Emergency nurses' perceptions and practices in assessing and managing acute pain in critically ill adult patients: a mixed-methods study

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Thesis submitted in fulfilment of the requirements for the degree of

Doctor of Philosophy

under the supervision of Professor Margaret Fry and Professor Doug Elliott

University of Technology Sydney
Faculty of Health

October 2023

Certificate of Original Authorship

I, Wayne Varndell, declare that this thesis is submitted in fulfilment of the requirements for the award of Doctor of Philosophy, in the Faculty of Health at the University of Technology Sydney. This thesis is wholly my own work unless otherwise referenced or acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis. This document has not been submitted for qualifications at any other academic institution. This research is supported by the Australian Government Research Training Program.

Signature:

Date:

Dedication

This work is dedicated to Belinda, a truly awesome force of nature, who has borne me through this journey and so many others. It is also dedicated to all the emergency nurses who go to work every day despite the challenges to make a difference in their patient's lives.

Acknowledgments

In omnibus gratias Deo

Although this research was conceived and conducted by the author, it would not have been possible without the help, support and encouragement of the many individuals and organisations mentioned below:

I am first indebted to those that welcomed me into their departments and enabled emergency nurses to participate in this study. I hope these pages reflect the true awesomeness of emergency nurses who strive each and every day to provide high quality, safe patient care in often chaotic and emotionally challenging times.

My very special thanks go to my supervisors, Professor Margaret Fry and Professor Doug Elliott, who have supported me throughout my PhD. Their wisdom, time and patience have helped me make this PhD journey; the pages herein cannot do justice to the countless spoken words, notes, drafts grown from their countless hours of support and advice.

To friends and colleagues at Prince of Wales Hospital for giving their support and encouragement.

I am deeply grateful to the College of Emergency Nursing Australasia for their generous support in assisting in the completion of this thesis, and the Australian College of Nursing for their generous support through the Joyce Wickham Memorial Grant; nurses supporting nurses to achieve.

Finally, and most importantly, to my wife Belinda, and children Caitlyn, Elliott and Rohan, a special thank you for your invaluable encouragement, love and support.

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Abstract

Background

Over three-quarters of patients presenting to an emergency department (ED) do so due to pain; of note, over 60% of critically ill patients experience severe pain that is unrelieved during care. Critically ill patients experience pain from multiple intrinsic and extrinsic sources in the process of resuscitation and stabilisation. While emergency nurses are positioned to manage acute pain, complexity of nursing practice, judgment and factors influencing pain management for critically patients in this clinical context remains unknown.

Aim

The primary study aim was to explore emergency nurses' perceptions and practices managing acute pain in critically ill adult patients.

Method

An explanatory sequential mixed-methods study design was used. Phase 1 was a quantitative survey utilised to identify emergency nursing pain management practice. Phase 2 comprised non-participant observations of nursing pain management practices in the resuscitation area (156.5 hours) of two trauma designated EDs in New South Wales, with concurrent semi-structured interviews (n=30) exploring nurse perceptions of pain management in critically ill patients.

Findings

The study identified that the emergency nurse was primarily responsible for the continuity of patient care and optimisation of pain control for critically ill patients. Survey results highlighted significant gaps in policy, pain management knowledge and training, poor ability to influence pain control or goals, and limited use of evidence-based pain assessment instruments. Findings were supported from observations and interviews of nurses working in the resuscitation area. Observation and interview findings identified that nurses were less confident in their ability to detect and manage acute pain in non-verbal or unconscious critically ill patients. While nurses actively sought ways to provide a reassuring presence and comfort to critically ill patients, this was limited by unpredictable workloads, availability of staff, and communication challenges.

Conclusion

Timely effective pain management in critically ill patients relies upon the knowledge, skills, expertise and confidence of the emergency nurse. However, poor levels of pain management knowledge, unpredictable workloads, geographical isolation, communication, and lack of evidence-based tools or protocols, increases the risk of poor pain management in critically ill or injured patients. Further investigations are urgently needed to examine interventions to develop effective training and education, and guidelines to assist emergency nurses manage acute pain for critically ill patients.

Anthology of Publications, Presentations, Awards and Grants

Thesis-based publications

Varndell, W; Fry, M & Elliott, D (2021) Applying real-time Delphi methods: Development of a pain management survey in emergency nursing. BMC Nursing. 20(1):149. DOI: 10.1186/s12912-021-00661-9

Varndell, W; Fry, M; Lutze M & Elliott D (2021) Use of the Delphi method to generate guidance in emergency nursing practice: A systematic review. International Emergency Nursing. 56(7347):100867. DOI: 10.1016/j.ienj.2020.100867

Varndell, W; Fry, M & Elliott, D (2020) Pain Assessment and Interventions by Nurses in the Emergency Department: A National Survey. Journal of Clinical Nursing. 29(13-14):2352-62. DOI: 10.1111/jocn.15247

Varndell, W; Fry, M & Elliott, D (2018) Quality and impact of nurse-initiated analgesia in the emergency department: a systematic review. International Emergency Nurse. 40:46-53. DOI: 10.1016/j.ienj.2018.05.003

Varndell, W; Fry, M & Elliott, D (2017), Exploring how nurses assess, monitor and manage acute pain for adult critically ill patients in the emergency department: protocol for a mixed-methods study. Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine 25(1):75. DOI: 10.1186/s13049-017-0421-x

Varndell, W; Fry, M & Elliott, D (2016) A systematic review of observational pain assessment instruments for use with nonverbal intubated critically ill adult patients in the emergency department: an assessment of their suitability and psychometric properties. Journal of Clinical Nursing. 26(1-2):7-32. DOI: 10.1111/jocn.13594

Thesis-based conference presentations

Australian Nursing and Midwifery Conference (2019) Pain Assessment and Intervention by Nurses in the Emergency Department (PAINED): A National Survey

International Conference for Emergency Nursing (2016) Knowledge and attitudes towards pain of emergency nurses: a single site survey

Awards

2022 UTS Student Research Forum Best 5-minute Poster Presentation

2022 UTS Student Research Forum Best 10-minute Presentation (School and Faculty category)

2020 Prince of Wales Hospital Foundation Research Medal

2018 NSW Health Nursing and Midwifery Excellence Awards (Innovation in Research)

2016 Tow Research Award (Nursing Division), Tow Coast Association Health & Medical Research

2014 Australasian Emergency Nurse of the Year, College of Emergency Nursing Australasia

Grants

2020 Research Medal ($50,000), Prince of Wales Hospital Foundation

2020 Joyce Wickham Memorial Grant ($5,000), Australian College of Nursing

CHAPTER 1: INTRODUCTION

Introduction

The overall aim of this study was to examine nurses' perceptions and practices in assessing and managing acute pain in critically ill adult patients in the emergency department (ED), providing important insight and understanding needed to educate and support emergency clinicians in the resuscitation area. The focus of this Chapter is to situate the study within the context of the broader literature, introducing the problem of acute pain management for a range of critically ill patients in the ED and highlighting the significance of the study. The purpose of the study and associated research objectives are then presented, concluding with an outline of the thesis structure.

The problem - experiences with acute pain

Many individuals experience acute pain as a consequence of an illness and/or injury, and commonly present to an ED for care and treatment (National Health and Medical Research Council, 2011). Pain is a subjective, complex and multidimensional concept that is defined broadly as '*an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage*' (International Association for the Study of Pain, 2020, p.1). A person's ability to detect potentially tissue-damaging stimuli is an important protective mechanism that involves multiple interacting peripheral and central mechanisms (Loeser & Treede, 2008), which can be influenced by psychological and environmental factors. The most reliable and valid indicator of pain is therefore the patient's self-report; yet for critically ill intubated patients, communication of pain intensity is problematic (Joint Commission on Accreditation of Healthcare Organizations, 2010; Schug et al., 2015).

In Australia, the number of critically ill patients managed in EDs is increasing, including those who require endotracheal intubation and mechanical ventilation (Varndell et al., 2015b). Critically ill patients experience significant levels of pain and discomfort from multiple intrinsic and extrinsic sources in the process of resuscitation and stabilisation in ED (Weir & O'Neill, 2008). To ameliorate the presence of pain, this patient group require intravenous analgesia, in addition to sedation, to prevent suffering, adverse physiological and psychological effects (Schug et al., 2015), and reduce the risk of harm related to self-extubation, purposeful or accidental removal of invasive monitoring devices, or injury to staff (Varndell et al., 2015a; Weir & O'Neill, 2008).

Assessing and monitoring pain in critically ill patients is however challenging, particularly for those unconscious or requiring mechanical ventilation and airway management as they are unable to verbally report pain intensity. This inability to communicate is commonly the result of endotracheal tube insertion and the use of paralysing agents, and/or altered levels of consciousness due to clinical sedation and/or their presenting condition or injury (Jacobi et al., 2002; Varndell et al., 2015a). These factors therefore, place the patient at greater risk of inadequate pain detection, assessment and inappropriate management (Nordness et al., 2021; Puntillo et al., 2009).

Normal pain behaviour symptoms (e.g. verbal complaints, sighing or moaning) may not be present for a critically ill patient, requiring emergency nurses to remain vigilant for subtle physical changes, while assessing and responding to minute-to-minute haemodynamic changes in the patient's condition. In the absence of patient self-report, clinicians commonly rely on observable pain indicators such as facial grimacing, crying and compliance with mechanical ventilation to form the basis for identifying and evaluating a patient's degree of pain intensity (Herr et al., 2011). Resuscitation management can often conceal the presence of pain, making detection and assessment more difficult in this patient cohort.

While care of intubated critically ill patients historically occurred in intensive care units (ICU), currently emergency nurses are increasingly managing this cohort for extended periods of time (O'Connor et al., 2009). As a result, intubated critically ill patients in the ED demand substantial amounts of staff resources similar to that in the ICU (1:1 nurse/patient ratio) for ongoing treatment of their underlying condition, including titration of analgesia, sedation and ventilator settings (Aitken et al., 2009). This ongoing care, assessment and monitoring of these patients, while awaiting ICU inpatient transfer, is the responsibility of the contemporary emergency nurse (Varndell et al., 2015c).

While emergency nurses are optimally placed to assess and initiate pain relief (Finn et al., 2012; Varndell et al., 2018a), the complexity of emergency nursing practice, judgment and factors influencing the detection, assessment and management of pain for critically patients in this clinical context remains unknown. To date, it remains unclear how emergency nurses manage acute pain in critically ill patients.

Research aim and objectives

Given this context, the aim of this study was to explore emergency nurses' perceptions and practices in managing acute pain in critically ill adult patients. The specific objectives were to:

1) Explore emergency nurses' knowledge and practices relating to the assessment and monitoring of acute pain in critically ill patients in ED;
2) Examine care activities and behavioural patterns, actions, and processes within the context of acute pain management;
3) Explore how emergency nurses influence pain management or act independently with regards to the critically ill patient in the ED; and,
4) Identify factors, perceived facilitators, barriers and workplace characteristics that shape emergency nurses' practice in pain management of critically ill patients.

Significance of the study

Study significance relates to addressing a critical knowledge/practice gap in the science of emergency nursing and the assessment and management of pain in critically ill adult patients in EDs. Assessing pain in critically ill patients that may be intubated, mechanically ventilated and sedated is a significant clinical challenge. When a patient has impaired oral communication skills and comprehension, the clinical acumen of an emergency nurse is paramount, and knowledge of behavioural cues are often relied on to inform pain assessment.

Pain is a multifaceted and subjective concept commonly experienced by critically ill patients. Importantly, during resuscitation and stabilisation, symptoms can be undetected or misinterpreted, leading to suboptimal treatment of pain. This is particularly so for those patients unable to self-report (Devlin et al., 2018). Despite pain management being a cornerstone in the care of critically ill patients in ED, this practice area remains poorly investigated. To date, the role of the emergency nurse and how they manage pain-relief for critically ill patients and the influencing factors and challenges perceived when working within the resuscitation area are not well understood.

From the perspective of nursing disciplinary knowledge, significance of this study includes generation of new knowledge that will assist to reduce human suffering in this important and growing vulnerable patient group. Across Australia, emergency nurses rotate through all clinical areas of an ED and manage patients with minor injuries to life-threatening conditions. Currently, it is unclear how emergency nurses working in the area of resuscitation need to be supported in their role to better manage pain for critically ill patients. The study will therefore, provide insight into pain management of the critically ill patient, including the skills and knowledge required to perform the resuscitation role by emergency nurses. Study findings will have relevance for practice in all ED settings, and can be disseminated and translated into education and policy guidelines for emergency nurses. Interpretation and conclusions of the study will further the science and practice of emergency nursing in managing pain in critically ill patients. Further, it is hoped that by exploring current clinical practice, examining pain assessment instruments, and the ED context, emergency nursing will benefit from the translation of findings into the real world of everyday practice.

COVID-19 impact statement

In January 2020, the COVID-19 pandemic emerged in Australia (Rockett et al. 2020) and impacted on implementation of phase 2 of this study. Phase 2 consisted of conducting non-participant observations and face to face interviews of emergency nurses working in the resuscitation area of the ED. Due to health protection measures enacted to protect vulnerable populations and key infrastructure such as hospitals, phase 2 was delayed by approximately 14-months, until the risk of infection was deemed low. At this time, to safely access the resuscitation area, the researcher was required to wear an N95 mask, gown, and visor, which restricted their hearing and ability to see facial expressions of participants clearly.

Structure of the thesis

The thesis is structured into nine chapters. Following this introductory Chapter 1:

Chapter 2: Background describes the history and specialisation of emergency care in Australia, development of emergency nursing as a distinct discipline, and the various models, functions and settings of care in the ED, including the resuscitation area. A discussion of acute pain theories follows, leading to a focus on the pathophysiology and psychological impact of acute pain for critically ill adult patients.

Chapter 3: Literature Review provides a comprehensive review of the literature, examining the contemporary evidence of acute pain management in critically ill patients, emergency nursing practice relating to acute pain management, and limitations of existing research in this topic area.

Chapter 4: Methodology presents an overview of the selected methodological approach, mixed-methods research, and related study design. The quantitative and qualitative methods selected and their linkage to the study's objectives are described, including the rationale for choosing an explanatory sequential mixed-methods design, and introducing the analytical lens used in the study. The chapter concludes with discussion on study design rigour and ethical considerations.

Chapter 5: Methods describes the procedures used to execute the two phases of the explanatory sequential mixed-methods study. First the development of the survey instrument is discussed and includes a detailed explanation and application of the real-time Delphi method used. This is followed by a description of phase 1 survey methods and participant recruitment methods. Phase 2 non-participant observation and semi-structured interview methods are then presented, along with and participant recruitment procedures. The data collection, analyses, and storage processes used in phases 1 and 2 are then discussed. Methods used for drawing the meta-inferences, integrating the findings from phase 1 and phase 2 are also discussed. This chapter concludes with a discussion on the approach taken to address rigour and phase-specific ethical considerations.

Chapter 6: Phase 1 Survey Results presents findings from the survey, establishing: (objective 1) the level of knowledge and the range of emergency nurses' practice relating to the assessment and management of acute pain in critically ill patients presenting to ED; (objective 2) the behaviours, actions and processes related to management of acute pain in critically ill patients managed in ED; and, (objective 4) potential barriers and factors impacting on acute pain management by nurses and how emergency nurses influence acute pain management in the ED.

Chapter 7: Phase 2 Observation and Interview Findings presents findings and discusses the thematic analysis of phase 2 work observations, field notes and interviews, and expands upon phase 1 findings to establish: (objective 2) the behavioural patterns, actions and processes concerning acute pain management in critically ill patients cared for in the resuscitation area of the ED; (objective 3) how emergency nurses influence pain management within the resuscitation area; and, (objective 4) perceived barriers, enablers and workplace characteristics that impact and shape acute pain management in the resuscitation area.

Chapter 8: Discussion and Conclusions draws the meta-inferences from the analysis and integration of the two-phase survey results, work observations and interview findings, and discusses the findings in relation to the existing literature base. The purpose of the chapter is to address the study's aim, that being the perceptions and practices of emergency nurses assessing and managing acute pain in critically ill patients. The study's methodological strengths and limitations are also discussed, prior to presenting the implications and recommendations for future policy, clinical practice, education, and research.

