This chapter presents the methodology, methods and approach to research design undertaken to address the research questions that underpinned this study.

Once qualitative research was perceived as unreliable, lacked focus and objectivity (Denzin & Lincoln, 2011). Due to this position qualitative research was considered second rate to quantitative research. Qualitative research data is recognised as deep, rich and descriptive depictions of research participants' interpretations, feelings and understandings in context provided by a qualitative approach (J. W. Creswell, 2013; Denzin & Lincoln, 2011; M Patton, 2015; Schneider, 2003)

Rigour in qualitative research has been challenged, more often by positivists' beliefs (Davies & Dodd, 2002; Rolfe, 2006). However, many of the quantitative, positivistic requirements for rigorous research are not applicable to qualitative research (Mertens, 2005).

Rigorous research is research that applies the appropriate research tools to meet the stated research question and aims of the investigation. The data collection tools produce information that is appropriate for the level of precision required in the analysis. The level of rigour is also supported by addressing a number of underpinning questions. Do the tools

maximize the chance of identifying the full range of phenomenon of interest? To what degree are the collection techniques likely to generate the appropriate level of detail needed for addressing the research question(s)? To what degree do the tools maximize the chance of producing data with discernible patterns? Once the data are collected, to what degree are the analytic techniques likely to ensure the discovery of the full range of relevant and salient themes and topics? To what degree do the analytic strategies maximize the potential for finding relationships among themes and topics? What checks are in place to ensure that the discovery of patterns and models is not superfluous? Finally, what standards of evidence are required to ensure readers that results are supported by the data?

Whilst there are tensions regarding rigour in qualitative research (Porter, 2007; Rolfe, 2006), there is agreement about the need for the researcher to make explicit their considered approach to research design in order for the reader to determine the methodological credibility of the research. The approach to interviews for this thesis is provided in table 1.

Table 1: Overview of the research framework for interviews

Research design Framework	Research design for phase one research
Epistemology	Social constructionism
Theoretical perspective	Interpretivist
Methodology	Qualitative
Research method	Semi structured interviews (nurses & junior doctors)
Research analysis	Thematic Analysis

5.2 Method: Interviews

Fundamental to qualitative research is maintaining a balance of voice between the perspective of research participants and the perspective of the researcher in order to truthfully represent the thoughts, perceptions and feelings of the research participants (Denzin & Lincoln, 2011).

Semi structured interviews using open ended questioning were conducted, audio taped and transcribed verbatim by the researcher (Teddie & Tashakkori, 2009). Patton (2002) described open ended interviews as those that “force respondents to fit their knowledge, experiences and their feelings into categories” (p. 348). Whilst the researcher had no intention of ‘forcing’ the participants, using semi structured interview guide provides guidance for both the researcher and the participant. Interview process took between 30 to 60 minutes. The semi-structured interview guide can be reviewed in appendix

The interviews with junior doctors and nurses were guided by the principles of the Active Interview (Holstein & Gubrium, 1995). This approach to interviewing does not promote passive respondents. The interview process is not simply a knowledge retrieval process from the participants. The interview promotes the participant to construct knowledge (Kvale, 1996). The interviewer acts as the constructive agent who influences the interview outcomes by stimulating each participants’ experiences with deteriorating patients (Holstein & Gubrium, 1995)(Fontana, 2002 Holstein & Gubrium, 1997).

The semi structured interviews opened with asking junior doctors to describe their experiences with deteriorating patients (unstable) in the role of a junior doctor. The interview with registered nurses opened with “describe your experiences with deteriorating patients (unstable) when working with the junior doctor (interns)”. Probing questions were included to ask for elaboration, clarification and further detail. Some probing questions were pre-planning in the interview schedule others arose from the context of the respondent narrative. As the interviews progressed, alternative questions were included to elaborate on situations or interpretations to prompt discussion and reflection. The interview design enabled the participants’ to move beyond a description of experiences and enabled them to construct

both the content and form of the interview-generated conversations (Holstein & Gubrium, 1995).

When researchers undertake semi-structured interviews, they generally expect the interviewee to provide an account of their experiences. This can take form of a series of facts, descriptions of an event or experience or an evaluation of how the experience went or even deeper self-reflection on what the experience meant to that person. Any component of these can make up the interview and this makes each interview unique to that person's experience (Wiles, Rosenberg, & Kearns, 2005). Therefore, the lens of each junior doctor and each nurse's interview construction communicated different layers and interpretation of their experience with deteriorating patient, junior doctor and acute ward nurses in rural hospital wards.

The interview provides the researcher with aural and oral construction of the health professional's experiences with deteriorating patients. The researcher then turns this into visual text. The researcher then needs to decide what elements of the interview are important and how to record and interpret them. The researcher had the advantage of her own construction of the interview experience with each health professional to refer to when analysing the data. The convergence of the code and retrieve from of analysis and computer assisted data analysis systems positions the research in the reliance on code and retrieve techniques that lose the many layers of the meaning embedded in the interview narrative. Computer assisted programs that try to capture the polyvocality of the constructed experience where different people are talking through the same text that allows for different interpretations of its content and the plurality of the text exist and provide validation and reliability to the analysis (Coffey, Holbrook, & Atkinson, 1996). However, the reliance on the

code and retrieve process does not capture the many layers of the meaning in the interview dialogue.

Ensuring quality in thematic analysis is difficult. The researcher must ensure they are transparent in the analysis of the view of the subjects experiences (Riessman, 1993).

Validity is the measure of quality and is the process that confirms the reconstruction of the meaning in the text that is then understood and reinterpreted theoretically by the researcher

The researcher avoided turning the interview into a therapeutic situation by using the semi structured interview guide. The researcher introduced the interview process with a briefing in which the interviewer defined the situation for the participant by briefly describing the purpose of the interview, the use of the tape recorder and asking the participant if they have any questions before starting the interview (Kvale, 1996). The interviews emphasised exploration, description and interpretation. The researcher sort to obtain description of the phenomenon and attempt to clarify and interpret with each participant.

5.2.1 Participants

Ethics approval (appendix 1) was obtained to interview six junior doctors and six registered nurses from acute care wards from two regional hospitals. A total of twelve interns and twelve registered nurses from acute care wards participated.

5.2.1.1 Junior doctor definition

Junior doctors in this study are graduate entry doctors; interns; first year internal medicine doctors; internship programme doctors (AMA, 2007; Ben-David, Snadden, & Hesketh, 2004).

In Australia all graduate entry doctors must complete a certified pre-registration program in

an accredited hospitals in order to gain registration at the end of the year (AMA, 2007; Ben-David et al., 2004).

Junior doctors who have completed an acute care ward rotation in their intern year and registered nurses working with junior doctors on acute regional wards were included in this study.

The following hospital settings are excluded to ensure consistency of focus on acute ward settings:

1. Psychiatric
2. Paediatric
3. Aged care or rehabilitation
4. Obstetrics
5. Intensive care
6. Emergency department

Interpretive phase one of study:

Leonard (1994) described the interpretive process as circular and moves back and forth to follow an authentic and deeper analysis. Depicting the person in a situation enables presentation of meaning and context. Interpretation seeks to develop explanations and understanding based on their experience and constructed understanding. The researcher approaches the phenomenon with a point of view or pre-understanding which orientates us towards the experience in a particular way. As the researcher, my pre-understanding and background in teaching final year medical students patient safety and care of the critically ill

patient will provide me with the ability to ask appropriate questions, enable analysis of themes and provide insights into the interpretive phase of this study.