Summary

This Chapter has detailed the research within the context of acute pain management and critically ill patients in the ED, the purpose and significance of the study, and the impact of COVID-19 and measures taken to limit this. The chapter concluded with the structure of the thesis. The following background Chapter details the geography and history of emergency care in Australia, the development of emergency nursing as a speciality sub-discipline, provides an overview of acute pain theories and discusses the pathophysiology and psychological impact of acute pain for critically ill adult patients.

CHAPTER 2: BACKGROUND

Introduction

This Chapter provides context for the thesis topic, presenting the history of emergency care in Australia, the development of emergency nursing as a speciality sub-discipline, details the range of emergency nursing roles performed across EDs, and focusing on the clinical roles providing care and pain management for critically ill patients. To provide context to pain management pain theories and the pathophysiology and psychological basis of acute pain, is detailed in reference to critically ill adult patients. The Chapter, therefore, seeks to provide an in-depth understanding of acute pain assessment and management in contemporary emergency care practice.

History of emergency care in Australia

Historically, emergency care in Australia was provided by General Practitioners (i.e. primary care physicians) at rural hospitals or by junior medical staff in urban teaching hospitals (Cameron et al., 1996). Designated 'casualty' areas developed in hospitals in the early 1970s, but functioned mainly as an after-hours hospital entry point, with patients monitored by ward nurses until the local or on-duty physician arrived.

Australian emergency care subsequently evolved, based on the Anglo-American model, where patients were brought to hospital-based designated clinical areas initially termed accident and emergency departments for high level medical care (Arnold, 1999). By 1981, the Australasian Society for Emergency Medicine (ASEM) was formed as a national association for medical practitioners with predominant practice in emergency medicine. The Society recognised the need to establish emergency medicine training programs and specialist examination processes. Specialisation led to establishment of the Australasian College for Emergency Medicine in 1982 to formally manage training program accreditation, examination, certification and specialist licensure (Cameron et al., 1996).

By the mid-1980s, the expectation to provide specialised emergency care led both nursing and medicine disciplines to become highly trained and permanently based in a designated ED area. With increasing patient presentations, demand for emergency care grew, technological advancements were achieved, and resuscitation procedures were optimised. Emergency care subsequently developed into a recognised clinical speciality that incorporated aeromedical retrieval (Fry, 2019).

Similarly, emergency nursing knowledge, skills and clinical expertise also expanded (Bennett, 1995; Whyte, 2000). To assist emergency nurses in gaining in-depth knowledge, skills and clinical expertise, speciality postgraduate courses were developed from 1979. The New South Wales College of Nursing extended its nursing education courses to include advanced emergency nursing programs, that in 1995, led to development of university-based Emergency Nursing postgraduate courses (Russell et al., 1997).

In 2002, the College of Emergency Nursing Australasia (CENA) was formed as the national professional association for emergency nurses. CENA sought to promote and advocate for standards, professionalism and education in emergency nursing (College of Emergency Nursing Australasia, 2020a). Specialist emergency nursing standards were subsequently developed by the College for the professional development, education and practice of emergency nurses across Australasia (College of Emergency Nursing Australasia, 2020b). In 2015, CENA began credentialing emergency nurses to promote consistency in academic preparedness and professionalism of nurses specialising in emergency health care (College of Emergency Nursing Australasia, 2020a). As demand increased for emergency care, the design and function of EDs, related models of care, and the scope of practice in emergency nursing has continued to be developed and refined.

Accessing emergency care in Australia

Access to public emergency care varies across the terrain of Australia. With a land mass of 7.7 million square kilometres and a population of 25.7 million - largely concentrated on the eastern coastal fringe and New South Wales region (31.5%) (Australian Bureau of Statistics, 2023a), proximity to and availability of emergency care services with onsite intensive care facilities are concentrated in metropolitan areas. Access to public emergency care across Australia is provided through a wide range of facilities and providers from remote nurse-led clinics, general practices to purpose-built EDs situated in hospitals. Australian EDs are classified into one of four levels based upon the design, service scope, workforce and support services available. The level of service reflects the complexity of the clinical activity and procedures undertaken, and is chiefly determined by the presence of medical, nursing and allied health personnel who hold qualifications compatible with the defined level of care (Table 2.1).

Table 2.1: Public hospital emergency department level and service scope

Level	Service Scope	Core services
1	Commonly situated in remote or rural area hospitals, and are typically designed to manage less acute presentations. Physicians and nurses typically have a basic level of emergency care training. Patients requiring intensive or sub-speciality care are retrieved to a major referral hospital.	• Plain radiology and pathology services • 24-hour access to emergency specialist advice by telephone, telehealth and retrieval service • Access to secondary sub-speciality services (e.g. surgery, medicine, orthopaedics)
2	Rural base hospital EDs provide acute and primary critical care, and can manage some complex cases and limited sub-speciality services to the level of invasive monitoring and short-term mechanical ventilation. Dedicated nursing and medical workforce. Nurses qualified in extended roles (e.g. triage, advanced clinical skills, advanced life support) and physicians qualified in emergency medicine. Patients requiring ongoing critical care are however retrieved to major regional or metropolitan hospitals.	• Extended radiology (e.g. CT, MRI) and pathology services • Pharmacy service • General surgical and anaesthetic services • Sub-speciality services (e.g. obstetrics and gynaecology, paediatrics) • Critical care services (e.g. cardiac, high dependency unit)

Level	Service Scope	Core services
3	Situated typically within major regional hospitals, with the capability to manage ongoing care for complex critical care cases. Dedicated nursing and medical workforce. Nurses qualified in extended roles (e.g. triage, advanced clinical skills, advanced life support) and physicians qualified in emergency medicine.	• Extended radiology (e.g. computed tomography (CT), magnetic resonance imaging(MRI) and pathology services • Pharmacy • General surgical and anaesthetic services • Critical care services (e.g. cardiac, intensive care) • Sub-speciality services (e.g. obstetrics and gynaecology, paediatrics) • Access to allied health and community services (e.g. physiotherapy, social work) • Access to mental health services
4	Located in large, multifunctional tertiary or major referral hospital with capabilities for managing a wide range of complex conditions, and have a significant onsite sub-specialty services. Dedicated nursing, medical workforce and allied health staff.	• Extended radiology (e.g. CT, MRI, interventional radiology) and pathology services • Pharmacy services • Specialty medicine and surgical (e.g. neurosurgery, plastic surgery) services • Anaesthetic services • Critical care services (e.g. cardiac, intensive care); • Allied health services • Access to mental health services • Access to community services

Source: Australasian College for Emergency Medicine (2012)

Patient presentations in the emergency department

From 2011 to 2022, the number of patients presenting to Australian public hospital EDs increased by over 2 million (n=2,249,045; 25.6%), with New South Wales departments experiencing the highest number of patient presentations (Table 2.2).

Table 2.2: Number of patient presentations to public hospital Emergency Departments

State/Territory	2011-2012	2021-22	Difference (%)
New South Wales	2,235,455 (34.2)	3,012,992 (34.3)	846,090 (25.8)
Victoria	1,509,065 (23.1)	1,856,312 (21.1)	301,976 (18.7)
Queensland	1,238,522 (18.9)	1,867,860 (21.3)	411,070 (33.7)
Western Australia	725,841 (11.1)	991,522 (11.3)	280,292 (26.8)
South Australia	427,011 (6.5)	572,886 (6.5)	151,461 (25.5)
Northern Territory	144,842 (2.2)	171,336 (1.9)	23,304 (15.5)
Australia Capital Territory	118,396 (1.8)	143,693 (1.6)	28,787 (17.6)
Tasmania	141,700 (2.2)	173,276 (2.0)	9,890 (18.2)
Total	**6,540,832**	**8,789,877**	**2,249,045**

Source: Australian Institute of Health and Welfare (2012, 2023)

In hospitals with no onsite critical care services or fewer specialised emergency clinicians, such as level 1 and 2 ED facilities, critically ill patients needing intensive care are transferred to a Level 3 or 4 hospital (i.e. inter-hospital) by ambulance and/or aeromedical services. However, transfer delay or stabilisation of a patient's condition may require the patient to stay in an ED, for a prolonged period of time. The most recent data available demonstrated that between 2017 and 2018, a total of 40,285 patients with a median age of 65 (IQR 51-75 years) were admitted to ICU from ED, of which a third (n=12,205, 30.3%) were mechanical ventilated (Australian and New Zealand Intensive Care Society, 2019).

Emergency department models of care

Increased complexity of care and workload demands placed on an ED have led to innovative models of care to optimise patient care and support best outcomes; these include: triage, Clinical Initiatives Nurse (CIN), fast track, sub-acute, acute and the resuscitation bay area.

Triage model of care

Triage, the process of sorting and prioritising persons or resources, is used in three distinct situations: military situations, disaster conditions and emergency departments. When performed in the ED, the aim of triage is to determine the priority of patients based upon on the urgency of their presenting condition, and that resources (staff, equipment and management of clinical areas) are optimally utilised. All patients presenting to the ED are first evaluated by the emergency nurse performing the triage role. The triage nurse conducts an assessment of the patient and then allocates an appropriate treatment area to ensure that the patient's journey is efficient, appropriate and safe (O'Brien et al., 2006).

Triage assessment is a highly complex process of collecting pertinent patient information and initiating decision-making that categorises and prioritises the needs of the patients seeking emergency care. A triage assessment consists of interpretation of the clinical history and physiological assessment, allocation of an urgency code and allocation to an appropriate area of ED (Hodge et al., 2013). The triage assessment is generally expected to take no more than five minutes; balancing speed and thoroughness to ensure the assessment itself does not impede access to necessary clinical intervention.

Based upon the triage nurse assessment, one of five categories of urgency is assigned to presenting patients, using the Australasian Triage Scale (ATS); a five-point scale with links to ED response times, and streaming to the relevant clinical area in the ED for appropriate care and management (Curtis & Ramsden, 2019). Across Australasia critically ill patients are triaged as category one or two (Table 2.3).

Table 2.3: Australasian Triage Scale categories, descriptions, waiting times and performance thresholds

ATS category	Description, example	Waiting time
1	Immediately life threatening; cardiac arrest	<1 minute
2	Imminently life-threatening; acute stroke, major multi trauma	10 minutes
3	Potentially life-threatening; moderately severe pain – any cause, head injury with short loss of consciousness – now alert	30 minutes
4	Potentially serious; minor limb trauma, non-specific abdominal pain (<65 years old)	60 minutes
5	Less urgent; minor wounds not requiring sutures, minor symptoms of low-risk conditions	120 minutes

Key: ATS, Australasian Triage Scale; SBP, systolic blood pressure; IV, intravenous.

Source: Australasian College for Emergency Medicine (2016)

Between 2011 and 2022, the majority (*n*=3,383,378; 38.5%) of patients presenting for emergency care attended an ED in New South Wales with potentially serious symptoms. Importantly, between 2011 and 2022, the number of critically ill patients presenting to ED with imminent or immediate life-threatening conditions nearly doubled (Table 2.4).

Table 2.4: Number of patient presentations in NSW between 2011-12 and 2021-22 by Australian Triage Scale category

ATS category	2011-12 (%)	2021-22 (%)	Difference (%)
1	35,629 (0.8)	67,589 (0.8)	31,960 (47.3)
2	493,325 (11.4)	1,333,462 (15.2)	840,137 (46.0)
3	1,589,860 (36.8)	3,383,378 (38.5)	1,793,518 (36.1)
4	1,837,466 (42.6)	3,184,019 (36.2)	1,346,553 (26.8)
5	359,009 (8.3)	818,373 (9.3)	459,364 (39.1)
Total	**4,316,741**	**8,789,877**	**4,473,136**

Source: Australian Institute of Health and Welfare (2012, 2023)

Explanations for the increase in critically ill patients being managed in ED have included: an ageing population (Duke et al., 2014), limited inpatient bed capacity (Richardson, 2006), case-mix (Richardson & Mountain, 2009), access block (lack of an available bed) and surge (Forero & Hillman, 2008; Richardson & Mountain, 2009), resource availability and skill mix (Dubois & Singh, 2009), and in the latter period, the COVID-19 pandemic (Rockett et al., 2020).

Clinical Initiatives Nurse

Following triage, patients awaiting care can be assessed by the Clinical Initiatives Nurse (CIN) who can commence early symptom management, such as pain management, and initiate diagnostic tests that includes plain film X-rays. The CIN role was first introduced into NSW EDs in 2002 and expanded in 2009 following the Garling Special Commission of Inquiry into Acute Care Services (2008), to improve outcomes for patients presenting to ED. Patients typically managed by the CIN nurse are patients with low-risk minor injuries that can be treated in the fast track area of the ED (Fry et al., 2012).

Fast track model of care

The fast track model of care usually has patients with low urgency conditions and injuries, who have no co-morbidities and are amenable to rapid assessment and management (Chrusciel et al., 2019). The aim of the fast-track model of care is to reduce low-acuity patient delays in receiving treatment and reduce the number of patients that did not wait to be treated. Patients treated in the fast-track area are typically discharged in under two hours (Combs et al., 2006; Considine et al., 2010). Presenting complaints commonly managed in the fast-track area include skin rashes, sprains, subcutaneous wounds and skin infections.

Acute and sub-acute model of care

The acute area typically receives patients presenting with potentially unstable or complex conditions that may require cardiac monitoring, frequent observation, specialised interventions and/or a higher-level care (Australasian College for Emergency Medicine, 2014). This can include patients presenting with chest pain, moderate to severe dyspnoea or stroke. Whereas the sub-acute area provides for low acuity ambulant patients with co-morbidities not requiring cardiac monitoring, such as atraumatic abdominal pain, mild asthma, diarrhoea and vomiting (NSW Ministry of Health, 2012).

The resuscitation model of care

The resuscitation area is where critically ill patients are allocated, with the resuscitation bay the area where critically ill patients will have immediate lifesaving interventions commenced. The resuscitation area provides a setting for intensive haemodynamic monitoring and care, and is equipped with advanced monitoring systems, airway equipment, mechanical ventilators and defibrillators to manage critically ill patients with acutely life-threatening medical emergencies. The resuscitation area is often divided into designated clinical bay (bed) areas. Conditions commonly managed in the resuscitation bay includes cardiac arrest, septic shock and major multi-trauma (NSW Ministry of Health, 2012).

The critically ill patient and the role of the emergency nurse

Emergency nurses working in the resuscitation area require highly developed knowledge, skills and expertise to safely manage critically ill or injured patients. With the rapid changes seen in emergency healthcare, the introduction of early patient deterioration detection systems (Clinical Excellence Commission, 2007) and standardised training programs (New South Wales Health, 2002), emergency nurses now increasingly conduct physical assessments, interpret clinical findings and implement and titrate therapies to optimise the care and welfare of critically ill patients in the resuscitation area. Today, the essential knowledge for a resuscitation nurse includes familiarity and use (i.e. technical know-how) of non-invasive and invasive monitoring and therapeutic equipment (e.g. mechanical ventilators, arterial lines, intravenous infusion pumps), interpretation and integration of diagnostic and physiological examination results into clinical decision-making, a detailed understanding of the role and use of a broad range of pharmacological agents such as inotropes, sedatives and analgesics, anticipating and prioritising life-threatening medical problems with limited information, and effective resource management (Varndell et al., 2015c). Importantly, emergency nurses perform numerous clinical activities, often simultaneously, for multiple critically ill patients while working within the resuscitation area, including the initial and ongoing assessment and management of acute pain (Varndell et al., 2015a).

The following section explores the concept of pain and the many theories that have evolved as to its manifestation and perception. Theories have largely been influenced and shaped by the development of pathophysiological and psychological findings concerning acute pain.

Pain and acute pain theories

The understanding of pain and the development of pain theories has been ongoing for thousands of years. The word 'pain' and its synonyms commonly refer to conscious experiences associated with bodily injury or disease, or to describe discomfort related to other unpleasant feelings (International Association for the Study of Pain, 2020). Pain is a complex construct, integrating the physiological, mechanical and neurochemical responses with social, behavioural and psychological responses to noxious stimuli, that can be experienced and recalled by those who are unconscious and unable to communicate its presence, such as the intubated critically ill patient (Clukey et al., 2014).

However, in early civilisations the notion that disease and pain could have natural causes did not exist. Many hypotheses were proposed as to the manifestation of pain related to disease, which dates back nearly five thousand years. These theories ranged from interruptions to the flow of bodily energy, supernatural punishment, an imbalance in bodily essence to the product of dedicated neural mechanisms (Woolfe, 2010) (Table 2.5).

Table 2.5: Ancient concepts of pain

Period	Essence of the concept
Ancient China	• The *Yellow Emperor's Classic of Medicine*, said to be written by Emperor Huangdi in 2600BCE describes pain as originating from interruptions in the energy flow pathways or meridians between the mind and body. • First description of inflammatory pain (Chen, 2011; Veith, 1966). • A recent examination of the source text suggests it probably dates from around 300 BCE, and may be a compilation of the writings of several authors (Curran, 2008).
Egyptian	• Pain arose when various body mixtures become unbalanced through supernatural elements influencing one's health (Burmistr, 2018), and relief from pain was more effective when done in conjunction with spiritual medicine (Bardinet, 1995).
Ancient Greek	• Homer's *The Illiad and the Odyssey* (8 BCE) provided the first descriptive terms for pain: *odynê,* meaning sharp or acute pain, and *pronos,* meaning long-lasting or chronic pain (Rey, 1995). • Hippocrates (460-370 BCE) argued that pain comes from body fluids, and that the heart was the seat of pain perception (King, 1998). • Platon (437-347 BCE) proposed that the soul was the origin of pain (Burmistr, 2018). • Aristotle (384-322 BCE) argued that pain was a form of passion, therefore pain, emotion, mental and health originated from the heart. • Pythagoras (570 – 495 BCE) and Anaxagoras (500 – 428 BCE) argued that the brain was the seat of perception, based on observations of individuals experiencing pain and the effects opium poppy seeds (morphine), hashish (cannabis) and oil of cloves had on relieving pain (Davies & Hollman, 2002; Ludlow, 2011). • Galen (130 – 201 CE) further proposed that the brain, rather than the heart was the organ of the senses that including the perception of pain. However, while Galen was able to demonstrate that the function of the nerves was to carry sensation, specifically vision, hearing and taste through experimentation on, and dissection of prisoners, Galen insisted that injuries (breach of continuity in humor) were the only cause of pain.

Period	Essence of the concept
Islamic period	• Avicenna (980-1037) proposed in his *Cannon of Medicine and Poem of Medicine,* that pain was an independent sensation dissociated from touch or temperature, and that the true cause of pain was a change of the physical condition of the organ; whether there was an injury present or not. • Avicenna described 15 different types of pain: boring, compressing, corrosive, dull, fatigue-pain, heavy pain, incisive, irritant, itching, pricking, relating, stabbing, tearing, tension and throbbing.
Renaissance period	• In *Principles of Philosophy* (1644), based upon observations made relating to pain in phantom limbs, Descartes argued that pain arose from the persistent agitation of the nerves from the phantom limb stimulating the brain. From this, Descartes first proposed a link between peripheral sensation and the brain, suggesting that sensations stimulated in the body are conveyed directly to the brain, where they are actually perceived. • In his work *Cerebri Anatome* (1664), Thomas Willis (1612-1675) detailed the functional anatomy of the brain, cerebral vasculature, the morphology of the central nervous system, classified nine of the 12 cranial nerves and their associated functions, and the importance of the limbic system in linking visceral states and emotion to cognition and behaviour, such as pain behaviours (Mesulam, 2000). • Isaac Newton (1642-1727) and David Hartley (1705-1757) propose pain impulses are a result of vibrating the substances within nerves (Burmistr, 2018).

Development of holistic care in the management of pain

The pursuit of understanding the manifestation of disease and pain throughout the early Egyptian, Chinese, Greek and Islamic civilisations, continues to influence many aspects of modern-day patient care, including the critically ill patient. Healthcare is grounded in the tradition of caring for the entire person, including their family and community – holistic care (Canfield et al., 2016; Ho et al., 2006; Hodge & Varndell, 2018). Addressing both the physical and spiritual care needs, as seen in ancient Egyptian medicine, of critically ill patients and their families is an important part of providing holistic care, which is reflected in nursing codes of ethics and professional conduct (International Council of Nurses, 2021; Nursing and Midwifery Board of Australia, 2018). Spirituality is a basic human characteristic that is not limited to religion or an organised system of faith, but broadly refers to the way individuals seek or express meaning, purpose and connection to the moment, self and others (Ho et al., 2018). Spiritual care seeks to attend to an individual's spiritual needs as they search for meaning of and coping with ill-health, suffering and pain; that is an important part of health recovery and resilience (Swinton et al., 2017). Religious beliefs and spirituality play a vital role in acute pain management through assurance for patients and their families during painful times (Dedeli & Kaptan, 2013).

There is growing evidence that spiritual care improves that ability to cope with life-threatening situations (Kisorio & Langley, 2016; Koenig, 1998; Sulmasy, 2009), quality of care (Astrow et al., 2007), decision-making (MacLean et al., 2003; McCord et al., 2004) and satisfaction of patients and their family (Chew et al., 2016). Care of the critically ill patient in the ED setting is often characterised by high-tech equipment such as cardiac monitors, mechanical ventilators, syringe drivers, or invasive devices such as chest drains and central venous catheters. Life-threatening illnesses or injuries can also represent an existential crisis, potentially causing spiritual pain for the critically ill patient, family and their community (Carrillo-Torres et al., 2016). Pain management should incorporate the spiritual or religious beliefs of the patient (Bernard et al., 2017).

While traditional Chinese medicine has continued to evolve over thousands of years, the techniques used by practitioners to restore balance between *yin* and *yang* have largely remained the same (Sutherland, 2000). What has changed has been the acceptance by practitioners of Western medicine of traditional Chinese medicine, such as acupuncture and herbal medicine, as part of care for the critically ill patient (Lam, 2001; Wang et al., 2017). Acupuncture has been successful in managing common complications associated with prolonged hospitalisation of critically ill patients such as aiding gastric emptying (Pfab et al., 2011), optimising patient sedation while using less sedative doses; thereby reducing possible sedative-related side-effects (Zheng et al., 2012) and improving pain control (Feeney et al., 2017; Zhang et al., 2014). Use of herbal medicine, such as Shenfu (an injection containing ginseng and aconite) has been successful in improving patient survival at 28 days (42.7 vs. 30.1%) and 90 days (39.6 vs. 25.9%) post in-hospital cardiac arrest, reduction in length of stay and duration of mechanical ventilation (Zhang et al., 2017).

Understanding of pain physiology was accelerated in the Ancient Islamic and Renaissance period, through autopsy and development of anatomical knowledge; culminating in the discovery of specialised nerves and the central and peripheral nervous system. These discoveries reshaped how pain was thought to be perceived and communicated in the human body in the early modern period. Through the application of experimental science, theories were proposed to explain the physiological and psychological nature of pain, its sequelae and its management.

Modern age

At the start of the early modern age in Europe, in the 1800s, the concept of pain was being gradually reshaped by the advancement of experimental science. Ideas about pain had however long been debated due to the complexity of pain itself and the brain, the generator of pain (Perl, 2007). The main dispute was whether pain is mediated by a specific, hard-wired pathway as initially proposed by Descartes, or a non-specific pathway in the nervous system.

To date, four theories about acute pain have been proposed: Intensity Theory, Pattern Theory, Specificity Theory, Gate Control Theory. Although no one theory yet completely accounts for all aspects of pain perception, the theories have allowed for a more complex understanding of pain and approaches to its management (Moayedi & Davis, 2013). An overview of acute pain theories is presented below, along with application of pathophysiological and psychological effects of acute pain to a critically ill patient.

Intensity Theory

The Intensity Theory, previously referred to as the Summation Theory, had been postulated at several different times throughout history, but was not substantiated until the late 1800s. It was first conceptualised by Plato in the fourth century BCE in his oeuvre *Timaeus*, in which he defined pain not as a unique sensory experience, but rather as an emotion that occurs when a stimulus is stronger than usual (Plato, 1994). Plato's concept was later reiterated in *Zoonomia* by Erasmus Darwin (Darwin & Darwin, 1794), and then again by Erb (1874). In its third iteration, Naunyn (1889) conducted a series of experiments exposing participants to stimuli that were below tactile perception (e.g. single hair). When the stimulation was applied (60-600 times per second) participants reported unbearable pain in less than 20 seconds. Naunyn concluded that a summation effect was occurring. Based upon this, Goldscheider (1894) proposed a neurophysiological model to describe the summation effect: repeated sub-threshold stimulation causes pain. While the notion of a neurophysiological link between pain sensation and perception by the brain completed the later developed Specificity Theory of pain, it was quickly dismissed in favour of Sherrington's evolutionary framework. Sherrington (1947) proposed the existence of specialised sensory receptors that respond to different types but also levels of stimuli. While Sherrington's work largely advanced the Specificity Theory (described below), it initially also resolved the divide between the Specificity Theory and the Intensity Theory in that: the main function of a receptor is to lower the excitability threshold of the reflex arc for one kind of stimulus, and heighten it for all others (Sherrington, 1947).

The Intensity Theory focused on cutaneous pain but did not address issues pertaining to deep-tissue, visceral or muscular pain; areas of likely tissue damage in the critically ill patient. Although visceral and muscular pain were discussed in the subsequent revision of the Intensity Theory by Sherrington (1947), these observations were not fully accounted for within the revised model. With the later discovery of specialised sensory receptors, support for Intensity Theory waivered.

Pattern Theory

Pattern Theory was first proposed by Goldscheider, a German physician in 1894, and was derived from the work of Max von Frey (Moayedi & Davis, 2013). This theory proposed that particular reproducible patterns of nerve activation were triggered by a summation of sensory input from the skin in the dorsal horn. Also proposed was existence of a rapidly conducting fibre system that inhibits synaptic transmission in a more slowly conducting fibre system that carries the signal for pain. These systems were also identified as epicritic and protopathic, myelinated and unmyelinated, and phylogenetically new and old, respectively. Under pathological conditions, the slowly conducting system establishes dominance over the fast with the result of slow, diffuse, burning pain or hyperalgesia (Treede, 2006).

Prior to Goldscheider's Pattern Theory, it was believed that subcutaneous receptors were alike. Goldscheider (1894) demonstrated that there were however, several distinct stimuli: pressure, warmth and cold, and also that localised points reacted only to a given stimulus with each point having a specific function. Nafe (1929) expanded upon Goldscheider's earlier work in his quantitative theory of feeling or somaesthesis, suggesting that rather than specialised receptors responding to their respective stimuli such as pain, somaesthetic sensation (i.e. perception) occurred by a specific and particular pattern of neural firing, and that the spatial and temporal profile of firing of the peripheral nerves encoded the stimulus type and intensity. Later, Lele (1954) and colleagues (Sinclair, 1955; Weddell, 1955) further detailed the pattern concept, and concluded that with the exception of nerve fibres innervating hair cells, all fibres were similar; that sensory discrimination was the result of specific patterns of activation, and that perception of pain by the brain was a result of intense stimulation of nerve fibres.

As with the Intensity Theory, the Pattern Theory also focused on cutaneous pain and did not address the emergence of deep-tissue, visceral or muscular pain. Further, the Pattern Theory proposed that there are no separate systems for perceiving pain but instead the nerves are shared with other senses; viewing the brain as being homogenous.

Specificity Theory

The Specificity Theory posited by von Frey in 1895, proposed that a mosaic of specific pain receptors in body tissue projected along a dedicated pathway in the brain (Dubner et al., 1978). One important feature, portended by Charles Bell in his essay *Idea of a New Anatomy of the Brain* (1868), concerned organisation of the nervous system: the brain was not a common sensorium, but a heterogeneous structure with multiple areas of specialised functions with unique somatosensory pathways. The theory maintained that nerve endings are pain receptors, which generate pain impulses carried by A-delta and C-fibres in peripheral nerves, and by the lateral spinothalamic tract in the spinal cord to a pain centre in the thalamus. This notion of somatosensory pain pathways emerged over several millennia; much of which was prefigured by the work of Avicenna and Descartes (Dallenbach, 1939).

Published posthumously in 1662, Descartes' manuscript entitled *Treaties of Man* described pain as a perception that existed in the brain, making the distinction between neural phenomena of sensory transduction (i.e. nociception) and the perceptual experience of pain. An essential precept in the development of Descartes argument was the description of nerves, which he perceived as hollow tubules that conveyed both sensory and motor information. Further, Descartes postulated that a 'gate' existed between the nerves and the brain, which opened as a result from a sensory cue. Specificity Theory gained further momentum, albeit briefly, when Blix (1884) and Goldscheider (1894) independently published their findings of sensory spots; areas on the skin that elicit a specific sensation when touched. These sensory spots were specific to warmth, cold, pressure or pain. While the independent findings of Blix and Goldscheider did much to challenge the contemporary Aristotelian dogma that pain is a quality of all senses, a percept of the mind, their findings moved support away from the Specificity Theory toward the Intensity Theory (Rey, 1995).

Unlike the Pattern Theory, which was criticised for not explaining the existence of specific somatosensory end organs (Moayedi & Davis, 2013), the Specificity Theory provided an initial neural framework regarding nociceptors and spinothalamic pathways which other pain theories have expanded upon. While the neural framework provided the basis for understanding cutaneous pain conduction, the Specificity Theory did not describe the inhibition or exaggeration of pain by emotion or the continued presence of pain after surgical removal of a body part (i.e. phantom limb pain). Further, the Specificity Theory described cutaneous receptors, with the exception of receptors innervating hairs, as 'pain receptors', implying that stimulation of one type of receptor elicits a single psychological or physiological response. This has not been borne out clinically, psychologically or physiologically (Perl, 2007).

Both the Pattern and Specificity theories of pain were based upon experimental evidence yet presented opposing views as to the perception and transmission of pain in the human body. In unifying these two theories, a compromise emerged in the form of the Gate Control Theory.

Gate Control Theory

The Gate Control Theory proposed by Melzack and Wall (1965) emerged from examining von Frey's Specificity Theory and physiological observations on spinal mechanisms to explain certain behavioural and psychological observations related to pain. Melzack and Wall deconstructed von Frey's theory of specificity into three assumptions: that individual receptors have a specific anatomy (the anatomical assumption) correlated to a specific physical (the physiological assumption) stimulus, and, in line with Goldscheider's neurophysiological extension to von Frey's original theory, barrages of impulses produced in different sensory fibres are decoded into a somaesthic (the psychological assumption) experience based in part on other ongoing brain activity. Melzack and Wall therefore suggested that pain arose when the number and frequency of impulse discharges exceeded a gated threshold.

The Gate Control Theory postulates that three spinal cord constituents are integral to sensory recognition and modulation: substantia gelatinosa cells in the dorsal horn, the central transmission cells in the dorsal horn and dorsal column fibres projecting to the brain; which is consistent with concepts of physiological specialisation and central summation on input control (Moayedi & Davis, 2013). The substantia gelatinosa cells act as presynaptic modulators of afferent patterns before they influence the transmission cells. These afferent patterns in the dorsal column are responsible for triggering selective brain processes influencing the modulating properties of the gate control system (Woolfe, 2010). This results in the activation of neural mechanisms by the branching transmission cell, which generates perception and response.

Expressed in simplified form, the Gate Control Theory proposes that when pain (C and A-delta) fibres are stimulated, pain impulses are passed presynaptically in the substantia gelatinosa and are transmitted to the brain, and they will be perceived and will continue to be felt as pain as long as the stimulus persists. Relief of pain is dependent on stimulation of the large, myelinated A-beta fibres, which normally transmit the perceptions of touch and pressure. A-beta fibre stimulation results in an inhibitory effect setup in the same area of the substantia gelatinosa where pain fibres synapse with a decrease in transmission or closing the gate to pain. Cessation of large fibre stimulation remove inhibition of pain in the substantia gelatinosa and open the gate to the transmission and perception of pain (Marieb & Hoehn, 2018). Melzack and Wall further posited that higher cortical functions contributed to this gate control mechanism; highlighting that psychological phenomena can directly affect the subjective experience of pain (Gatchel & Rollings, 2008). Over the past 40 years, progress has been made in strengthening the Gate Control Theory by elucidating the neuroanatomy and neuropharmacology of pain pathways in the peripheral and central nervous system (Coderre et al., 1993; Humphries et al., 1996; Pohl et al., 1992; Steedman et al., 1985).