Purposive sampling was utilised following ethics approval from two regional hospitals in two different states of Australia. The number of participants required is relational to the data collected. Data collection continued until the researcher was assured that data saturation and redundancy had been achieved. Data saturation and information redundancy is achieved when no new themes or essences emerge from the participants or the data generation continues to repeat itself (Streubert & Carpenter, 1999). Mertens (1998) recommends that the number or size of the sample be governed by repetition of themes and sub-themes instead of extending themes. She recommends that approximately six participants be chosen for an interpretive study.

5.2.2 Data Analysis

Thematic analysis is a qualitative method for identifying, analysing and reporting patterns (themes) within data. It organises and describes a data set in rich detail. It also interprets various aspects of the research topic. There are many different ways thematic analysis can be applied.

“Following the interviews the researcher listen to the tape, check that the interview could be understood and verify the need for a follow-up interview” (V Braun & V. Clarke, 2006, p. 79).

To ensure accuracy, interviews were transcribed verbatim. The researcher listened to the tapes while reading the transcripts for accuracy. Participants were asked to review the transcripts to check the data as recognised to be true by those who had the experience. This ensured that the researcher didn't manipulate the material. All transcriptions were de-

identified and stored in a password protected computer. Thematic analysis was utilised to extrapolate the themes from each interview (Welsh, 2002). Thematic analysis is a manual analysis of transcriptions in order to identify themes that emerge. It is a process of identifying the themes and re-reading the data. In order to recognise a pattern in the data, where the merging themes become the categories for analysis (Rice & Ezzy, 1999). To obtain an overall sense of the data collected the entire text was read through (Tesch, 1990).

Themes derived from the data set were developed using an inductive approach (V Braun & V. Clarke, 2006).

A short list of codes that match a text segment were developed. The expansion of categories was then reviewed and re-reviewed.

Content analysis occurs when codes are identified and grouped into categories. Initial codes and categories were independently verified by the principal investigator using a thematic analysis strategy. Data was coded and analysed inductively from the bottom up. Using the raw data line by line analysis.

“Pure induction is never possible, because our standpoints and ontological, epistemological and theoretical frameworks always shape how we read and interpret data, but we can aim to ground our analytical observations in the data rather than in prior theory.” (V Braun & V. Clarke, 2006, p. 97).

A four step process of thematic data analysis will occur: immersion, coding, categorising and generation of themes (Green et al., 2007).

- Researcher transcribing interviews
- Re reading through transcriptions

- Data Matrix from semi structure interview was developed.
- Line by line analysis process applied to the transcriptions and inserted into the data Matrix.

Having well defined study question and aims was important to ensure that the analysis process remained consistent. The semi- structured questions provided a framework to consolidate data extracts. The data extracts could then provide a cluster of responses from each participant's but also as a group of junior doctors, a group of registered nurses and then a comparison of responses between professional groups. This comparative analysis (Polit & Beck, 2010) clusters the similarities and parallels the differences of participant responses as a group of junior doctors, registered nurses and a combined group of health professionals. This assisted with the development of overarching themes and subthemes.

Themes and concepts were embedded throughout the participant interview transcriptions. While the emergent themes were evident the active role of the research played an important part in identifying patterns, selecting the data extracts that were aligned with the research question and aim and then reporting them (Taylor & Ussher, 2001). Emerging themes were not those that 'resided' in the data they were socially constructed in the dialect of the interview, the researchers thought constructions of the data and then creation of the links to understand and interpret them (Ely, Vinz, Downing, & Anzul, 1997: 205-6).

The theoretical framework is important to complement method and what the researcher is exploring in order to acknowledge how decisions have been made. Thematic analysis utilised a realist method in this research. The researcher acknowledged that each participant made meaning from their experience and their environment and social

interaction impinged on their meanings and interpretation of the experience. The social constructionist theoretic framework brings a number of assumptions about the nature of the data, what the data represents in terms of reality. The transparency of the theoretical framework utilised to analysis the data must be made transparent (V Braun & V Clarke, 2006).

Rigorous analysis of interview data is integral to the production of high-quality interpretive research (Green et al., 2007). This study provides an explicit account of how themes are linked to data and theory in order to produce valuable evidence.

5.3 Conceptual Framework

Epistemology refers to the nature of knowledge, or "a certain way of understanding what it means to know" (Crotty, 1998, p. 10). Making explicit the epistemological stance of research clarifies the focus and perspective of inquiry. The theoretical perspective of Wenger's (1998a) CoP clearly focuses on a sociocultural view of learning. Lave and Wenger (1991) positioned legitimate peripheral participation as a social constructivist perspective of learning. The epistemological stance of social constructivism represents knowledge as socially constructed by those actively engaging in activities where knowledge exists (Crotty, 1998; Mertens, 2005). From this standpoint, knowledge construction is an individual process of inventing "concepts, models and schemes to make sense of experience" (Schwandt, 2000, p. 197). However, rather than adopting an epistemological stance of social constructivism, this research reflected a social constructionist perspective of inquiry.

Social Constructionism is the chosen conceptual framework applicable to the study. Social constructionism differs from positivistic empirical perspectives. Social constructionism attempts to make sense of the social world. Individuals create and construct knowledge as

they engage with the world. Social constructionism views knowledge as constructed and negotiated through interactions (Andrews, 2012; Michael Crotty, 1998b). Positivists position knowledge as an objective reality; which assumes cause and effect in order to create knowledge which is value free (Bunniss & Kelly, 2010) .

As Crotty (Michael Crotty, 1998a) explains ...*“Constructionism is the view that all knowledge and therefore all meaningful reality as such, is contingent upon human practices, being constructed in and out of interaction between human beings and their world, and developed and transmitted within an essentially social context”* (p. 42).

Therefore, individuals can create and construct meanings and interpretations as they engage with the world (Michael Crotty, 1998a). It is the interaction between human beings, objects, concepts, context and cultures that constructs and shapes their interpretation of their world, and is developed and infused within a social context (Michael Crotty, 1998b). Social exchange and language is viewed as constructive and the linguistic expression and reference can shift from context to context, it is socially constructed and does not represent one reality (Stead, 2004). Whereas, constructivism focuses on meaning making through individual cognitive processes; (Young & Collin, 2004) Social constructionism's concepts originate from social relationships and emphasises discourse (language) which is contextually embedded (Stead, 2004; Young & Collin, 2004). Knowledge is sustained by social processes and knowledge and social action go together (Young & Collin, 2004).

Social constructionism is closely related to, but distinct from social constructivism. Social constructionism, like social constructivism, also perceives knowledge as a continual, social process of testing and modifying existing knowledge when confronted with new experiences. Ackermann (2001) and Crotty (1998) contend that social constructivism represents learning

as an individual process, focussing on active meaning-making that occurs in the individual mind as a result of the individual's interactions within a group (Ackermann, 2001; Crotty, 1998). In contrast, social constructionists' position learning and interpretation as a process of collective generation and transmission of meaning created through the social interactions from a group (Crotty, 1998; Schwandt, 2000).

An important distinction in relation to this research study, is the emphasis social constructionism places on learning as engagement with a particular culture, and the authentic characteristic of that culture (Ackermann, 2001). As Crotty (1998) explained "social constructionism emphasizes the hold that our culture has on us: it shapes the way in which we see things (even the way we feel things!) and gives us a quite definite view of the world" (p. 58). Further, social constructionists are interested in issues of power that result from the interplay between cultures and representations of power, as contestations of legitimacy of knowing and of knowledge (Burr, 2003). Such concerns are of significant interest to this research study in terms of exploring the legitimacy of knowing and of knowledge through processes of social negotiation of participation, learning and identity construction where culture, academic and workplace knowledge and practices intersect.