The Gate Control Theory's most important contribution to understanding pain was its emphasis on central neural mechanisms, and is the accepted theory guiding acute management in critically ill patients today (Schug et al., 2015). This theory forced medical and biological sciences to accept that the brain is an active system that filters, selects and modulates inputs, and that the dorsal horns were not merely passive transmission stations but sites at which dynamic activities (e.g. inhibition, excitation and modulation) occurred. Implicit in the hypothesis is that pain is evoked when brain activity reaches a certain level as a result of sensory and/or central inputs.

While the Gate Control Theory has led to some of the most fruitful research in the field of pain, many of the details of this theory have however, been shown to be inaccurate (Moayedi & Davis, 2013). For example, there were over-simplifications and flaws in the presentation of the neural architecture of the spinal cord, the location and the model pertaining to how large afferent fibre stimulation inhibits or modulates C-fibres, and the hypothesised modulatory system, which is now known to include descending small-fibre projections from the brain stem (Treede, 2006). Further, research based on this theory focuses on acute pain evoked by noxious stimulation, such as multi trauma, and has revealed complex physiological mechanisms at every level, from nociceptors, the spinothalamic pathway to the affective expression in the cerebral cortex at the frontal lobe (Craig, 2003; Mayer & Price, 1976). Additionally, the Gate Control Theory initiated the idea that pain was not purely the result of physical injury but rather a complex experience, influenced by cognitive and emotional factors.

Melzack (2001) emphasised that noxious stimuli enter an already active nervous system that is a substrate of past experience, culture, anticipation, and emotions. Cognitive processes act selectively on sensory input and motivation to influence pain transmission via the descending tracts to the dorsal horn. As a result, the amount and quality of pain are determined by individual factors such as previous pain experiences and one's concept of the cause of pain and its consequences. Cultural values can influence how one feels and responds to pain (Katz & Rosenbloom, 2015; Melzack & Wall, 1965). Pain therefore is a highly personal experience and more than a noxious stimulus. Increasingly the plasticity of the nervous system is being recognized along with the individuality of the pain response.

Of the four commonly described acute pain theories, the Gate Control Theory best aligns with contemporary empirical knowledge and understanding, as well as clinical application to pain experiences in critical care patients. While Gate Theory has failed to describe phantom limb pain, it has been a catalyst for many contemporary studies in the field, and significantly advanced the pathophysiological and psychological understanding of acute pain in the critically ill patient (Schug et al., 2015).

Acute pain and the critically ill patient

While acute pain is commonly experienced by critically ill patients, it often remains under-appreciated, undetected and under-treated by health care professionals (Gélinas, 2007; Ma et al., 2010; Puntillo et al., 2004). Critically ill patients, in addition to acute pain arising from the illness or injury itself, are also exposed to multiple sources of iatrogenic pain in the ED, such as clinical procedures required to manage their illness or injury.

Pain is an alarm signal of actual or potential bodily harm, which elicits defensive or protective reactions (Auvray et al., 2010; Chapman, 2005; Eccleston & Crombez, 1999). Pain in the critically ill or injured patient disrupts homoeostatic regulation, activating a complex sequence of neural, hormonal and behavioural responses (Lord & Varndell, 2019). Advances in molecular biology, genetics, immunology, imaging and clinical medicine have improved clinician understanding of the pathophysiology and psychology of pain and the pain experience (Seixas et al., 2014). We now know that there are multiple pain centres in the brain, and that the function of pain receptors and nociceptors can be altered by local inflammatory responses at the site of tissue damage; commonly associated with life-threatening conditions or injuries (Levine & Taiwo, 1994). Nociceptive pain is protective, and associated with noxious stimuli that have the potential to damage tissue. Inflammatory pain is both protective and adaptive; following tissue damage or infection, the body's immune system is mobilised to create swelling, tenderness and extra sensitivity in the injured area. This response has evolved to discourage contact with the affected area, and to reduce or prevent movement so that healing can take place (Woolfe, 2010). The third pain type, neuropathic pain is pathological and therefore, is maladaptive rather than protective (Lacomte et al., 2011). Understanding the physiology of acute pain enables emergency clinicians to monitor and manage this complex phenomenon.

Physiology of acute pain

Understanding of the physiology of acute pain has increased with the understanding of how the nervous system detects painful stimuli, and how it then processes the information. The processing of painful stimuli is undertaken by a subgroup of receptors in the nervous system called nociceptors. Nociceptors are unspecialised, free, unmyelinated nerve endings that convert a variety of stimuli into nerve impulses, which the brain interprets to produce the sensation of pain. Nerve cell bodies are principally located in the dorsal root ganglia, with the exception of the trigeminal nerve (located in the trigeminal ganglia). From the ganglia, one nerve branch is projected toward the periphery and forms the peripheral nervous system (PNS), and one is directed centrally to the spinal cord or brainstem forming the central nervous system (Besson & Chaouch, 1987; Willis & Westlund, 1997).

In the body's peripheral nervous system, specialised nociceptors, polymodal C, A-beta and A-delta fibres innervate all tissues and respond to a wide range of noxious stimuli. A-beta fibres have the largest-diameter afferent fibres, and respond maximally to light touch, kinetic stimuli and temperature (Buchthal & Rosenfalck, 1966). A-beta fibres are present primarily in nerves that innervate skin with conduction speeds between 30-70 milliseconds. C and A-delta fibres similarly innervate the skin, but also extend to deep somatic and visceral structures. C-fibres respond polymodally to thermal, mechanical and chemical stimuli, with an impulse conduction speed between 0.6-2.3 milliseconds. A-delta fibres respond to mechanical and mechanothermal stimuli and have impulse conduction speeds around 20 milliseconds. The difference in impulse conduction speeds between A-delta and C-fibres is cited as the reason for different pain sensations (Dworkin et al., 2003). Neuronal impulses in fast conducting A-delta fibre nociceptors produce the sensation of sharp, fast pain (epicritic pain), while slower C-fibre nociceptors produce the sensation of delayed, burning, dull pain (protopathic pain). Peripheral activation of the nociceptors (transduction) is modulated by a number of chemical substances, produced or released when there is cellular damage.

Recent tissue damage due to illness, injury, or surgery initiates complex processes and gives rise to a multitude of neurophysiological and biochemical events affecting how pain is experienced. For critically ill patients who experience intense, repeated or prolonged stimuli to already damaged or inflamed tissues, sensory nerve endings are exposed to a milieu of cellular breakdown products and inflammatory mediators; leading to amplification of pain signals (Kox et al., 2012). Patients that are critically ill also often experience injuries that result in skin lacerations and fractures (Reardon et al., 2015). Consequently, these patients may experience multiple sensory pain stimuli that requires complex clinical assessment, monitoring and management. Release of inflammatory mediators activates the sympathetic nervous system (SNS), giving rise to physiological and metabolic changes such as increased heart and respiratory rate and blood pressure, which result in increased demand for oxygen, gluconeogenesis and amino triphosphate consumption (Hasenboehler et al., 2006). Yet critically ill patients often lack the physiological and metabolic reserves to sustain increased functional demands whilst maintaining homeostasis (Crouch, 2003). As a consequence of these mediators being activated, pain is perceived more acutely, prompting an increase in the production, transport and membrane insertion of chemically gated and voltage-gated sodium and calcium ion channels (Porth & Grossman, 2018). This change increases the excitability of nociceptors and lowers the threshold for activation by mechanical, thermal and chemical stimuli. Central sensitisation occurs in response to increased C and A-delta fibre action potentials being sent centrally towards the dorsal horn of the spinal cord and the central nervous system. Sensitisation is a clinically important process that contributes to tenderness, soreness and hyperalgesia; increasing what would normally be innocuous stimuli to being a painful experience. This places the critically ill patient at an increased risk for experiencing greater pain intensity to the smallest noxious stimuli, and again highlights the importance of appropriate assessment, monitoring and management by clinicians of potential sources of pain. The following section details the pathophysiological and psychological mechanisms that occur from unrelieved pain.

Physiological consequences of unrelieved pain in the critically ill patient

Unrelieved pain is a stressor that can lead to physiologic changes and negative effects on the nervous, cardiovascular, respiratory, endocrine and immune systems (Puntillo et al., 2009). Failure to relieve pain produces a prolonged stress state, which can result in poor patient outcomes (Lord & Varndell, 2019).

Nervous system

During acute pain experiences, an individual's sympathetic nervous system and neuro-endocrine system are activated. The SNS is responsible for regulating almost every organ system to optimise homeostatic control. The SNS is dominant in a state of stress, such as injury to tissue. Activation of the SNS results in the sympatho-adrenal response causing secretion of acetylcholine, leading to the release of adrenaline (epinephrine) and to a lesser extent noradrenaline (norepinephrine) into the circulatory system (Marieb & Hoehn, 2018). While SNS activation promotes survival (i.e. flight-or-fight), prolonged activation has several negative multisystem effects (Puntillo et al., 2009). Pain, when allowed to persist untreated, also gives rise to changes in the nervous system that could result in permanent, persistent pain of a different nature than the original nociceptive of inflammatory pain (Siddall & Cousins, 2004). Research confirms that changes in neural mechanisms can produce sensitisation of peripheral and central neuronal pathways; further amplifying pain intensity (Apkarian, 2011; Baliki & Apkarian, 2015; Crofford, 2015; Tracey & Mantyh, 2007; Zhang et al., 2018). The release of adrenaline and noradrenaline produces wide ranging physiological effects; many of which are detectable during clinical examination (Table 2.6).

Table 2.6: Physiological effects and clinical features of sympathetic nervous system activation

Organ	Effect	Clinical features
Brain	• Activation of cells in the amygdala, locus coeruleus and periaqueductal grey • Altered balance between limbic and frontal cortex control of micturition	• Heightened awareness • Fear • Analgesia • Urge to pass urine or incontinence
Eyes	• Inhibits ophthalmic nerve	• Dilated pupils
Heart	• Increased rate and force of contraction • Increased speed of conduction	• Increased heart rate • Increased blood pressure
Blood vessels	• Constriction of blood flow of skin • Dilatation of blood vessels to muscles	• Cold, pallor • Increased exercise capacity
Lungs	• Dilates bronchioles	• Increased tidal volume
Liver and Pancreas	• Breakdown of glycogen into glucose • Increased metabolic rate • Inhibition of insulin production • Increased blood glucose	• Reduced urine output • Concentration of urine
Gastrointestinal	• Decreased motility to stomach and intestine • Constriction of gastrointestinal organs	• Inability to digest • Nausea, vomiting, constipation
Kidneys	• Constriction of blood vessels to kidneys • Increased production of ADH • Increased production of renin • Retention of sodium	• Activation of renin-angiotensin-aldosterone pathway • Increased glomerular filtration rate • Water retention
Penis	• Inhibits tumescence	• Flaccid penis
Skeletal muscle	• Rhythmic contraction	• Shaking or shivering • Teeth chattering
Skin	• Reduced blood flow to skin • Activates sweat secretion	• Piloerection • Pallor, mottling • Sweating

Key: ADH, antidiuretic hormone.

Source: Lord & Varndell (2019) Porth & Grossman (2018), Marieb & Hoehn (2018) and Reardon et al. (2015)

Cardiovascular system

For the critically ill patient unrelieved pain drives the cardiovascular system to increase SNS activity, increasing heart rate, blood pressure and peripheral vascular resistance. As the increasing workload and stress strain the myocardium, oxygen consumption increases. When myocardial oxygen consumption is greater than supply, myocardial ischaemia and, potentially, myocardial infarction can occur; an event made more likely in the presence of critical illness or injury (Schug et al., 2015). Further, due to an increased cardiac output (i.e. blood flow and heart rate), fibrinolytic capacity is reduced, increasing the risk of deep vein thrombosis and pulmonary embolism due to hypercoagulation (Wood, 2003). Impaired muscle function, muscle fatigue and rigidity from repeated involuntary reflex muscle spasms in response to unrelieved pain can exacerbate the risk of developing thrombosis (Siddall & Cousins, 2004).

Respiratory system

For intubated critically ill patients who are breathing spontaneously without the aid of continuous mechanical ventilation, unrelieved pain can result in the patient limiting the movement of the thoracic and abdominal muscles in a bid to reduce pain, known as splinting (Jafari et al., 2017). In addition, to causing ventilator dysynchrony, pooling of secretions and sputum retention within the airways due to a reluctance to breathe deeply or cough, can lead to: atelectasis, pneumonia, reduced vital lung capacity, hypoxia, hypoxaemia, increased respiratory and expiratory pressures and reduced alveolar ventilation (Schug et al., 2015). This situation is made worse due to bronchorrhoea, a cholinergic response secondary to irritation of the epithelial lining of the trachea from the presence of an endotracheal tube and suctioning.

Endocrine system

Unrelieved pain also has profound physiological effects on the endocrine system. Initially, severe pain causes hyperarousal of the hypothalamic-pituitary-adrenal-thyroid-gonadal (HPATG) system, the major stress control mechanism of the body (Tennant, 2013). Activation of the HPATG system results in evaluated serum hormone levels that affect renal function and urinary output, fluid and electrolyte balance, blood volume and pressure, regulation of blood glucose, cellular metabolism and sleep (Puntillo et al., 2009). However, critically ill patients have limited physiological capacity to maintain homeostasis. If pain is not recognised and managed by clinicians, the HPATG system cannot maintain normal hormone production indefinitely, and some serum hormone levels may quickly fall below a normal functional range. This can result in loss of pain-control function, impaired protection and regeneration of injured tissue, depression of the immune system and cellular metabolism (Porth & Grossman, 2018; Schug et al., 2015), retention of sodium and water resulting in urinary retention and increased excretion of potassium. This physiological sequelae can lead to hypokalaemia, fluid overload, increased cardiac workload and hypertension (Middleton, 2003).

Immune system

The immune system plays an important role in maintaining health, and resisting infection and disease (Whiteside & Herberman, 1994). As a consequence of continued SNS stimulation, hormone and enzyme activity from unrelieved pain, lymphocyte proliferation is reduced, monocytes become dysfunctional and natural killer cell activity is suppressed, resulting in depression of the immune system (Salo & Nissila, 1990).

Critically injured patients that require surgery are at higher risk of poor outcomes due to inadequately treated pain and the impact of surgery on the immune system. There is significant evidence that surgery depresses immune system function (Amodeo et al., 2018; Jutza et al., 1997; Salo & Nissila, 1990). Critically ill patients often require multiple surgical interventions. This, combined with the severity of trauma, can further depress the immune system (Faist et al., 1990; West & Mold, 2012). Depression of the immune system is further exacerbated by administration of common critical care medications such as intravenous propofol, a potent sedative agent (Sanders et al., 2009; Wood, 2002). Importantly, these sedatives are first line care agents used frequently in the resuscitation of critically ill patients in any ED (Varndell et al., 2015b). Studies examining depression of the immune system in response to major surgery and trauma identified that adequate provision of pain relief is essential to ameliorate surgery and trauma induced decreases in immune system effectiveness (Hietbrink et al., 2006; Kox et al., 2012).

While acute pain can be a predominant physiological stressor that activates many pathophysiological mechanisms in critically ill patients, the psychological impact and resulting behavioural and cognitive sequelae of unrelieved pain, is as important as the production and transmission of the pain signal (Michaelides & Zis, 2019; Prevost, 2005).

Psychological consequences of unrelieved pain in the critically ill patient

Although pain can be defined physiologically, pain is also a unique and subjective experience that can be defined as “whatever the experiencing person says it is, existing whenever he/she says it does” (Herr et al., 2011, p.44). However, perception of acute pain is also highly dependent on the context in which it occurs (Lambert et al., 1960). Through first-hand experiences individuals learn to predict pain, which may become a source of fear and anxiety (Auvray et al., 2010; Chapman, 2005; Eccleston & Crombez, 1999; Grillon et al., 1991; Michaelides & Zis, 2019; Van Damme et al., 2006).