Crotty (1998) contends that the concepts of epistemology and ontology are mutually dependent and difficult to distinguish conceptually when discussing research, as: "to talk about the construction of meaning [epistemology] is to talk of the construction of a meaningful reality [ontology]" (Crotty, 1998, p. 10). Therefore, whilst supporting that the assumptions that underpin all qualitative research are both epistemological and ontological, for reasons of clarity, Crotty (1998) omits ontology from his four elements of research design.

The social constructionist research agenda:

The social constructionist research agenda aims at listening to participants every day and meaningful aspects of their social world. The researcher explicitly orientates themselves to the interaction and discourse of the participant's construction of social reality. The researcher appreciates the naturalist's aspect of the description of what is going on with the emphasis of how these events exist in the realities of the participants' everyday lives. The participant social world is treated as a subjective perception and focus on the practical activities in which the participants are continually engaged to construct manage and make sense of their social world. The most important aspect of constructionism is its emphasis on the constructive process of knowledge in particular contexts. The constructionist peruses the content of the "what" of reality and the "how" of the participant's reality and its representation. P. 25-26 (Silverman, 2014).

The following dot points identify why the social constructionist approach is appropriate for this research:

- The 2nd stage of the project is using an interpretive approach exploring (using interviews) the human experiences and interaction in a social context of junior doctors recognising and responding to patient deterioration.
- Junior doctors' social context is situated in an interdisciplinary (acute ward setting) which they construct meaning by interacting with ward staff and patients who are ill.
- Junior doctors' meaning and knowledge of their experiences is constructed, not only through the social process of working in an acute ward setting will critically ill patients, but also through the narrative of their experiences transmitted within an interpretive interview setting.

Why include registered nurses and apply social constructionism as a conceptual framework?

- Knowledge translation of the interactions between people (**nurses**, doctors and patients) during which shared versions of knowledge are constructed. The production of shared knowledge is not only of objective observations but of the social processes and interaction in which the junior doctors and nurses engage in (Burr, 2015; Michael Crotty, 1998a).
- Constructionism brings objectivity and subjectivity together; by their subjective construction from their objective position. Thus the objective position and subjective construction of registered nurses interacting with junior doctors in this context provides insight from nurses' perspectives.
- Knowledge is viewed a by-product of relationships not only of individual minds alone (not only cognitive)(Gergen, 2001)

Junior doctor perceptions of their preparedness for practice in the management of acutely ill patients are suboptimal (Goldacre, Taylor, & Lambert, 2010). Junior doctors called to review patients due to a change in their clinical status have identified that their confidence and application of appropriate skills improves over time (Bleakley & Brennan, 2011; Marel et al., 2000) . This process occurs through situated learning and the construction of professional knowledge applied in the clinical workplace. These doctors are situated in a community of practice that is influenced by culture and context (Burr, 2015; Michael Crotty, 1998a).

Situated learning involves learning through activities which are goal directed (e.g. to assess the patients airway) in authentic environments (in a clinical wards environment) (Stephen, 1994). The intention is to apply health professional knowledge (knowledge learnt in university) to the workplace (clinical hospital ward and patient). The original source of the learnt knowledge is transferred to different circumstances that are different to the original source.

Therefore, the learner connects the circumstances of knowledge acquisition to the construction of knowledge in the authentic environment through social interaction and activity (Stephen, 1994).

Junior doctors engage in situated learning when reviewing unwell patients because they perform tasks and solve problems in an environment which requires various intended uses of their knowledge (Brown, Collins, & Duguid, 1989) . The deteriorating patients and management requires domain specific knowledge in complex thinking, social based learning and cognition by the junior doctor. Finally, the junior doctor is required to apply their embedded knowledge to the authentic situation (Brown et al., 1989).

Junior doctors can construct different meanings and ways of proceeding when managing critically ill patients (Michael Crotty, 1998a). Junior doctors are situated in an interdisciplinary environment that has social and contextual elements that influence workplace-based learning and professional practice. Knowledge translation of the interactions between junior doctors and other health professional informs clinical decision making in context (Burr, 2015; Michael Crotty, 1998a).

5.4 Interview results

The capacity of the junior doctor to recognise, respond and manage the deteriorating patient was explored in the semi structured interview with interns from two regional hospitals in two different Australian states.

Interviews were completed with 12 junior doctors and 12 Registered Nurses from acute wards. Using a reading frame, Adele completed initial note-taking for all interviews. One transcript (appendix 2) and notes (appendix 3) are provided as evidence of the candidate's approach, along with a sample of tabulated quotes for all interviews, although only a sample of the first three interviews is provided here (appendix 4).

Objective: Describe the experiences of junior doctors in the recognition and management of the deteriorating patient in the regional acute context.

Overarching question: What are the experiences of junior doctors in the recognition and management of the deteriorating patient in the regional acute context?

Interview question

Please describe your experiences with deteriorating patients (unstable) in the role of a junior doctor: please include patient experiences that have progressed to MET calls, cardiac arrests, unplanned transfer to ICU and/or patient unexpected deaths.

Probing questions:

- a) What type of calls from the nurses do you receive?
- b) What clinical skills did you use in these situations?
- c) Do you call the MET call in these circumstances? Why?
- d) How was the situation resolved?

Chapter 6: Modified Nominal Group Technique

The nominal group technique is frequently referred to as a consensus method (Delbecq, Van de Ven et al. 1975, Horton 1980, Sink 1983, Fink, Kosecoff et al. 1984, Jones and Hunter 1995).

The Delphi technique is another consensus method commonly adopted in health research (Williams and Webb 1994, Kelly, Moher et al. 2016). These methods largely draw from quantitative estimates through qualitative approaches. Their purpose focus on situations where individual judgments need to be collated and merged to arrive at decisions which cannot be designed by one person effectively. These methods advocate for problem solving and idea generating which routine meetings do not effectively achieve (Delbecq and Van de Ven 1971, Delbecq, Van de Ven et al. 1975, Fink, Kosecoff et al. 1984).

The aim of the aim of these methods is to determine to what extent 'experts' agree on a particular issue. Decision making in groups or committees are commonly governed by an individual or parties representing vested interests. They are often inefficient at group decision making and are time consuming. Group meetings made up of different professions, having different views and agendas often experience conflict and commonly one group can dominate over others with more members or power inequities. Discussion can become repetitive or redundant if not facilitated in a structured sequence and time can be wasted due to members talking around a subject rather (protracted) than coming to a solution. Often solutions are reached through dominance rather than a balanced review of the whole group's decision (Van de Ven and Delbeco 1971, Horton 1980).

The NGT was originally developed in the 1960's in aerospace, environment and industrial areas for group analysis, investigation, evaluation and decision making (Butterfield 1988). The

initial authors, Van de Ven & Delbecq (1972, 1975) identified that the process could be applied in other setting such as education, health care and policy (Allen, Dyas et al. 2004, Castiglioni, Shewchuk et al. 2008, Lossius, Krüger et al. 2013, Foth, Efstathiou et al. 2016). The technique has been found to be beneficial in identifying and problem solving research questions, training and assessment needs, programme evaluation and structuring meeting and conferences (Butterfield 1988, Touchie, De Champlain et al. 2014, McConnell-Henry, Cooper et al. 2015).