Despite being used interchangeably, fear and anxiety are separate phenomena, with differing aetiology, response patterns, time course and intensity (Ochsner et al., 2006) that can alter pain perception. Fear is an immediate alarm reaction to a present threat, characterised by impulses to escape, and typically results in a surge of sympathetic arousal (Barlow et al., 1996). Conversely, anxiety is a future-orientated emotion characterised by negative effect and apprehensive anticipation of potential threats, and results in increased environmental and somatic scanning (i.e. hypervigilance and muscle tension), and neuroendocrine activation. Fear mobilises the person to take action (i.e. flight-or-fight response), whereas anxiety leads to increased sensory receptivity. Although both are alerting signals modulated by the amygdala (Ressler, 2010), they appear to prepare the body for different actions: anxiety is a generalised response to an unknown threat or internal conflict, whereas fear is focused on known external danger. Importantly, fear and anxiety have both been demonstrated to affect pain perception and tolerance (Rhudy & Meagher, 2000). Fear and anxiety can considerably alter pain perception and tolerance; fear increases a person's tolerance of pain for longer periods of time, while anxiety conversely increases a person's sensitivity to pain, or hyperalgesia (Rhudy & Meagher, 2000).

For critically ill patients, unrelieved pain and anxiety are common experiences, and correlate with poor outcomes (Johnson et al., 1992; Kress et al., 2003; Oh et al., 2015). Unrelieved or unrecognised pain can also result in critically ill patients experiencing distressing cognitive impairment, such as disorientation, mental confusion and a reduced ability to concentrate (Oh et al., 2015).

Summary

This Chapter discussed the history and development of emergency care, including increasing demand and geographical challenges in providing definitive critical care within the ED context. The development of emergency nursing as a specialist nursing discipline and the various sub-specialised roles that have been adopted to continue to meet patient care have been presented. In the final section, key acute pain theories and current pathophysiological and psychological understanding of acute pain were detailed.

Unrelieved or unrecognised acute pain has major influences on the physiological and psychological systems of critically ill patients. More importantly, unrecognised or unmanaged pain can lead to adverse outcomes, altered perception and tolerance of acute pain, and haemodynamic compromise. Despite evidence of poor outcomes associated with unrelieved or unrecognised acute pain there is little evidence on how emergency nurses, recognise, monitor and manage acute pain in critically ill patients. The following Chapter presents an integrative review of the literature on the current state of acute pain management in the ED, pain assessment instruments, nurse-initiated pain management and barriers to pain management.

CHAPTER 3: LITERATURE REVIEW

Introduction

This Chapter presents an integrative literature review that examines contemporary evidence about acute pain management in critically ill patients. The search strategy and results are initially described. Next, the literature relating to current acute pain management in the ED is presented. This is followed by a critical appraisal of pain assessment instruments. Next, literature concerning nurse-initiated pain management is detailed. Finally, literature regarding barriers to pain management is examined. Synthesis of the evidence presented enables understanding of the state of science and the limitations of existing research regarding management of pain for critically ill patients and emergency nursing practice. The integrative review presented below, critiques and contextualises current research, and was guided by the work of Whittemore and Knarlf (2005). Aspects of this chapter have been previously published:

> Varndell, W., Fry, M. & Elliott, D. 2016, 'A systematic review of observational pain assessment instruments for use with nonverbal intubated critically ill adult patients in the emergency department: an assessment of their suitability and psychometric properties.', Journal of Clinical Nursing, vol. 26, no. 1-2, pp. 7-32.
>
> Varndell, W; Fry, M & Elliott, D (2018) Quality and impact of nurse-initiated analgesia in the emergency department: a systematic review. International Emergency Nurse. 40:46-53.

Review search strategy

A comprehensive literature search was conducted using the following databases: Cumulated Index to Nursing and Allied Health Literature (CINAHL), Excerpta Medica (EMBASE), Medline, ProQuest, The Cochrane Library, and the National Institute of Clinical Excellence. The search covered the period from 1948 to April 2023. No date or language restrictions were applied. Several search terms were used: 'pain theories OR mechanism AND pain', 'pain AND critical care', 'pain AND management', 'pain assessment AND non-verbal OR intubated', 'pain assessment AND emergency OR critical care', 'pain assessment AND emergency nurse OR critical care nurse', 'measuring pain AND critical care', 'acute pain AND barrier', 'pain AND standard OR consensus' and, 'pain AND position statement AND emergency'. The review was supplemented with a manual search of reference lists from included published studies and grey literature. The grey literature was explored for policies, guidelines and recommendations relating to pain management, and included organisational and professional associations related to emergency, sedation or critical care, and Google Scholar (Figure 3.1).

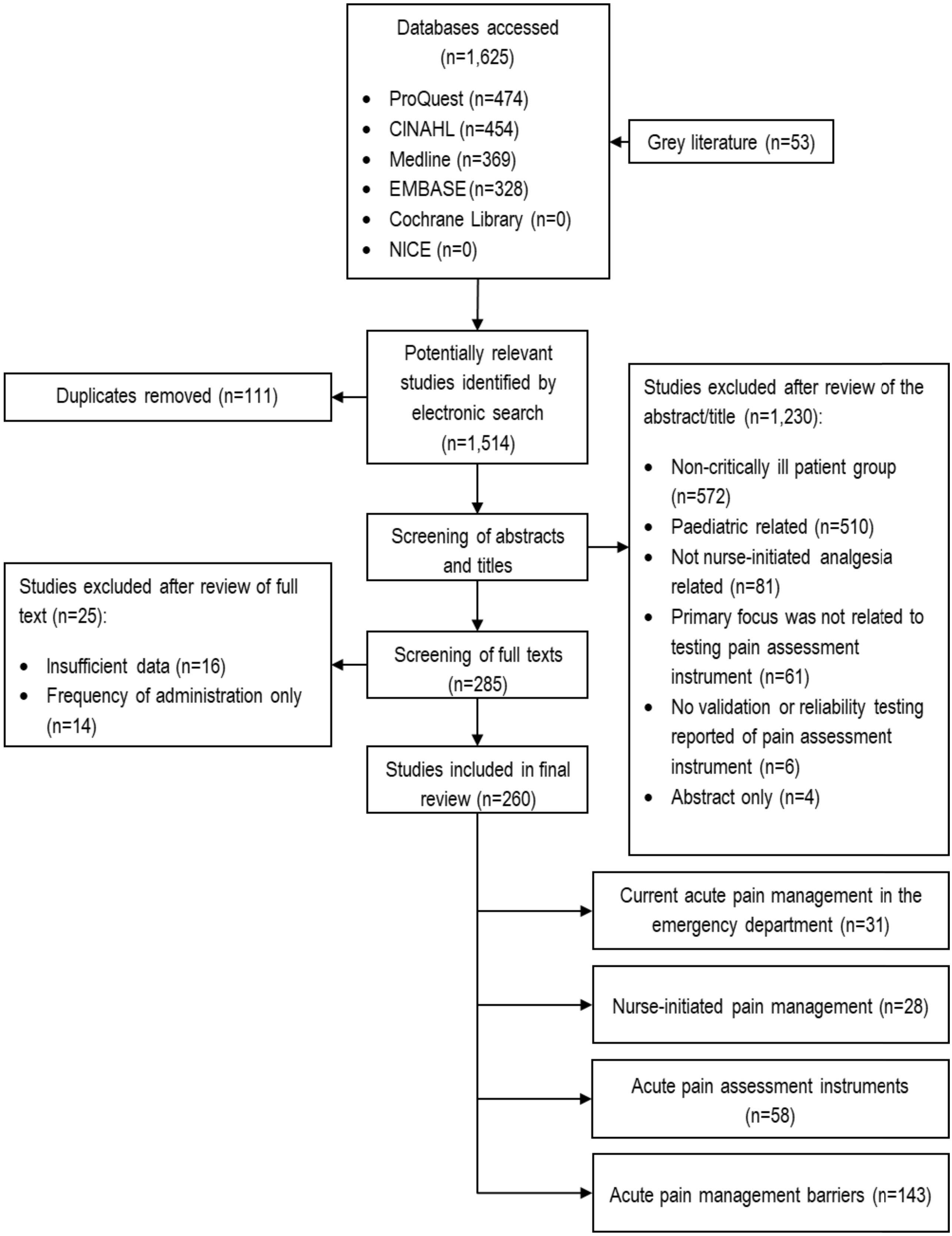


Figure 3.1: PRISMA flow diagram

As illustrated in the above figure, the initial search yielded 1,625 articles. Of those, 285 (17.5%) were retrieved for full text screening, with 260 (16%) forming the final review. Included studies spanned the period of 1948 to 2023, with the majority (n=190; 73.1%) published from the United States of America. Within the included studies, there were 121 (46.5%) narrative reviews and 20 (7.7%) systematic literature reviews. From a primary research perspective, a total of 90 (34.6%) cohort studies and 3 (1.2%) randomised controlled trials were identified. Data extraction was conducted by the researcher, and included: the authors, country of origin, study design, setting, sample size and characteristics, key findings and limitations. The researcher's supervisors verified the accuracy of the data extraction and synthesis by random audit. Extracted data were then summarised and synthesised in narrative and descriptive numerical form. Study validity was evaluated by the researcher using the Critical Appraisal Skills Program (CASP) '*Making Sense of Evidence Tools'* (Critical Appraisal Skills Program UK, 2018). Methodological quality was summarised using the appropriate CASP checklist (RCT, systematic review, qualitative and cohort study), where a response of 'Yes (+)' was given a value of 1, and 'No (0)' or 'Can't tell (+/-)' a value of 0 (Deeks et al., 2003; Tripathi & Dusing, 2015; Varndell et al., 2016a). Measuring instruments identified were additionally evaluated using criteria recommended from the psychometric literature (DeVillis, 2011; Elliott, 2007; Furr & Bacharach, 2013; Streiner et al., 2015). The identified literature was categorised under the following themes: i) current state of acute pain management in the ED; ii) nurse-initiated pain management; iii) acute pain assessment instruments; and, iv) acute pain management barriers. These themes are discussed below.

Theme 1: Current state of acute pain management in the ED

Despite more than 30 years of research, acute pain management remains poorly assessed and inadequately treated in the ED setting. The term 'oligoanalgesia', meaning the inadequate or underuse of analgesics in the face of valid indication (Helm et al., 2020), was first coined by Wilson and Pendleton in their seminal 1989 study, that identified that over half of patients (n=111; 56%) presenting to ED in acute pain received no analgesia. Further, those that did receive analgesia had to wait over an hour (n=87; 44%), with those reporting severe pain administered suboptimal doses of opioid analgesia (n=63; 32%). Since then, studies worldwide continue to report the prevalence of infrequent pain assessment and oligoanalgesia in ED (Barksdale et al., 2016; Dale & Bjørnsen, 2015; France et al., 2014; Hsu et al., 2022; Ridderikhof et al., 2017; Varndell et al., 2018b; Viglino et al., 2019).

The first approach to guide acute pain assessment and the use of analgesics was the World Health Organization analgesic ladder (Ballantyne et al., 2016). The analgesic ladder was the first strategy proposed in 1986 to legitimise the use of opioids in the management of pain in cancer patients (Ventafridda et al., 1985). The analgesic ladder is a simple model for the stepwise introduction and upward titration of analgesics starting with non-opioids, progressing through mild and finally strong opioids. It is based on five main principles developed following the recommendations of an international group of experts, which have significantly influenced pain management policies globally: oral administration where possible; analgesics should be given regularly; type of analgesic should be chosen based on reported pain intensity; dosing of analgesic should be adapted to the patient; and, clear patient education on the use of analgesic medication should be provided. The efficiency of this approach is debatable and yet to be proven through large-scale studies (Barakzoy & Moss, 2006; Jadad & Browman, 1995). However, it still provides a simple approach to reducing patient morbidity due to pain (Hussien & Hay, 2022; Orhan et al., 2008). Since the first publication of the clinical ladder, the principles have been adapted over the years to guide the management of acute pain (Yang et al., 2020).

Currently, no single standard of care exists globally for the management of acute pain in critically ill or injured patients in ED (Fabbri et al., 2023). Within the literature, nine position statements were identified relating to acute pain management in an ED setting. Of these, four (44.4%) generated recommendations based on literature review (Hachimi-Idrissi et al., 2020b; Herr et al., 2019b; Motov et al., 2018; Savoia et al., 2015), one (11.1%) used nominal group technique to generate recommendations that were then ranked using a modified Delphi technique (French Society for Emergency Medicine, 2010), and one used survey method to consolidate recommendations drawn from reviewing the literature (Hachimi-Idrissi et al., 2020a). Overall, seven (77.8%) provided guidance concerning the incremental, multimodal use and dose of analgesics to manage acute pain (American College of Emergency Physicians, 2017; Australian and New Zealand College of Anaesthetists, 2022; French Society for Emergency Medicine, 2010; Hachimi-Idrissi et al., 2020a; Motov et al., 2018; Royal College of Emergency Medicine, 2021; Savoia et al., 2015), two recommending pain assessment and reassessment timeframes (Hachimi-Idrissi et al., 2020a; Royal College of Emergency Medicine, 2021). In general, patients presenting to ED in mild pain are managed with paracetamol or non-steroidal anti-inflammatory drugs (NSAIDs). In instances of moderate pain, nitrous oxide, methoxyflurane or weak opioids (e.g. codeine, tramadol) can be used in addition to paracetamol and NSAID medications.

For those reporting severe pain such as critically ill patients, opioids are the most commonly agreed upon analgesic, that includes intravenous paracetamol (French Society for Emergency Medicine, 2010; Savoia et al., 2015), morphine, fentanyl, oxycodone, hydromorphone or ketamine (American College of Emergency Physicians, 2017; Cisewski & Motov, 2019; Fabbri et al., 2023; French Society for Emergency Medicine, 2010; Hachimi-Idrissi et al., 2020a; Motov et al., 2018; Royal College of Emergency Medicine, 2021; Savoia et al., 2015; Schug et al., 2020). Following initial opioid analgesia, a reverse analgesic ladder approach is used to step down analgesia (Beard & Wood, 2015; Schug et al., 2020), and to avoid secondary harm, such as exacerbating renal failure in critically ill or injured patients (Herranz Prinz et al., 2022) (Table 3.1).

Table 3.1: Summary of policy recommendations in managing acute pain in the ED

Sponsoring organisation(s)	Year	Title	Type of report, method	Summary of recommendations
Australian and New Zealand College of Anaesthetists and the Faculty of Pain Medicine	2022	Position statement on acute pain management (PS41)	Position statement, systematic literature review (Schug et al., 2020)	• Pain management education is essential for all clinicians. • Use evidence-based pain assessment instruments appropriate to patients' condition, including presence of anxiety. • Pharmacological management of pain, paracetamol first line if mild, escalating to include NSAID if moderate pain. In severe pain states, use opioids at lowest effective dose. • Acute pain management strategies suggested for principal injury types (e.g. hip fracture, chest trauma) • Opioid stewardship and weaning should be part of patient management practices. • Patient/carer education regarding analgesic use, benefits and potential side-effect to be provided.

Sponsoring organisation(s)	Year	Title	Type of report, method	Summary of recommendations
Royal College of Emergency Medicine	2021	Management of Pain in Adults	Practice guideline, narrative review	• Initial pain assessment <10 mins of presenting; reassess per pain intensity: ○ No pain (0/10): <60mins ○ Mild pain (1-3/10): <60mins ○ Moderate pain (4-6/10): <30mins ○ Severe pain (7-10/10): <15mins • Pain management flowchart, progressing from paracetamol, adjuvants (NSAID, codeine, nitrous oxide, methoxyflurane) to parenteral opioids (morphine, fentanyl, ketamine) in severe pain states.
European Society of Emergency Medicine	2020	Approaching acute pain in emergency settings: European Society for Emergency Medicine (EUSEM) guidelines	Practice guideline, systematic literature review and survey of experts (n=103) (Hachimi-Idrissi et al., 2020b).	• Initial pain assessment <15mins of presenting; reassess every 15mins. • Acute pain management flowchart, beginning with a non-opioid analgesic, adding NSAID at lowest dose in mild pain, and using parenteral opioids in severe pain states. • Consideration of non-pharmacological interventions (e.g. splinting, heat/cold, distraction).