The NGT has been utilised to develop guidelines in the health care sector, identification of research priorities and educational interventions (Waddell and Stephens 2000, Potter, Gordon et al. 2004, Castiglioni, Shewchuk et al. 2008, McMillan, Kelly et al. 2014).

The Nominal Group Technique (NGT) is designed to facilitate collaborative and democratic decision making (Delbecq and Van de Ven 1971). The classic NGT consists of six steps:

1. Individual generation of ideas.
2. Recording of all participants' ideas (in a round-robin format).
3. Group discussion of all generated ideas (to organize the list and remove duplications).
4. Preliminary vote to select the most important ideas.
5. Group discussion of the vote outcomes (including additions and further merging of overlaps).
6. Final voting on the priority of items.

6.1 NGT process

The role of the group members is to build consensus as to the content and presentation of what skills junior doctors need to recognise, respond and manage deteriorating patients in the afferent limb. The aim of this process is to inform education, industry and policy makers what junior doctors as health care practitioners require in the workplace. There are a number of approaches to facilitating a NGT. The process is highly structured and requires stringent adherence to rules. The aim of this technique enables all members to voice their opinions and views, while enabling a consensus on a shared understanding of ideas.

The nominal group technique is an effective way of gathering and interpreting data about a detailed and complex practice for junior doctors. It is a structured meeting which aims to provide a structured procedure for obtaining qualitative information from a targeted group who are also familiar with the problem area. The purpose is to generate ideas, discuss them and then rank them in a controlled way by the guidance of the facilitator. The facilitator controls the information gathering process, rather than leading the discussion enabling all voices to be heard (Horton 1980, Gibson and Soanes 2000, Castiglioni, Shewchuk et al. 2008).

The nominal group technique adopted in this study was the following:

The process of the NGT is (Delbecq, Van de Ven et al. 1975, Butterfield 1988):

1. Introduce nominal group process to the group
2. Silent generation of ideas by writing them down individually
3. Round robin listing the ideas without discussion or clarity
4. Discussion and clarification of ideas on a white board
5. Rank and order the idea silently
6. Submit the rankings to the facilitator

7. Total rankings presented to group

8. Conclusion

However, there are many variants on the NGT when it is used in practice. The researcher followed the NGT methods as ascribed by Delbecq, Van de Ven et al. (1975).

6.2 Advantages and disadvantages of NGT

The main advantage of the NGT over other strategies is the enhanced opportunity for all participants to contribute ideas and to minimise the domination of the process by more confident or outspoken individuals (Foth, Efstathiou et al. 2016) . Other advantages (Delbecq and Van de Ven 1971, Van de Ven and Delbecq 1972, Nelson, Jayanthi et al. 2002, Foth, Efstathiou et al. 2016) include:

- The generation of a greater number of ideas compared to other group practises.
- The generation of more creative ideas than other group processes.
- The efficiency of interpreting the results (as ideas are generated, voted on/ranked, and evaluated at the session itself).
- Interfaces multiple disciplines
- Avoids semantics and produces rich data
- Participants can articulate their ideas more clearly due to the silent generation of ideas.
- Participants can gain a sense of accomplishment due to the results being presented at the conclusion of the session.
- The process is not resource intensive for the facilitators or time consuming for participants. The comparatively efficient use of time when compared to the Delphi (NGT can have a single meeting whereas Delphi may require a number of cycles).
- There is less risk of participant attrition compared to the Delphi process.

Disadvantages include:

- The limited number of topics and issues that can be covered (tend to be single-topic sessions).
- The limitation of idea generation to the meeting itself (i.e., no opportunity for participants to think about the issue in depth and generate additional ideas in their own time). However, this was mitigated by the researcher by sending participant information sheets prior to the session allowing participants to consider the topic and question to be answered.
- The need for participants to feel comfortable with, and remain within, a very structured group process.
- The lack of anonymity, which may limit participants' willingness to express their views.
- The necessity for all members to be capable of, and comfortable with, expressing their ideas in writing and then communicating them verbally to the group.
- The time commitment required from participants, and the necessity for them to attend a specific location at a given time, which may limit participant numbers.
- The lack of generalisability of the results to the wider population due to the specific characteristics of the participants (both in terms of who is nominated to attend, and who agrees to participate).
- The limited nature of the data with regard to the number of respondents.

The researcher decided to use the NGT because due to its efficient use of time and the ability to capture all participants in the room in one session. Compared to the more time consuming process of the Delphi technique that requires a series of questionnaires where participants need to respond to a broad question initially, then continue to respond to subsequent

questionnaires which are built upon the responses to the proceeding questionnaire. This process ceases when “consensus” has been reached among participants. While the Delphi process is anonymous and can accommodate a larger groups of participants than the NGT the Delphi can experience a high attrition rates influencing validity and reliability of the final results (Delbecq, Van de Ven et al. 1975, Kelly, Moher et al. 2016, McMillan, King et al. 2016).

6.3 Modified NGT Pilot

The candidate completed a pilot of the Nominal Group Techniques (NGT) in May 2015 at the 6th International Clinical Skills Conference in Prato Italy.

The candidate presented a workshop 1.5 hours using a modified Nominal Group Technique at the 6th International Clinical Skills Conference; Creativity and Diversity in Clinical Skills Education and Research; Prato, Tuscany 17th-20th May 2015. Title - What are the skills required for junior doctors’ when patients deteriorate in a regional hospital ward? Appendix ... Provides the workshop method, intended audience, outcomes, number of participants and back ground. Appendix ... Provides the lesson plan which was delivered at the workshop by the candidate using a modified version of NGT. The exercise was an excellent process regarding the use of NGT and what worked well and what didn’t. Representation at the workshop was good, 8 participants; nurse (*n*-2) and specialist doctors (*n*-6) (international). Management of the session was co-ordinated by the candidate, explanation of the process and how it will work. Another academic assisted with scribing and time keeping to enable the candidate to focus on discussions with participants. A PhD supervisor participated in the workshop as well. The planning of the session was limited to 1.5 hours in total, therefore, it was decided not to include the ranking phase of the technique. No ethics approval was processed to present the list of skills identified by the international group of health

practitioners who attended the workshop. Therefore, the results of the skills list cannot be reported. The method did provide diverse amount of technical skills, communication skills, knowledge, attitudes and situational awareness skills along with environmental process skills. This highlighted the plethora of skills nominated by the group. The advantage of conducting this technique in a conference was having a captured audience who attended due to interest in the topic and provided the opportunity to clarify skills stated face to face. The pilot also highlighted the potential risk planning a NGT and inviting very busy “time poor” experts from a regional hospital was capturing the target audience at a convenient time for all. Lastly, the candidate found that having practiced the technique in Prato and using the session plan template would be a good guide for the NGT method when conducted in Australia.

6.4 The validity of NGT

The level of experience and expertise of the participants is believed to improve the validity of the data generated not the number of participants (Potter, Gordon et al. 2004). While the researcher cannot conclusively know whether any particular judgement is good at any one time. The researcher can identify a method of arriving at judgments that will produce good judgement than other methods. There is no absolute means for judging at the time whether a decision is valid, and thus whether one particular method for producing consensus is better than others. Therefore, the way the question is posed is important so that the researcher does not influence judgments about appropriateness of the answers. It is possible that judgements derived from general questions may differ from those originating from specific questions (Black, Murphy et al. 1999).

Braun and Clarke (2006) and Polit and Beck (2006) state that the validity and reliability of the NGT findings can be enhanced through the comparison of the findings from similar studies.