Sponsoring organisation(s)	Year	Title	Type of report, method	Summary of recommendations
American Society of Pain Management Nurses, and the American Pain Society	2019	Pain Assessment in the Patient Unable to Self-Report	Position statement, narrative review (Herr et al., 2019b)	• Use of a hierarchy of pain assessment techniques: look for possible causes, attempt self-report, observe patient behaviours, solicit, then attempt trial of analgesia. • Use evidence-based behavioural pain assessment instruments , minimise emphasis on vital signs. • Assess pain regularly, reassess post-intervention and document
American Academy of Emergency Medicine	2018	The Treatment of Acute Pain in the Emergency Department: A White Paper Position Statement Prepared for the American Academy of Emergency Medicine	Position statement, literature review	• Pharmacological management of acute pain begins with a non-opioid analgesic, adding NSAID at lowest dose if pain is mild. In severe pain, use parenteral opioids with caution, and at the lowest effective dose. • Non-pharmacological management options should be considered. • On discharged, joint decision-making with patient, in severe pain immediate release opioids at lowest effective dose.

Sponsoring organisation(s)	Year	Title	Type of report, method	Summary of recommendations
American Academy of Emergency Medicine; American Academy of Emergency Nurse Practitioners; Emergency Nurses Association; and the Society of Emergency Medicine Physician Assistants	2017	Optimizing the Treatment of Acute Pain in the Emergency Department	Policy statement	• Pharmacological management of acute pain should begin with a non-opioid analgesic, adding NSAID at lowest dose if pain is mild. In severe pain, use parenteral opioids with caution, and at the lowest effective dose.
Italian Intersociety; Italian Society of Emergency Medicine; Italian Resuscitation Council; Italian Society of Anaesthesia, Resuscitation, Emergency and Pain; Italian System Society 118; Italian Association for the Study of Pain; and the Italian Society of Emergency Surgery and Trauma	2015	Italian intersociety recommendations on pain management in the emergency setting	Consensus statement, literature review (n=148)	• Pain should be assessed using the appropriate evidenced-based tool. • Pharmacological management of acute pain should begin with a non-opioid analgesic, adding NSAID or weak opioid (e.g. tramadol) at lowest dose if pain is mild. In severe pain, use parenteral opioids with caution, and at the lowest effective dose. • Use of IV paracetamol recommended • Consideration of non-pharmacological interventions (e.g. splinting, heat/cold, distraction). • The management of procedural pain often requires analgosedation; increased safety and use of evidenced-based analgosedation assessment tools is required.

Sponsoring organisation(s)	Year	Title	Type of report, method	Summary of recommendations
French Society of Anaesthesia and Resuscitation, and the French Society for Emergency Medicine	2010	Sedation and analgesia in emergency facilities	Consensus statement, nominal group technique followed by Delphi	• Pharmacological management of acute pain should begin with a non-opioid analgesic, adding NSAID at lowest dose if pain is mild. In severe pain, use parenteral opioids with caution, and at the lowest effective dose. • Use of IV paracetamol is appropriate in severe pain. • The management of procedural pain often requires analgosedation; increased safety and use of evidenced-based analgosedation assessment tools is required. • Care-induced pain must be avoided where possible and managed pre-emptively with analgesia as appropriate. • Ongoing team training in the use of local pain management protocols/policies is essential.
Australasian College for Emergency Medicine; Australian College of Emergency Nursing; and the College of Emergency Nursing Australasia	2009	Joint policy statement emergency department pain management	Position statement	• Ensure robust policies are instituted within the ED and clinicians are familiar with their use. • Pain must be assessed using evidence-based tools appropriate for patient. • Pain management research is fostered

Key: IV, intravenous; NSAID, non-steroidal anti-inflammatory drug.

The literature details that in the resuscitation area, patients undergo lifesaving procedures, often at a crucial phase in their care when outcomes are difficult to predict, requiring ongoing opioid pain management and sedation (Nguyen et al., 2000; Rivers et al., 2002; Trzeciak et al., 2006). Further, standards and policy statements identified within the literature recommend that emergency nurses who manage critically ill patients must be able to assess and monitor for the presence of pain; identify and differentiate the various levels of sedation; detect complications related to analgesia and sedation administration and appropriately intervene (Schug et al., 2020); and, understand the ethical and legal aspects of analgosedation (Australian and New Zealand College of Anaesthetists, 2022a, 2022b).

Evidence suggests that the haemodynamic status of critically ill patients can change minute-by-minute, and therefore require close nursing assessment and monitoring, specifically of their physiological state including the presence of pain (Romare et al., 2022). As the literature shows, relying on changes in vital signs as a primary indicator of pain can be misleading however, as these may also be attributed to underlying physiologic conditions, homeostatic changes, and medications (Schug et al., 2020). There was limited evidence that supports the use of vital signs as a single indicator of pain; however, both physiological and behavioural responses often increase temporarily with sudden onset of pain (Foster et al., 2003). Changes in physiological measures should be considered a cue to begin further assessment for pain or other stressors (Swift, 2018).

A patient's response to analgesia, sedation and the emergent critically illness/injury can be unpredictable; not only within and between patient populations, but also within a single hospital stay for an individual patient (Australian and New Zealand College of Anesthetists, 2014; Coté et al., 2009; Mehta et al., 2009; Rowe & Fletcher, 2008; The American Society of Anethesiologists, 2009). Hence, the challenge for emergency nurses in maintaining adequate analgesia suitable to the critically ill patient's needs and physiological tolerances also requires on-going assessment and monitoring (Shehabi et al., 2013). Further, to detect and optimise pain management, emergency nurses must use a systematic process with a reliable and valid pain assessment tool.

Theme 2: Pain assessment instruments

Management of acute pain is reliant on accurate assessment based on the self-report of patients, using a valid pain assessment instrument, clear documentation and frequent reassessment (Ducharme, 2011; Gordon et al., 2005; International Association for the Study of Pain, 2020; National Health and Medical Research Council, 2011). Within the adult ED setting, verbal pain intensity rating scales, such as the Verbal Descriptor Scale and Verbal Rating Scale, are commonly used to assess and monitor pain severity (Gerdtz et al., 2007; National Health and Medical Research Council, 2011; NSW Health, 2011).

The Verbal Descriptor Scale (VDS), first devised by Keele (1948), is also known as the Verbal Rating Scale, and was one of the earliest pain instrument measures used in practice. The instrument scale consists of a list of adjectives used to denote increasing pain intensities, such as 'no pain' and 'worst possible pain'. Each adjective can be assigned a number by a patient; standardising communication between clinicians in deciding the efficacy of analgesia. Patients are instructed to indicate by pointing or choosing one of the adjectives that best represents their pain.

For a verbalising patient, validity and reliability of the VRS has been evaluated across three studies with 280 adult participants (patients n=240, non-patients n=40) under varying conditions that included perceived physical pain, auditory and optical (light) evoked nociception (Brunelli et al., 2010; Lara-Muñoz et al., 2004; Ponce de Leon et al., 2004). Moderate to high interrater reliability coefficients were found (κ=0.53-0.77 and κ_w=0.71). For validity, high correlation coefficients were reported on comparing VDS to Numerical Rating Scale (NRS) (r=0.902, ICC 0.796; p=<.001). However 25% of ratings were unable to discriminate between background and acute exacerbations in pain.

Many ED clinicians prefer to assess pain using the Numerical Rating Scale (NRS) in contrast to the VRS. Downie (1978) was the first to describe the NRS, which consists of a demarcated line orientated vertically or horizontally and numbered 0 to 10, that can be used for both adults and children (aged six years and above). Patients verbally rate their pain on a scale of 0 to 10, where 0 means no pain present and 10 means most pain present or point to a number that best represents their intensity of pain.

Reliability and validity of the NRS has been evaluated across four studies involving 1,018 participants (patients n=978, non-patients n=40) under varying conditions that included perceived physical pain, auditory and optical (light) evoked nociception (Ahlers et al., 2008; Brunelli et al., 2010; Lara-Muñoz et al., 2004; Ponce de Leon et al., 2004). Moderate to high Interrater coefficients were found (κ_w=0.63 and κ=0.71-0.86). On validity testing, a moderate to high positive correlation (ρ=0.55-0.895; p<.001) was noted when comparing NRS scores to Nonverbal Behavioural Pain Scale (BPS) scores in responsive patients (n=75; 66.4%). The level of agreement within one scale point between the NRS rated by the patient and the NRS scored by the attending nurses was 73%. Of note though, high patient scores (NRS ≥4) were underestimated by nurses when compared to patient self-report (patients, 33% versus nurses 18%). Further, the NRS may exhibit different psychometric properties depending on the body area to which it is applied, as discrimination was reported to be low (U=0.5, 95% CI 0.4. to 0.7) (Saltychev et al., 2016).

The VRS and NRS have several practical advantages, which include measures of pain being based upon patient self-report, ease and quickness of administration whether in written or verbal form and easy adaptation to support other language users. A number of limitations are also noted. Reliability and validity testing has been minimal including limited evaluation of instrument responsivity (Bosdet et al., 2021; Brunelli et al., 2010), that is the ability of an instrument to detect clinically important changes, or examination of instrument clinical feasibility or utility. Further, non-weighted coefficient measures were used in the studies, despite the scales being ordinal (Rubin, 2009), which may have misrepresented the degree of interrater reliability. While current evidence supports the use of NVR and VRS in patient groups able to communicate the intensity of pain being experienced, obtaining a report of pain from critically ill patients may be hampered by the presence of an endotracheal tube, decreased level of consciousness, delirium, cognitive impairment (Neville & Ostini, 2014), communication limitations, parenteral sedatives, and potentially neuromuscular blocking agents (Ahlers et al., 2008). Therefore, the use of either the VDS or NRS in the critically ill patient for the assessment of pain, may result in suboptimal care and detection of pain.

Pain management is an essential component for delivering quality care to critically ill patients and in particular for those unable to verbally communicate. To understand and quantify the presence of pain in critically ill intubated patients, Fordyce (1976) argued that pain should be analysed as behaviour; a concept that forms the basis of non-verbal pain intensity assessment instruments. The use of an appropriate and valid observational pain assessment instrument is fundamental to detecting and optimising pain management in nonverbal critically ill intubated patients in the ED (Mularski, 2004; Payen et al., 2001).

Assessing and monitoring pain in intubated critically ill patients is challenging. Critically ill intubated patients are commonly unable to verbally report pain due to altered oral communication (e.g. endotracheal intubation) and/or altered levels of consciousness (e.g. sedation, delirium), placing them at great risk of inadequate pain management (Jacobi et al., 2002; Puntillo et al., 2004; Puntillo et al., 2009; Varndell et al., 2015a). In the absence of self-reporting, pain behaviours such as facial grimacing, crying and ventilator compliance form the basis for identifying and evaluating a patient's degree of pain (Herr et al., 2011).

A total of 34 studies examining pain instruments were identified from a wide range of countries or regions: USA (n=11); Canada (n=8); Netherlands (n=3); Spain (n=2); South America (n=2); and single studies from Australia, France, Iran, India, North Africa, Sweden, Switzerland, and Taiwan. Six nonverbal pain assessment instruments were evaluated: the Behavioural Indicators of Pain Scale (BIPS), Behavioural Pain Scale (BPS); Critical Care Pain Observation Tool (CPOT); Faces, Legs, Activity, Cry and Consolability Scale (FLACC); Pain Assessment in Advanced Dementia (PAINAD); and Nonverbal Pain Scale (NVPS). Compared to verbal pain assessment instruments discussed earlier, nonverbal observational pain assessment instruments commonly measure facial expression, body movement and posturing, crying and patient compliance with mechanical ventilation when detecting the presence and intensity of pain. Four nonverbal pain assessment instruments (BIPS, CPOT, FLACC and PAINAD) also include verbal response and tone of speech. Importantly, the review identified that none have been evaluated in an ED setting (Table 3.2).

Table 3.2: Dimensions, domains and item weighting of observational pain assessment instruments

Instrument	Total items, scoring method	Behavioural dimension, domains (item weighting)					
		Facial expression	Body movement	Body posture	Verbal response	Ventilator compliance	Other
BIPS	Items: 15 Item weighting: 0 to 2 Total score: 3 (painless) to 12 (severe pain)	Relax (0) Tense, frowning/grimacing (1) Regularly frowning/clenched jaw (2)	*Calmness* Clam, relaxed, normal movements (0) Occasional restless movement, shifting position (1) Frequent movement, including head or limbs (2)	*Muscle tone* Normal (0) Increased. Flexion of fingers and/or toes (1) Rigid (2)		Tolerates MV (0) Coughs, however tolerates MV (1) Fights with respirator (2)	*Consolability* Comfortable, quiet (0) Reassured by touch or talk, distractable (1) Difficulty to comfort by touch or talking (2)
BPS	Items: 12 Item weighting: 1 to 4 Total score: 3 (no pain present) to 12 (most pain present)	Relaxed (1) Partially tightened (2) Fully tightened (3) Grimacing (4)	*Upper limb* No movement (1) Partially bent (2) Fully bent with finger flexion (3) Permanently retracted (4)			Tolerating movement (1) Coughing but tolerating ventilation most of the time (2) Fighting ventilator (3) Unable to control ventilation (4)	

Instrument	Total items, scoring method	Behavioural dimension, domains (item weighting)					
		Facial expression	Body movement	Body posture	Verbal response	Ventilator compliance	Other
CPOT	Items: 15 Item weighting: 0 to 2 Total score: 0 (no pain present) to 8 (most pain present).	Relaxed, neutral (0) Tense (1) Grimacing (2)	Absence of movements (0) Protection (1) Restlessness (2)	Relaxed (0) Tense, rigid (1) Very tense or rigid (2)	Talking in normal tone or no sound (0) Sighing, moaning (1) Crying out, sobbing (2)	Tolerating ventilator or movement (0) Coughing but tolerating (1) Fighting ventilator (2)	
FLACC	Items: 15 Item weighting: 0 to 2 Total score: 0 (no pain present) to 10 (most pain present).	No particular expression or smile (0) Occasional grimace or frown, withdrawn, disinterested (1) Frequent to constant quivering chin, clenched jaw (2)	*Legs* Normal position or relaxed (0) Uneasy, restless, tense (1) Kicking, or legs drawn up (2)	Lying quietly, normal position, moves easily (0) Squirming, shifting back and forth, tense (1) Arched, rigid or jerking (2)	*Cry* No cry - awake or asleep (0) Moans or whimpers, occasional complaint (1) Crying steadily, screams or sobs, frequent complaints (2)		*Consolability* Content, relaxed (0) Reassured by occasional touching, hugging or being talked to, distractible (1) Difficult to console or comfort (2)

Instrument	Total items, scoring method	Behavioural dimension, domains (item weighting)					
		Facial expression	Body movement	Body posture	Verbal response	Ventilator compliance	Other
PAINAD	Items: 12 Item weighting: 0 to 2 Total score: 0 (no pain present) to 10 (most pain present).	Smiling, or inexpressive (0) Sad, frightened, frown (1) Facial grimacing (2)		Relaxed (0) Tense, distressed, pacing, fidgeting (1) Rigid, fists clenched, knees pulled up, pulling or pushing away, striking out (2)	None (0) Occasional moan or groan, low level speech with a negative or disapproving quality (1) Repeated troubled, calling out, loud moaning or groaning, crying (2)		*Breathing* Normal (0) Occasional laboured breathing, short period of hyperventilation (1) Noisy laboured breathing, long period of hyperventilation, Cheyne-stokes respiration (2)

Instrument	Total items, scoring method	Behavioural dimension, domains (item weighting)					
		Facial expression	Body movement	Body posture	Verbal response	Ventilator compliance	Other
NVPS	Items: 15 Item weighting: 0 to 2 Total score: 0 (no pain present) to 10 (most pain present).	No particular expression or smile (0) Occasional grimace, tearing, frowning, wrinkled forehead (1) Frequent grimacing, tearing, frowning, wrinkled forehead (2)	Lying quietly, normal position (0) Seeking attention through movement or slow, cautious movement (1) Restless, excessive activity and/or withdrawal reflexes (2)	Lying quietly, no posturing or hands over areas of body (0) Splinting areas of the body, tense (1) Rigid, stiff (2)			*Physiologic I* Stable vital signs (no change in past 4hrs) (0) Change over past 4hrs in any of the following: SBP >20mmHg, HR >20/min, RR>10/min (1) Change over past 4hrs in any of the following: SBP>30/mmHg, HR >25/min, RR>20/min (2) *Physiologic II* Warm, dry skin (0) Dilated pupils, perspiring, flushing (1) Diaphoretic, pallor (2)

Key: HR, heart rate; MV, mechanical ventilation; SBP, systolic blood pressure

Overall, methodological quality of the studies examining behavioural pain assessment instruments was fair to high (median 11, range 7-12), with convenience sampling methods deemed to be appropriate. The majority of studies (n=30; 88.2%) provided a detailed description of the order and type of patient stimulation, including duration of assessment. Assessments were mostly (n=25; 73.5%) performed by trained independent assessors. Potential confounders were patient depth of sedation and degree of delirium. Ten (29.4%) studies measured depth of sedation at the time of assessing pain response (Ahlers et al., 2008; Aïssaoui et al., 2005; Chen et al., 2011; Damström et al., 2011; Gélinas & Johnston, 2007; Juarez et al., 2010; Morete et al., 2014; Payen et al., 2001; Rijkenberg et al., 2015; Young et al., 2006). Depth of sedation and pain response was only measured in one study (Aïssaoui et al., 2005), and was found to have a moderate negative correlation (r=.432; p<.001). Only one study assessed for delirium, but did not explore it as a potential confounder on pain assessment (Rijkenberg et al., 2015).

All instruments were tested for validity, although there was limited evidence of responsiveness testing (Ahlers et al., 2010; Aïssaoui et al., 2005; Azevedo-Santos et al., 2016). Eight studies examined convergent validity, comparing the test instrument to BPS (Chanques et al., 2014; Gomarverdi et al., 2019; Juarez et al., 2010; Latorre-Marco et al., 2016), NVPS (Odhner et al., 2003), CPOT (Paulson-Conger et al., 2011), and one study compared change in pain score following administration of analgesia (Voepel-Lewis et al., 2010). Seven studies examined concurrent validity by comparing scores with patient self-reports of pain (Chen et al., 2011; Damström et al., 2011; Gélinas et al., 2006; Gélinas et al., 2009; Gélinas & Johnston, 2007; Topolovec-Vranic et al., 2010; Topolovec-Vranic et al., 2013) (Table 3.3).

Table 3.3: Summary of validity testing of observational pain assessment instruments

Instrument	Validity testing Concurrent	Criterion	Construct	Convergent	Discriminant
BIPS	None	None	None	BPS r=.94-.99[Ac]	Changes in mean score varied over time (*p<.001*)
BPS	None	None	Change in mean score, from rest to non-painful stimuli, 3.0 to 3.3[t]; rest to painful procedure, 3.36 to 5.02[c]; overall t=2.28[e]	VRS r=.67[b], NVPS ρ=.69-.77[l] CPOT r=.85-.97[Ab]	Change in mean scores between painful procedures 4.6 to 5.2[t]; between rest and non-painful procedures, 3.23[z] to 3.7[t]; lightly sedated, (RASS -2 to 0) 3.0 to 4.5[u] Change in mean scores between rest and painful procedure, deeply sedated (RASS -5 to -3) 3.0 to 6.8[u], t= -9.07[h]; conscious sedated 3.3 to 3.4[b], and when intubated t= -12.07[h] or extubated t= -15.96[h]; overall change, 3.0[u] to 5.1[b] Changes in mean score in intubated patients, increased pain condition was r=.71, with low pain condition r=.57[Ae] Changes in mean score in non-intubated patients, increased pain condition was r=.83, with low pain condition r=.76[Ae]
CPOT	Correlation with patients self-	Change in mean score, pre-procedure, 0.27;	Change in mean score, at rest σ=.49[f], during procedure σ=.50[f], at	BPS r=.85-.97[Ab] PAINAD r=.86[s]	Change in physiological indicators (blood pressure) *F*=59.36 – 8.34[g]

Instrument	Validity testing: Concurrent	Criterion	Construct	Convergent	Discriminant
	reporting pain, r=.71[g], σ=.435[w]	during procedure, 1.93; and post procedure 0.10[x] CPOT ≥3 AUC=.83[Ag]	recovery σ=.40[f]; change in MAP ρ=.32-.45[f] Change in mean score by domain: - before vs. during procedure: facial expression, 0.10-0.80; body movements, 0.04-0.43; muscle tension 0.08-0.34; compliance with ventilator, 0.04-0.37[x] - During vs. after procedure: facial expression, 0.80-0.05; body movements, 0.43-0.01; muscle tension, 0.34-0.04; compliance with ventilator 0.37-0.01[x] - Before vs. after procedure: facial		Change in median score by domain, at rest to painful procedure, 0.0-3.0[u]; rest to non-painful procedure, 0.0-2.0[u] Change in mean scores between rest and painful procedure, deeply sedated (RASS -5 to -3), rest to painful procedure 0.0-2.0[u]; and lightly sedated (RASS -2 to 0) 0.0-1.5[u] Change in mean score from baseline to painful procedure 2.22±0.28[aa] to 3.13±1.56[n]; Cohen D 2.0[n] Change in mean score from baseline to non-painful procedure 0.95±0.19[Aa] Sensitivity 39%, specificity 85%[Af]

Instrument	Validity testing: Concurrent	Criterion	Construct	Convergent	Discriminant
			expression, 0.10-0.05; body movements, 0.11-0.05; muscle tension, 0.08-0.04; compliance with ventilator, 0.27-0.10[x] Increase in mean score during dressing change and turning, +2.80 (95% CI 1.84-3.75)[o]		
FLACC	None	None	Change in mean score post analgesia, 5.27 (SD 2.3) vs. 0.52 (SD 1.1)[y]	NVPS r=.86[r]	None
PAINAD	None	None	None	CPOT r=.86[s] FLACC τ=.29[Ah]	Following movement z= -8.01[Ah]
NVPS	Correlation with patients self-reporting pain, σ=.435[v]		Change in mean score, before, during and after painful procedure, F= 135.86[m]	NRS r=.86[r] BPS ρ=0.69 - 0.77[l]	Related measures (ANOVA); non-communicative, turning F=5.32[w] Change in mean score from baseline to procedure in line with BPS and CPOT[d], and 10mins post procedure, nil difference noted score[d]

Instrument	Validity testing: Concurrent	Criterion	Construct	Convergent	Discriminant
			Change in mean score from rest to procedure, 5.41[l]		

Key: GCS, Glasgow Coma Scale; MAP, Mean Arterial Pressure; RASS, Richmond Agitation and Sedation Scale.

Legend

a	Ahlers et al. (2008)	m	Kabes, et al. (2009)	y	Voepel-Lewis et al. (2010)
b	Ahlers et al. (2010)	n	Kanji et al. (2016)	z	Young et al. (2006)
c	Aïssaoui et al. (2005)	o	Linde et al. (2013)	Aa	Nazari et al. (2022)
d	Chanques et al. (2014)	p	Marmo et al. (2010)	Ab	Gomarverdi et al. (2019)
e	Chen et al. (2011)	q	Morete et al. (2014)	Ac	Latorre-Marco et al. (2016)
f	Damström et al. (2011)	r	Odhner et al. (2003)	Ad	Azevedo-Santos et al. (2016)
g	Gélinas & Johnston (2007)	s	Paulson-Conger et al. (2011)	Ae	Chen et al. (2019)
h	Gélinas et al. (2006)	t	Payen et al. (2001)	Af	Stilma et al. (2019)
i	Gélinas et al. (2009)	u	Rijkenberg et al. (2015)	Ag	Frandsen et al. (2016)
j	Gélinas et al. (2010)	v	Topolovec-Vranic et al. (2013)	Ah	Dunford et al. (2022)
k	Gélinas et al. (2011)	w	Topolovec-Vranic et al. (2010)		
l	Juarez et al. (2010)	x	Vazquez et al. (2011)		

Reliability testing was conducted for all instruments, with limited evidence of acceptability testing noted (Gélinas et al., 2011; Odhner et al., 2003; Payen et al., 2001; Topolovec-Vranic et al., 2010). Acceptability and psychometric analysis found several weaknesses across the majority (n=22; 65%) of studies (Ahlers et al., 2010; Aïssaoui et al., 2005; Chanques et al., 2014; Chen et al., 2011; Damström et al., 2011; Gélinas et al., 2009; Gélinas & Johnston, 2007; Kabes et al., 2009; Linde et al., 2013; Marmo & Fowler, 2010; Odhner et al., 2003; Payen et al., 2001; Rijkenberg et al., 2015; Topolovec-Vranic et al., 2010; Topolovec-Vranic et al., 2013; Vazquez et al., 2011; Voepel-Lewis et al., 2010; Young et al., 2006) related to convenience sampling, small sample size and low number of item-to-subject (i.e. patient) ratio assessments; which limited generalisability of the instruments. Within the psychometric instrument literature, a sample size of 100 to 200 is recommended (Anthoine et al., 2014; Bollen, 1989). Further, an item-to-subject ratio of 1:10 is recommended for future testing of instruments (Schwab, 1980).

Of the six observational pain assessment instruments examined, only three (BPS, CPOT and PAINAD) were evaluated with adequate sample sizes and item-to-subject ratios (Aïssaoui et al., 2005; Damström et al., 2011; Gélinas & Johnston, 2007; Morete et al., 2014; Rijkenberg et al., 2015). Of these, the CPOT has had the most extensive testing for validity and reliability (Chanques et al., 2014; Damström et al., 2011; Gélinas et al., 2011; Gélinas et al., 2006; Gélinas et al., 2009; Gélinas & Johnston, 2007; Kanji et al., 2016; Linde et al., 2013; Marmo & Fowler, 2010; Paulson-Conger et al., 2011; Rijkenberg et al., 2015; Topolovec-Vranic et al., 2013; Vazquez et al., 2011) and feasibility (Gélinas, 2010; Gélinas et al., 2011; Topolovec-Vranic et al., 2013). The CPOT has also been tested against the BPS, NVPS and PAINAD (Chanques et al., 2014; Gomarverdi et al., 2019; Kontou et al., 2023; Paulson-Conger et al., 2011) and the recommended gold standard, patient self-report (Odhner et al., 2003). Further, unlike the BPS and NVPS, the CPOT has been tested in both verbal and nonverbal patient populations, including patients with delirium; this potentially broadens the instrument's use within the ED setting (Table 3.4).

Table 3.4: Summary of reliability testing, acceptability and responsiveness of observational pain assessment instruments

	Reliability			
Instrument	Internal consistency	Inter-rater agreement	**Acceptability**	**Responsiveness**
BIPS	Overall, Cronbach-α=85[Ac] Domains: facial expression, α=.87; calmness, α=.84; muscle tone, α=.80; and, consolability, α=.85[Ac] Reduced internal consistency when RASS -5 (unrousable), α=.63	No statistical differences reported (*p<.001*)	None	None
BPS	Overall, Cronbach-α=.501[q] - .94[t] Intubated patients, Cronbach-α=.81[t] Non-intubated patients, Cronbach-α =.83[t]	Overall, κ=.67[a]-.83[z]; ICC=.74[u] - .95[c]; at rest, r^2=.71; during procedure, r^2=.50 Domains (deeply sedated), total score, κ=.83; facial expression, κ =.80; upper limb movements, κ=.72; and ventilator compliance, κ=.62 Domains (conscious), total score, K=.80; facial expression, κ=.78; upper limb movements, κ =.67; and ventilator compliance, κ=.61 During non-painful procedure Lin's ρ=.74, during painful procedure Lin's ρ=.88[Aa] Domains (non-painful procedure): facial expression, κ=.63; upper limb movements, κ=.64; ventilator compliance, κ=.83[Aa]	Satisfaction survey, 85.7% (24/28) were satisfied or very satisfied with ease of use; 25% (7/28) concerned about relative complexity of the BPS; 89.3% (25/28) considered BPS effective in assessing pain[c]	Effect size, total score, 2.2-3.4[c] Effect size, sedated vs. conscious sedated, total score (2.5-1.8), facial expression (3.6-2.4), ventilator compliance (1.4-0.9) and upper limb movement (0.7-0.5)[b] Responsiveness coefficient 1.72[Ad]

Instrument	**Reliability** Internal consistency	Inter-rater agreement	**Acceptability**	**Responsiveness**
		Domains (painful procedure): facial expression, κ=.61; upper limb movements, κ=.60; ventilator compliance, κ=.43[Aa]		
CPOT	Overall, Cronbach-α =.56[f]-.93[Ae]; painful stimuli, Cronbach-α =.31-.81; non-painful procedure, Cronbach-α =.56-.72[f]	Overall, κ_w=.52-.88[h]; ICC=.60-.97[v]; *r*=.957[n]; K=.79-1.0[x] Overall, during non-painful procedure Lin's ρ=.67, during painful procedure Lin's ρ=.62[Aa] Domains (non-painful procedure): facial expression, κ=.46; upper limb movements, κ=.64; ventilator compliance, κ=.60[Aa] Domains (painful procedure): facial expression, κ=.35; upper limb movements, κ=.38; ventilator compliance, κ=.24[Aa]	Feasibility, 78.8-100%; utility, 54.5-72.7%[i] At 3- and 12-month post-implementation, increased documentation of pain assessment, (U=298.00; *p*=.97); decreased administration of sedation (H=10.29; p<.05); analgesia boluses decreased (H=5.84); decreased CPOT (≥2) score post-implementation, over 75% of pharmacological interventions documented as effective at (U=106.00; *p*=.43), with less behavioural indicators documented implementation of CPOT[k]	None
FLACC	Overall, Cronbach-α =.84[r]-.882[y]	Each category highly correlated with the others (ρ=.69-.92) expect the cry category (ρ=.18-.36). Cronbach-α improved to .934 when cry category removed[r]	FLACC cry and consolability often marked 'not applicable' (62 and 16 times respectively)[r]	None

Instrument	**Reliability** Internal consistency	Inter-rater agreement	**Acceptability**	**Responsiveness**
		Domains, total score, κ=.98; face, κ=.93; Legs, κ=.97; Activity, κ=.93; Cry, κ=.72; Consolability, κ=.96[r]		
PAINAD	Overall, Cronbach-α =.76[Ah]- 80[s]	Test-retest, at rest ICC=.92, on movement ICC.98[Ah]	None	None
NVPS	Overall, Cronbach-α =.75l-.89[p]	Overall, K=.71[a]; ICC=.34-.97[w]	10 completed questionnaires, comparing CPOT to NVPS; feasibility sufficiently to very, 49% vs. 47%; applicability, sufficiently to very, 18% vs. 7%[w]	None
	Before stimulus, Cronbach-α =.36; during, Cronbach-α =.62; after, Cronbach-α =.62[m]	Domains, face, $κ_w$=.70; respiration, $κ_w$=.52; activity, $κ_w$=.52; guarding, $κ_w$=.32; physiology I, $κ_w$=45; and physiology II, $κ_w$=.02[d]		
	Intubated patients, Cronbach-α =.82; non-intubated patients, Cronbach-α =.81[d]			

Legend

a	Ahlers et al. (2008)	m	Kabes, et al. (2009)	y	Voepel-Lewis et al. (2010)
b	Ahlers et al. (2010)	n	Kanji et al. (2016)	z	Young et al. (2006)
c	Aïssaoui et al. (2005)	o	Linde et al. (2013)	Aa	Nazari et al. (2022)
d	Chanques et al. (2014)	p	Marmo et al. (2010)	Ab	Gomarverdi et al. (2019)
e	Chen et al. (2011)	q	Morete et al. (2014)	Ac	Latorre-Marco et al. (2016)
f	Damström et al. (2011)	r	Odhner et al. (2003)	Ad	Azevedo-Santos et al. (2016)
g	Gélinas & Johnston (2007)	s	Paulson-Conger et al. (2011)	Ae	Chen et al. (2019)
h	Gélinas et al. (2006)	t	Payen et al. (2001)	Af	Stilma et al. (2019)
i	Gélinas et al. (2009)	u	Rijkenberg et al. (2015)	Ag	Frandsen et al. (2016)
j	Gélinas et al. (2010)	v	Topolovec-Vranic et al. (2013)	Ah	Dunford et al. (2022)
k	Gélinas et al. (2011)	w	Topolovec-Vranic et al. (2010)		
l	Juarez et al. (2010)	x	Vazquez et al. (2011)		

As noted earlier, use of an appropriate and valid observational pain assessment instrument is fundamental to detecting and optimising pain management in nonverbal critically ill intubated patients in the ED. Of the observational pain assessment instruments reviewed, none were tested in an ED setting.