The authenticity of the participant in the group also provides validity to the NGT process. For example, the researcher needs to describe who the participants are and what makes them relevant to the topic in question.

6.5 Consensus

It is important to explore issues of consensus when referring to validity and reliability when using this method. Consensus in NGT method does not mean that all participants agree with all the ranked items. Consensus refers to the relative ranking and weighting of ranked items by the participants. There are two types of consensus: strength of cumulative vote score and number of votes per item. Prior to the study it was decided that the strength of the cumulative vote score would determine the level of consensus (Sink 1983) . When consensus is achieved, it can be argued that there is evidence of concurrent validity in that the experts themselves have both identified and agreed upon the priority issues that need addressing. When component skills of professional effectiveness are an objective of the research question, then the use of consultative methods, such as NGT, improve the validity of the study (Caves 1998). Cave (1998) claims that the skills identified have high face validity; meaning they appear to be the most relevant to those working in the environment. Consensus supports evidence of validity in that the experts themselves have both identified and agreed upon, the requisite skills (Caves 1998).

6.6 Ethics

Ethics approval was granted to conduct the NGT at Monash Rural Health (appendix 5) and invite academic leads, final year medical students completing their MBBS, registered nurses, interns and consultant medical officers from Bendigo Health by the Monash University Human Ethics Committee. Hansen (2006) notes a potential ethical problems with NGT is the fact that

the researcher cannot guarantee the maintenance of confidentiality and anonymity of the participants. The importance of confidentiality was emphasised in the consent form in which participants agreed to protect the privacy of their fellow participants.

6.7 Nominal Group Technique Main Study

The nominal group technique (NGT) was conducted to identify the skills (technical and non-technical) required for junior doctors (interns) to recognise, respond and manage a deteriorating patients in an acute regional hospital ward. The group was asked to generate a set of competencies (skills) that will inform medical education curriculum for junior doctors to recognise, respond and manage deteriorating patients. The question posed was: What are the key technical and non-technical skills that junior doctors require to recognise, respond and manage the deteriorating patient in an acute hospital ward setting? The process was structured meeting to provide an orderly process for obtaining qualitative information from a target group. The group included health professionals who are closely associated with intern doctors and the deteriorating patient context in an acute regional hospital ward. The group in this research consisted of registered nurses, intern doctors, final year medical students, consultant medical officers and academics who teach final year medical students. The purpose of the NG process was to generate ideas, which are then discussed and ranked by the group. The group was guided by a facilitator (researcher), who managed the group process and information flow, acted as a collector of concepts generated as opposed to leading the discussion. The facilitator worked with three other researchers (PhD supervisors) acting as note-taker, co-ordinating activities with the white-board and time keeper. The technique aimed to avoid the known pitfalls of group interviews or focus groups, where some participants can be silent or overridden in the presence of more articulate and dominant personalities, particularly when perceived to be in a different position in the hierarchy. This

method facilitates all members to have an equal opportunity to contribute. The group process took approximately 2.5 hours in its entirety. The NGT was chosen because it's an efficient way to achieve consultation and consensus with professional groups.

6.7.1 Participants and recruitment

A purposive sampling technique was employed for participant selection for the NGT. Purposive sampling ensured representation of several groups (five in total). This qualitative recruitment method aspires to reflect the diversity within a given group of health professionals. Rather than using convenience sampling technique the researcher chose purposive sampling or sometimes known as purposeful sampling (Barbour 2001, Patton 2015). Convenience sampling (also known as availability sampling) is a specific type of non-probability sampling method that relies on data collection from participants who are easily accessible and available to participate in the study. Whereas, purposive sampling emphasises the selection of "information rich" cases in which the researcher gains information from those who have a great deal of experience and knowledge about the issue of inquiry. Therefore, the information rich cases provides insights and depth of understanding rather than empirical generalisations (Creswell and Plano Clark 2011, Patton 2015). Secondly the researcher intended to include a maximal variation sample to include a diverse range of participants who were expected to have different perspectives on the research question (Creswell and Plano Clark 2011).

Therefore, participants were selected because they were considered to have knowledge and experience with junior doctors in the afferent limb of patient deterioration in a regional hospital setting. The group of health professionals who participated were composed of people who are expert in the appropriate area and who have credibility with the target

audience. While clinicians have clinical expertise (interns, nurses and consultants), final year medical students have expertise from having experienced the impact of the deteriorating patients with junior doctors. This is why the researcher decided that these participants would help answer the question (Black, Murphy et al. 1999, Creswell and Plano Clark 2011).

The participants were all from a Regional town of Bendigo Victoria. Invitation to participate was sent to the respective wards and department of the regional hospital, final year medical students and university academic leads. A letter of introduction, an invitation to attend the NGT session and a participant information sheet was enclosed (see appendix). The participants were asked to contact the researcher via email if they wished to participate. Participants were recruited on a first-come first-serve basis.

Fourteen participants accepted an invitation to participate in the NGT evening. Previous researchers using the NGT method have included between six to fourteen participants (Castiglioni, Shewchuk et al. 2008, McMillan, Kelly et al. 2014, Touchie, De Champlain et al. 2014, McMillan, King et al. 2016).

The faculty members and graduating final year medical students from Monash Rural Health-Bendigo, senior medical consultants', interns and registered nurses with broad experience in working with interns when managing the deteriorating patient in the afferent limb at the regional hospital accepted to participate in the NGT. These participants were not only interested in the subject of junior doctors and the deteriorating patient but had intimate knowledge and experience and were considered experts on what they think the skills are that junior doctors require to recognise, respond and manage deteriorating patients prior to the arrival of the MET.

Touchie *et. al.* (2014) refers to expert participants as “subject matter experts” because of their knowledge and experience with subject matter. Subject matter experts from a consultant medical background were recruited from general medicine, intensive care and emergency medicine. Academic leads (n=2) were also senior medical consultants, coordinate and teach into the Bachelor of Medicine and Bachelor of Surgery (MBBS) program and have knowledge, and experience with junior doctors and the deteriorating patient. Consultant medical officers from Bendigo health (n=2) who work with junior doctors and deteriorating patients in acute care contexts. Subject matter intern experts (n=2) were those who had experienced a deteriorating patient in both the afferent and efferent limb of deterioration in the clinical ward environment. Final year medical student graduates (n=4) were subject matter experts who had experienced an afferent and efferent deteriorating patient with a junior doctor during their clinical placements. The subject matter expert nurses were recruited from general and surgical ward nursing and clinical education (n=4). Each of these experts worked actively with junior doctors (interns) in the clinical ward setting in both the afferent and efferent limb of the deterioration patient call. Each subject matter expert was provided with a participant information sheet describing the NGT objective, process and level of commitment required. The following table describes the group demographics.

Table 2: Subject matter expert demographics for NGT

Health professional group	Gender	Age range	Clinical experience range
Nurses (Registered division 1)	Female (<i>n</i> -4)	30-50	10-30 Medical ward (<i>n</i> -1) 10 years' experience Surgical ward (<i>n</i> -2) with approximately 25 years' experience Nurse education (<i>n</i> -1) acute services with 30 years' experience
Final year medical students	Female (<i>n</i> -3) Male (<i>n</i> -1)	20-25	Undergraduate clinical placements only – not easily quantifiable
Interns (junior doctors)	Female (<i>n</i> -2)	22-25	11 months – currently practicing as interns
Consultant medical officers	Male (<i>n</i> -1)	35-40	Emergency department doctor with 15 years' experience
	Female (<i>n</i> -1)	35-40	Endocrinologist and intern co-ordinator at Bendigo Health 15 years' experience
Monash Faculty academic leads/consultant medical practitioners	Male (<i>n</i> -2)	<i>n</i> -1: 35-40 <i>n</i> -2: 45-55	<i>n</i> -1 intensivist and academic lead with 12 years' experience <i>n</i> -2 Nephrologist and academic lead with 26 years' experience.

Participant knowledge and experience with junior doctors and deteriorating patients ranged from 11 months to 27 years. Out of the fourteen participants 10 were female, 4 nurses and 6 doctors. This variation suited the purpose of the research question which was to identify the technical and non-technical skills required for junior doctors in the afferent limb of patient deterioration. Both nurses and consultant doctors work with junior doctor who recognise,

respond and manage patient deterioration. The variation of discipline back ground and experience also contributed to the credibility of the data results (ref). Firstly, participants from a nursing who work directly with junior doctors could draw from the recent experiences with junior doctors in this context. Final year medical students who have just completed a clinical placement where they worked with junior doctors in this context could provide insight from their experiences and perspective. Junior doctors themselves who were embedded in the experience and have current knowledge of how they practice when recognising, responding and manage deteriorating patients. Consultant medial officers who have prior work experience as junior doctor and now supervise junior doctors who recognise, respond and manage deteriorating patients. Lead academics who teach final year medical students recognition, and management of patient deterioration and also supervise junior doctor in the clinical context.

6.7.2 The NGT event

Prior to the NGT evening the researcher provided her PhD supervisor with a structured plan for the evening (see appendix). The plan specified timing of each phase and specific roles for each supervisor. The researcher was the main facilitator for the evening. One supervisor was the time keeper, another a scribe for the white board and the other to add skills to the excel spread sheet and calculate the ranked items. It should be noted that even though consensus methods are widely used in research, the methods are neither standardized nor are they consistently described and used (Crisp, Pelletier et al. 1997, Caves 1998).

1. Introduction and presenting the question:

Participants were informed that the purpose of the session was to identify the technical and non-technical skills required for junior doctors to recognise, respond and manage deterioration prior to the arrival of the MET in a regional hospital. The researcher explained that the results were to be collected as part of her PhD thesis research and results from the session were intended to inform junior doctor curriculum design for teaching and learning methodologies in patient deterioration and the role of the junior doctor. The evening took place in the auditorium at Monash Rural health – Bendigo 26 Mercy Street on the evening of Tuesday the 22nd of November starting at 6pm. Food and refreshments were provided in the foyer prior to the commencement of the session. Participants were provided with name tags with first names only.

The group was provided with a power point presentation declaring the purpose of the evening. The researcher provided an overview of her PhD and the three phases. The presentation reviewed the researchers finding from her integrative review of the literature regarding the factors that influence junior doctors' capacity to recognise, respond and manage deteriorating patient prior to the MET arrival. The researcher described the second phase findings of qualitative interviews that explored the experiences of junior doctors along with nurses working with junior doctors in the recognition, response and management of the deteriorating patients in the regional acute ward context (appendix). The research reviewed the NGT process and the participants' role in the process. A hand-out was provided to the participants to review each of the phases (appendix). The seating in the auditorium was a scaled lecture theatre arrangement enabling participants to view the power-point

presentation and white boards easily without forming into conversational groups; seating is important to facilitate the NGT process (Bromley 2014). The professional groups did seat themselves with like professional groups. Prior to commencing the session all participants completed the consent forms to participate in the NGT (see appendix).

2. Silent generation of skills:

The participants were asked to work independently and in silence for ten minutes and generate a list representing what they think the skills (technical and non-technical) are that junior doctors require to recognise, respond and manage patient deterioration. They recorded their responses on a worksheet provided (see appendix).

3. The round-robin:

Each participant was then asked to present a single response to the group using a “round-robin” format to ensure everyone had equal opportunity to nominate responses. To promote open disclosure and increase response volume, the researcher told participants that they should simply read a single response from their list and not give a rationale for their response or relate it to other responses. One PhD supervisor recorded each response on the white boards. Each response was recorded under a designated technical or non-technical skills from each participant. It was each participant who elicited the response to be technical or a non-technical skill. Each response was written verbatim on the white boards visible to the group. Skills were not repeated however, if a group member thought that their skill provided a different emphasis or variation they included this.

The round-robin nomination process continued until all participants’ members presented their entire list to the group. The object of this step is to map out the group’s thinking. The researcher explained to participants to present ideas in brief words or phrases. One ideas was

taken from each participant serially and that members can pass if they have no further items to present (Delbecq, Van de Ven et al. 1975). Participants did not provide a skill if it was already listed on the white-board. The group was asked not to engage in side conversations or attempted to discuss items prior to completing the list. The benefits of the round robin enabled all participants to equally present their ideas, assists in the idea being presented not the personality, provides a written record and enables the group to deal with a larger number of ideas. It also avoids ideas being lost or forgotten to be presented, encourages hitch hiking of ideas from other participants and encourages the group to explore the question fully.

4. Discussion and clarification:

Following this each participant was given the opportunity to briefly discuss the nominated responses for the purpose of clarification, not evaluation, to ensure each response was understood from a common perspective. During the discussion phase, there was response elaboration and a small number of responses were altered for clarity. Some of the non-technical skills were identified by the groups as human factors rather than non-technical skills. Each recorded skill was discussed to determine clarity, importance and rationale. For each idea the researcher asked if there were any questions or comments group members wanted to make about the skills presented. This step provided the opportunity for members to express their understanding and clarify any issues and identify repetitive skills. It was not necessarily the creator of the idea who had to explain the idea. This phase enabled each participant to understand the meaning of each individual idea. This phase assists participants to make informed decisions when ranking their priorities. The facilitator's role was to expedite the group to avoid argument and ensure all participant ideas were discussed. As the primary facilitator I was required to reaffirm that although the group may not agree with a particular

idea, the purpose of this phase was only to clarify the ideas. The aim of this phase was for clarification to ensure that every response is understood from a common perspective.

5. Ranking phase and analysis:

The final phase consisted of a prioritising exercise where each participant anonymously selected sixteen skills from the generated list that they felt were the most important. The decision to rank sixteen skills was originally informed by Horton (1980) and Sink (1983) who recommend voting should reflect one third of the generated list. However, a total of seventy-four skills were listed requiring 24 skills to be ranked. It was decided that a more manageable number be used. Many authors recommended different variations of the number of items to be ranked. These ranged from five to sixteen items ranked (Potter, Gordon et al. 2004, Harvey and Holmes 2012).

In the system described by Delbecq et al (1975), scoring can occur by rating the importance of the top ten items from 10 (most important) to one (least important). Other authors have asked participants to rank the top fourteen items from 1-14 (McMillan, Kelly et al. 2014). It was decided that the participants would rank sixteen skills; one being the most important and sixteen the least. This was perceived by the researcher to be a more manageable number of skills.

The researchers asked the participants to rank the top sixteen skills in terms of relative importance (1=most important to 16 least important). Participants were provided with post notes with number 1-16 printed on them and ask to rank the skills noted by sticking it next to the skill on the white board. This process allowed the participants to walk around the white boards and consider the skills and their relative ranks. In some cases, respondents were noted to place their rank on one item and later change it for another. This was performed in silence

by the participants. There was no discussion during the ranking phase. Some authors argue that this process should be confidential to ensure ranking is not influenced by others (Potter, Gordon et al. 2004, Harvey and Holmes 2012). However, participants identified that it was useful to see what others had ranked compared to their decisions.

The ranks for each of the selected responses were summed across participants to derive a group result. The quantitative analysis of data results from the scoring and ranking methods used to conclude the meeting process and identify group priorities.

Data management – Microsoft office Excel spread sheet was used to record the skills and scores allocated by each participant for each skill. The sums of scores were calculated from each skill. Two PhD supervisors transcribed the skills and ranking result while the research facilitator confirmed the rankings and scores.

Data presentation:

Due to the length of the ranked list and time consuming process of presenting the results it was concluded that the results (when calculated) would be sent via email to the participants. Following supper, the list was reviewed and discussed. Some statements were clarified.

Conclusion and wrap-up:

Participants commented on the weighting of non-technical skills that were ranked compared to technical skills. The facilitator presented an overview of the most important ideas & key learning outcomes from the NGT process.

All participants were thanked from their time and effort.

All results were calculated and sent through to the participants via email.

6.7.3 Results

The group of fourteen participants identified a total of seventy-four skills were listed on the white boards (tables 3 & 4). All skills were categorised by each participant as either technical or non-technical skills. The fourteen participants ranked a total of fifty-four skills as relatively more important than others (table 3). Only twenty-one of the skills listed in the round robin phase did not receive a ranking by the group; nine technical and twelve non-technical skills (table 4). Twenty-eight technical skills and forty-six non-technical skills were listed in the round robin (table 3). On review of the final ranking of the fifty-four skills more non-technical skills were considered important in the skills listed and ranked by participants required for junior doctors to recognise, respond and manage patient deterioration in an acute ward setting. A total of thirty-one non-technical skills were ranked out of the fifty-four total skills. Twenty-three technical skills were ranked out of the total seventy-four skills listed. The weighting of non-technical skills for the first twenty-five skills ranked clearly identifies that nineteen were non-technical and only six were technical. Seventeen of the skills listed in the last twenty-nine skills were ranked from the technical skills category. This is an interesting finding that more non-technical skills were ranked higher in the first half of the ranking compared to the second half.

The strength of cumulative vote score did not always correlate with the number of votes per item. Prior to the study it was decided that the strength of the cumulative vote score would identify the consensus (Sink 1983). The weighing of importance was not always relative to the number of votes for example; knowing the patient's resuscitation status was ranked at as number six with a sum of ranks of seventy-five however, nine participants ranked the skill. In comparison to the technical skill of performing a focussed assessment (e.g. chest pain) and

interventions being ranked as number two by nine participants with a sum of ranks of one hundred and twenty. Clearly nine participants considered the ability to perform a focussed assessment and interventions was more important than knowing the patient's resuscitation status.

Having the ability to know when they, the junior doctor, are out of their depth was ranked as number ten. However, the need to consult seniors early was ranked number eighteen and knowing to escalate care early in the chain of command was ranked number twenty-two. Interestingly the reference to the junior doctor knowing the policy of the medical emergency team calling criteria was not articulated only intimated in the skill ranked twenty-two; know to escalate early in the chain of command.

Only eight skills were ranked by a single participant identifying these skills to be relatively less important than others, six of which were categorised as technical skills; Ability to review drug chart, recognising when to use allied health team members, knowing what Intravenous fluids to order and deliver, perform blood cultures competently; knowing how to access pathology; ability to interpret a chest x-ray, perform a Head to toe assessment, knowing who to call (registrar/consultant) after hours and informing next of kin.

Table 3. The top 16 skills ranked by each of the 14 participants during the NGT event

Table Reference:

Technical skill
Non-Technical Skill

Total score: Top 16 ranked by each of 14 participants	Strength-sum of ranks	Number of participants selecting item
1. Identifying deteriorating patient-verbally/visually	188	12
2. Ability to perform a focussed assessment (e.g. chest pain) & interventions	120	9
3. ALS skills (including equipment e.g. defib)	111	8
4. Verbal and written communication	94	8
5. Identification of primary issues early	82	7
6. Knowing patient resuscitation status	75	9
7. Generate a treatment plan	70	7
8. Being able to give clear handovers/referrals	59	7
9. Ward 'smarts' – know where resources / equipment are	54	8
10. Recognising when out of depth	54	6
11. Ability to make decisions with incomplete information	52	6
12. Recognising 'red flags' (cues of serious illness)?????clinical tests non-tech	47	6
13. Learning the art of graded assertiveness - professionalism	47	6
14. Performing an assessment: Primary & secondary	47	4
15. Intra-venous cannula insertion	44	7
16. Creating a plan post-deterioration	41	6
17. Ability to synthesise information for incoming team to integrate into working team	40	7
18. Willingness to consult seniors early--be proactive	40	3
19. Ability to just make a decision	39	5
20. Ability to delegation of tasks appropriately	39	4
21. Knowing what to ask to elicit relevant information	38	4
22. Know to escalate early in chain of command – registrar or MET	37	4
23. Calling for senior medical/nursing help	34	3
24. Dealing with failure—being resilience	33	5
25. Documenting a confirmed change of care with senior consultants and family	30	4
26. Perform an accurate fluid assessment	30	3
27. Safe prescribing - doses & side effects	27	6
28. Know different forms of O2 delivery / management of breathlessness / knowing devices & how to use	27	4
29. Knowing appropriate sources of information (where to access)	27	3

30. Systematic approaches to common ward scenarios	25	2
31. Direct, conduct & interpret further observations (e.g. ECG)	22	2
32. Accurately writing and understanding written documentation	21	3
33. Know patient's medical history	21	2
34. Confidence and ability to team lead	18	5
35. Follow up patient following review	18	4
36. Interpretation of objective & non-objective patient information	18	2
37. Knowing when it is safe to leave patient	17	3
38. Being immersed & interactive with staff—develop good rapport and trust	14	3
39. Ability to prioritising patient workload (triage)	14	2
40. Scribing & confirming accurately	11	3
41. Perform pain assessment and management	11	2
42. Knowing themselves--put aside personal reactions	11	2
43. Ability to diagnosis and management of shock states	9	2
44. Utilisation of ward personnel appropriately	8	4
45. Skills needed in daylight hours compared to after hours	8	2
46. Ability to review drug chart	6	1
47. Recognising when to use Allied Health team members	6	1
48. Knowing what Intra venous fluids to order and deliver	4	1
49. Perform Blood cultures competently (taking)	4	1
50. Knowing how to access pathology	3	2
51. Ability to interpret a CXR	3	1
52. Perform a Head to toe assessment	3	1
53. Knowing who to call (registrar or consultant) after hours	2	1
54. Informing next of kin	1	1
	1904	224
		= 16 x 14

Table 4. Skills listed but not ranked by the NGT Participants

Skills not ranked from the 'round robin' list	Rank status
Technical skills	
Accurately measuring & interpreting vital signs	Nil
Performing & interpreting ABGs and VBGs	Nil
Access electronic medical record system	Nil
IDC insertion	Nil
NGT insertion	Nil
ETT suction	Nil
Appropriate patient positioning	Nil
Perform Intra-osseous blood & fluid	Nil
Handover MET at end of shift	Nil
Non-Technical skills	
Recognise what hasn't been done	Nil
Think independently	Nil
Knowledge of drug delivery options	Nil
Know services available & accessible	Nil
Knowing the difference between skills in daylight hours and after hours	Nil
Remembering to handover MET follow up at end of shift	Nil
Prioritising patient care (all patients in their care)	Nil
Ward orientation--know where things are	Nil
Debrief team--system, procedural, psychological issues following patient incidents	Nil
Knowing 'safe' interventions	Nil
Interpretation of objective & non-objective information	Nil
Explicit direct staff to obtain specific vital signs	Nil

Discussion

Following the publication of Tomorrow's Doctors in the United Kingdom in 1993 (Council. and Education Committee 1993), this facilitated a framework to guide medical education to experience a paradigm shift from a didactic reproduction of factual data to a competency based model of undergraduate and post - graduate medical education. Nationally this

paradigm shift has been reflected by the Australian Curriculum Framework for Junior Doctors (Graham, Gleason et al. 2007, Confederation of Post graduate Medical Education Councils 2009). In a competency based post paradigm, programs need to demonstrate that the newly qualified doctors are competent for all aspects of practice. With the evolution of Rapid Response Systems following the publication of the “Confidential inquiry into quality of care before admission to intensive care” (McQuillan, Pilkington et al. 1998), competency based medical training failed to recognise the desired graduate attributes to guide the development of a curriculum, assessment and evaluation of junior doctors to recognise , respond and manage patient deterioration prior to the arrival of expert assistance (rapid response team). Competency-based education is competence by purpose, not merely opportunistic learning experiential learning (ref). Competence to advance training requires learners, who provide direct patient care, require their assessment and evaluation to focus on that care. However, the lack of evidence regarding the skills required for junior doctors in the afferent limb of patient deterioration is limited. The NGT findings describe discrete behaviours (technical and non-technical skills) that when met allows education curriculum designers to know that the junior doctor is competent and delivers safe patient care in this context.

The remainder of this chapter provides the candidate’s dot-points for discussion and completion of this chapter.

Technical and non-technical skills.

- What are they? - beginning
- What does the literature say?
- The discourse between communication as a non-technical skill
- Communication (verbal and written)
- Are they skills or behaviours – human factors

Interdisciplinary training

Implications for Interdisciplinary training – tiered system of training in standard 9

- Independent practice and assessment then team based
- Insitu simulation and education for ward smarts now the environment etc.
- Frequency of training needs formative to summative along the education continuum

Patient safety

- Theory to practice of patient safety – challenges in teaching this
- Aviation as an example – why do doctors and nurses ignore warning signs and pilots don't?

Modality of curriculum and why?

- Based on the number of non-technical skills listed.

Recommandations

Limitations

Conclusion

Appendices 1–5. Interviews, interview notes, and ethics approvals. Redacted.

Appendix 6 : Nominal Group Technique Pilot

Creativity and Diversity in Clinical Skills Education and Research

Abstract – (Research in clinical skills education using simulation)

What are the skills required for junior doctors' when patients deteriorate in a regional hospital ward?

Workshop:

This modified nominal group technique will encourage discussion and attempt to review the skills required for junior doctors to recognise, respond and manage the deteriorating patient in the acute ward prior to the arrival of the rapid response team (RRT).

Intended audience:

- Medical educational supervisors of junior doctors
- Educators and academics in medical education.
- Any health care professional

Outcomes:

1. Data generated will raise awareness and stimulate thoughts and ideas in teaching junior doctors in the daunting task of managing deteriorating or critically ill patients in the afferent limb; prior to the arrival of the RRT.
2. Participants will experience a modified nominal group technique approach to generating ideas on this subject.

Number of participants - 15-20

Resource requirements:

- Computer and projector for PowerPoint presentation
- Tables and chairs
- White board and markers

Background to this Question:

Training health practitioners to recognise and respond to clinical deterioration in acute care is essential to ensure patients are safe from preventable harm. This requires the health practitioner to accurately assess and interpret signs and symptoms and promptly escalate care for these patients. However, contextual skills for the junior doctor are not always made explicit, even though junior doctors are frequently called to review patients who are potentially unstable or deteriorating.

Graduating medical students and junior doctors have identified that they are uncomfortable, lack knowledge and experience anxiety when exposed to a deteriorating, or unstable patient in an acute ward setting. This research will use a mixed method approach in order to explore the factors that influence final year medical students and junior doctors' ability to recognise, respond and manage the deteriorating patient in a regional hospital ward. Data will be collected using semi structured interviews and patient chart reviews. Nominal Group Technique with clinical experts and consumers will determine competencies in this clinical context.

The competencies developed will inform the design of a simulation program for final year medical students and junior doctors to recognise, respond and manage the deteriorating patient in a regional acute hospital ward.

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Lesson Plan- Prato Workshop

Session time: 1.5 Hours		
Modified Nominal Group Technique		
Learning Objectives <ol style="list-style-type: none"> 1. Identify the key technical and non-technical skills that junior doctors require to recognise, respond and manage the deteriorating patient in an acute hospital ward setting prior to the arrival of the rapid response team (RRT). 		
Question <ol style="list-style-type: none"> 1. What are the key technical and non-technical skills that you believe junior doctors' require to recognise, respond and manage the deteriorating patient in an acute regional hospital setting? 		
Equipment requirements: PowerPoint presentation White board A4 paper for each person – with Monash Logo & Plain	<i>Tables in groups</i> <i>Chairs for 5-6 table for each group</i> <i>Number of participants' 15-20</i>	
Activity	Teaching tool	Timing
Tuning In: <ul style="list-style-type: none"> • Introduction of myself – <u>presenter-moderator</u> • Then ask Assistant and Simon to introduce themselves • Ask participants to introduce themselves, where they work and why they wanted to attend the workshop • Present overview and back ground – how the session will run & review 	PowerPoint - presentation	20 min

<p>PowerPoint – stress that this is a pilot study to inform the researcher of what works and what doesn't when using the NGT</p> <ul style="list-style-type: none"> • Ask for a time keeper 		
<p>NGT Phase 1</p> <ul style="list-style-type: none"> • <u>Generate skills</u>: present the question to the group in written form and read to the group. Direct the participants' to write one short statement per skill and to work silently and independently- 10 minutes • Keep PP. presentation slide on NGT up. 	A4 Monash heading paper	10 min
<p>NGT Phase 2.</p> <ul style="list-style-type: none"> • <u>Recording skills</u>: group members take it in turns to provide one skill at a time per person until all skills are exhausted. There is no need to repeat skills: however, if a group member believes that a skill provides a different emphasis or variation they can include this. Continue until all members have exhausted their ideas. No discussion of the skills proposed at this time. 	<p>White board</p> <p>Assistant writes each skill on the white board and Adele co-ordinates the participants and precludes other participants from discussing the skill.</p>	20 min
<p>NGT Phase 3.</p> <ul style="list-style-type: none"> • <u>Discussing skills</u>: Each recorded skill is then discussed to determine clarity, importance and rationale. For each idea Adele will ask: Are there any questions or comments group members would like to make about this skill? This step provides the opportunity for members to express their understanding and clarify any issues. It is not necessarily the creator of the idea who is obliged to explain the idea any member can voice their opinion. 	<p>Assistant to change or alter wording on white board as discussed with participants</p>	20 min

NGT Phase 4. <ul style="list-style-type: none"> • <u>Discussion</u>: Participants are encouraged to generate ideas regarding how these skills could be taught to junior doctors to improve their ability to recognise, respond and manage deteriorating patient in acute wards. • Question participants if there are any differences in the scope of practice of newly graduated doctors in their country. • 	Adele	15min
Wrap up: overview of the most important ideas <ul style="list-style-type: none"> • Ask participants what main outcomes they gained from today's workshop 	Adele	5min

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