Theme 3: Nurse-initiated pain management in the emergency department

Timely and effective management of acute pain remains one of the greatest challenges for EDs worldwide, and is recognised globally as an important quality of care indicator (Australasian College for Emergency Medicine, 2009; National Health and Medical Research Council, 2011; Schug et al., 2020). The frequency with which acute pain is the impetus for attending ED (78% - 86%), the significance of pain to patients and their family (Wells et al., 2008), and the relative ease with which pain can often be ameliorated (Fry et al., 2011; Gawthorne et al., 2021; Woolner et al., 2020), render analgesia a prime and achievable target for optimisation of a patient care. Emergency nurse-initiated interventions were developed to decrease delay in providing treatment, with one of the key strategies a focus on pain relief. Traditionally, patients in pain had to wait until they were assessed by a physician and subsequently prescribed an analgesic, and a nurse would then administer the prescribed medication. This process has however been found to contribute to significant analgesic delay (Arendts & Fry, 2006). Increasingly, this traditional medical driven model of assessing and treating pain in ED was being viewed as suboptimal (Bernstein et al., 2009). Given that nurses were undertaking pain assessment, patient observations and providing care delivery throughout the patients' stay in ED, new models of care were being considered. Emergency nurses were well placed to respond to patients' needs such as pain, in a more timely manner (Varndell et al., 2020).

Across Australia the introduction of medication standing orders, such as nurse-initiated analgesia, have been one of the most important strategies implemented in EDs to facilitate timely care, and early symptom management (Elder et al., 2015; Fry et al., 2011). Medication standing orders, often in the form of policies or protocols, permit nurses under specific circumstances to initiate medication based on their clinical judgement, without an authorised prescriber's order (Fry et al., 2011). Since their earlier adoption of nurse-initiated narcotic protocols established in post-anaesthetic care in South Australia (Coman & Kelly, 1999), there use has expanded. As a result, emergency nurses no longer have to wait for a physician's assessment and instead can initiate patient analgesics; a process that has reduced significant delay in pain relief and minimised human suffering (Bernstein et al., 2009). Building on an earlier systematic review on the impact of nurse-initiated analgesia (NIA) in adult patients presenting to the ED in acute pain (Varndell et al., 2020), 16 relevant studies were identified published from a wide range of countries that included Australia (n=6), USA (n=3), Brazil (n=1), Canada (n=1), Hong Kong (n=1), Iran, (n=1), Italy (n=1), the Netherlands (n=1) and Sweden (n=1). The type of analgesics able to be initiated by emergency nurses varied, but commonly (n=19; 47.7%) included opioids such as morphine (Table 3.5).

Table 3.5: Characteristics of included studies in the systematic review

Author, country	Design	Sample, indication	Nurse-initiated analgesia
Fry & Holgate (2002), Australia	P	N=349, pain rated VAS ≥5	Morphine
Fry, Ryan et al. (2004), Australia	P	N=202, mild to moderate pain	Combination paracetamol and codeine
Kelly, Brumby et al. (2005), Australia	R	N=58, suspected renal colic	Morphine
Fosnocht & Swanson (2007), USA	B/A	N=583, isolated limb or back pain	Morphine, combination paracetamol and hydrocodone and ibuprofen
Goh, Choo et al. (2007), Hong Kong	P	N=209, isolated limb injury or inflammatory condition, pain rated NRS ≥5	Ketorolac
Fry, Bennetts et al. (2011), Australia	R	N= 2,066, patients presenting with pain, any cause	Opioids, nitrous oxide, paracetamol and ibuprofen
Muntlin, Carlsson et al. (2011), Sweden	QE	N=150, atraumatic abdominal pain <48h	Morphine
Finn, Rae, et al. (2012), Australia	RCT	N=889, patients presenting with pain, any cause	Morphine, oxycodone, combination ibuprofen and codeine, combination paracetamol and codeine, paracetamol and ibuprofen
Tanabe, Hafner et al. (2012), USA	P	N=155, sickle cell disease	Hydromorphone, morphine, pethidine, hydrocodone and oxycodone
Seyedhossein, Doroudgaret et al. (2014), Iran	RCT	N=318, onset of pain <6h, no analgesia taken	Morphine
Barksdale, Hackman et al. (2016), USA	R	N=1002, non-urgent back-pain, dental pain, limb injury, sore throat, ear pain or pain due to abscess	Oxycodone, paracetamol and ibuprofen

Author, country	Design	Sample, indication	Nurse-initiated analgesia
Pierik, Berben et al. (2016), Netherlands	B/A	N=660, isolated musculoskeletal limb injury	Morphine, fentanyl, midazolam, esketamin (ketamine analogue), tramadol, diclofenac, ibuprofen and paracetamol
Viglino et al. (2019), Italy	P	N=200, pain rated NRS≥4	Paracetamol, oxycodone and methoxyflurane
Woolner et al. (2020), Canada	P	N=560, presenting with pain at triage	Paracetamol, ibuprofen
Gawthorne et al. (2021), Australia	CS	N=72 (by nurses), confirmed fractured neck of femur	Ropivacaine
dos Santos et al. (2021), Brazil	CS	N=185, triaged as semi-urgent with pain	Paracetamol, metamizole

Key: B/A, before and after study design; CS, cohort study; QE, quasi-experimental; RCT, randomised controlled trial; R, retrospective study; P, prospective study.

Overall, the methodological quality of the studies included was high (mean 9.3, range 8-11). Convenience sampling methods were judged to be appropriate, with suitable inclusion and exclusion criteria stated. All studies described the NIA protocol and the inclusion and exclusion criteria used; most (n=10; 62.5%) provided information regarding nurse training in the use of the protocol (Barksdale et al., 2016; dos Santos et al., 2021; Finn et al., 2012; Fosnocht & Swanson, 2007; Fry et al., 2011; Fry & Holdgate, 2002; Fry et al., 2004; Gawthorne et al., 2021; Goh et al., 2007; Kelly et al., 2005; Muntlin et al., 2011; Viglino et al., 2019; Woolner et al., 2020), with two studies describing education provided to staff (Fry et al., 2011; Muntlin et al., 2011). Nine (56.3%) studies included a comparison group, typically as a before and after cohort (n=5; 45.6%). Common limitations concerned the identification and analysis of confounding factors. Potential confounders considered pertinent were the number and availability of emergency nurses able to initiate analgesia, effect of pre-hospital analgesia, age, and clinical urgency (i.e. triage category). Of the sixteen studies included, 6 (37.5%) reported the number of emergency nurses trained in the planned intervention, none reported the frequency of availability during the study (dos Santos et al., 2021; Fosnocht & Swanson, 2007; Fry & Holdgate, 2002; Gawthorne et al., 2021; Muntlin et al., 2011; Pierik et al., 2016). One study (9.1%) examined for correlation between triage category and NIA (Barksdale et al., 2016), one study (9.1%) examined age and gender in relation to time to analgesia (Finn et al., 2012), and one (9.1%) study examined pre-hospital administration and impact of NIA (Fosnocht & Swanson, 2007).

The introduction of NIA has impacted the quality of care provided in the ED setting. When NIA protocols are used, patients were five times more likely (SE 4.7) to receive analgesia, often (66.7%) within 40 minutes (overall, 35.8, range 1.8 – 72 minutes) of presenting to ED (Finn et al., 2012; Fosnocht & Swanson, 2007; Fry & Holdgate, 2002; Fry et al., 2004; Gawthorne et al., 2021; Goh et al., 2007; Kelly et al., 2005; Pierik et al., 2016; Seyedhossein et al., 2014). While the majority (n=10; 62.5%) of protocols allowed for a single dose of an analgesic to be administered by an emergency nurse, patients reported significant reduction in pain intensity (dos Santos et al., 2021; Finn et al., 2012; Fosnocht & Swanson, 2007; Fry & Holdgate, 2002; Fry et al., 2004; Gawthorne et al., 2021; Muntlin et al., 2011; Pierik et al., 2016; Seyedhossein et al., 2014; Tanabe et al., 2012). NIA appears to be safe, with an overall low frequency of adverse events (4.0-4.3%) and lack of serious outcomes reported (dos Santos et al., 2021; Finn et al., 2012; Fry & Holdgate, 2002; Gawthorne et al., 2021; Viglino et al., 2019; Woolner et al., 2020).

While NIA protocols promote a more effective and efficient process in the management of patients' pain by allowing emergency nurses to administer pain relief to patients experiencing acute pain, the quality of pain management begins with effective assessment of pain. As previously discussed, international guidelines recommend pain must be adequately assessed in all patients, with appropriate and timely analgesia provided at the point of assessment (Australasian College for Emergency Medicine, 2009; Schug et al., 2020). Despite best practice guidance, timely effective pain management remains low, suggesting barriers to care are present (Sampson et al., 2020).

Theme 4: Barriers to pain management in the Emergency Department

Knowledge and clinical practice, when not based on solid scientific evidence, is known to lead to the development of negative attitudes or poor decision-making in pain management (McNamara et al., 2012). The researcher extracted data from 143 articles that included country of origin, study method, sample size and context, findings and limitations. Included studies were largely (n=77, 54%) qualitative, with three literature reviews (Forero & Hillman, 2008; Thompson et al., 2018; Truchot et al., 2022). Overall, the methodological quality of the studies included was fair (mean 7.1, range 6-9). Common limitations were small sample size (Akbar et al., 2019; Bergman, 2012; Erkes et al., 2001), limited time spent observing (Gregory & Waterman, 2012), and limited validation of developed investigative tools (Coker et al., 2010). The findings from each study were categorised thematically under the following seven barriers: i) myths and misconceptions; ii) knowledge, attitudes and bias; iii) subjectivity; iv) communication; v) demographic and socioeconomic; vi) emergency department overcrowding; and, vii) workforce culture.

Barrier 1: Myths and misconceptions

As with most phenomena there are myths or misconceptions about pain, which have arisen out of an incomplete understanding of the concept, with close links to a clinician's professional training or background (Weiner, 2001). Despite the strong ethos and commitment of the nursing discipline to adequately treat pain (Butcher, 2005), there remains strong investment in myths about pain that ultimately lead to suboptimal assessment, estimation of intensity and treatment. Common myths within ED include: patients in pain will have elevated vital signs (Alspach, 1994), administering analgesia will interfere with obtaining an accurate diagnosis (Butcher, 2005; Duignan & Dunn, 2008), older patients do not require analgesia as they experience less pain (Howard et al., 2014; Wilder-Smith, 2005), opioid dependent patients require less analgesia than non-opioid dependent patients (Aebischer & Hanna, 2022; Laroche et al., 2012), if the patient can be distracted there is no pain, use of opioids leads to addiction, and sedated patients do not require analgesia because they do not experience pain (Batiha, 2014; Gallagher, 2004; Olszewski et al., 2014; Tracey & Morrison, 2013; Varndell et al., 2015c; Weiner, 2001). These myths and misconceptions may falsely guide clinical judgement and attitudes and lead to suboptimal management.

Barrier 2: Knowledge, attitudes and bias

Pain management is the responsibility of emergency nurses as they have the most interaction with patients, the quality of which depends on the knowledge of emergency nurses. Inadequate knowledge about pain and analgesia amongst clinicians is a significant barrier to optimal pain management. Education around pain management does not feature greatly in under graduate medical and nursing school programs (Tse & Ho, 2014a).

Limited knowledge combined with negative attitudes toward pain and its management may lead to inappropriate and inadequate pain management practices and stereotyping of patients (Duignan & Dunn, 2008). An early study by Heath (1998) examining Australian nurses' (n=42) attitudes and knowledge of pain management found that nurses tended not to believe patients' reports of severe pain, especially if the patients' body language did not correspond. Where patients were unable to verbalise, such as the critically ill intubated patient and where body language did not correspond with the patients reporting of pain, nurses administered less opioid analgesia. Of the nurses in the study, 69% (n=29) gave non-therapeutic doses whilst only 41% (n= 13) stated that they would give the maximum prescribed dose of analgesia. Heath concluded that when nurses are forced to make pain management choices and when the expressed pain did not correlate with body language, decisions were made based on personal attitudes, subjectivity and learned judgements pattern knowledge.

Conversely, patients exhibiting exuberant behaviour, for example rolling around on the floor, screaming, thumping the floor, who are knowledgeable about their condition, or considered to be or state that they use illegal drugs, are often negatively perceived as clock-watchers, drug-seekers, malingerers or attention seekers (Bennetts et al., 2012; D'Arcy, 2008; Duignan & Dunn, 2008). As noted above, health care providers also make conclusions regarding patients' pain experience from observable pain behaviours (Hirsh et al., 2015; Keefe, 2000). Unbiased assessment of pain (e.g., behaviours that reflect a person is experiencing pain) is essential because providers base decisions about patient's pain experience, in part, from observable behaviours (Keefe & Block, 1982). Individuals suffering from back pain commonly exhibit the following pain behaviours: guarded movement, bracing, rubbing, touching the painful area, grimacing, and sighing (Keefe et al., 1984). These behaviours can be readily assessed and are particularly advantageous when patients are unable to verbalise the presence of pain, such as intubated critically ill patients (Keefe, 2000). Interpretation of pain related body postures is a reliable and valid method of pain assessment (Merkle et al., 2020). For example, study results indicate that pain behaviours correlate with patients' ratings of pain among both clinicians and laypeople (Clark & Robinson, 2019). Furthermore, changes in observed behaviours correlate with changes in patient's ratings of pain (Alamam et al., 2019; Keefe & Block, 1982). Few studies were identified that examined the influence of pain-related body postures on pain management decisions for chronic pain patients; studies by Wandner et al. (2013) and Zhang et al. (2021) found that men were rated by laypeople as experiencing more pain than females exhibiting the same pain-related body postures. These findings however, have not yet been generalised to clinical settings. Consequently, research has yet to determine whether health care providers base pain management decisions, in part, on pain-related behaviours among patients with co-morbid psychological disorders.

The most extensive assessment of nurses' knowledge and attitudes toward pain that is comparable across multiple countries (Burns et al., 2010; Coleman et al., 2009; Matthews & Malcolm, 2007; Yildirim et al., 2008), was conducted using various translations of the Knowledge and Attitudes Regarding Pain Survey (Ferrell & McCaffery, 2014). The Knowledge and Attitudes Regarding Pain Survey (KASRP) is a 37-item questionnaire, containing 21 true or false items and 16 multiple-choice items.

In this literature review, a total of 30 studies were identified using KASRP to assess nurses' (n=11,255) knowledge and attitudes toward pain. Most studies were conducted in North America and Europe (n=8; 26.7%), with overall mean total scores ranging from 27.7% to 77.9%. The lowest scored topics were knowledge of pain management, pharmacology, use of NSAID medication, optimal route of administration for patients in prolonged pain and knowledge of drug addiction/dependency (Bernardi et al., 2007; Eid et al., 2014; Keefe & Wharrad, 2012; Kiekkas et al., 2015; Plaisance & Logan, 2006; Tse & Ho, 2014a; Yildirim et al., 2008). Years of experience, level of education and specific education in pain management were commonly associated with higher test scores, age, clinical area of practice in cross-sectional studies, ethnicity and personal experience of pain were infrequently associated with higher test scores (Admassie et al., 2022; Ahmadi et al., 2023; Al-Sayaghi et al., 2022; Alnajar et al., 2019; Alqahtani & Jones, 2015; Bernardi et al., 2007; Eid et al., 2014; Hadjisavva et al., 2021; Innab et al., 2022; Kahsay & Pitkäjärvi, 2019b; Keefe & Wharrad, 2012; Maribbay et al., 2022; Ou et al., 2021; Plaisance & Logan, 2006; Tse & Ho, 2014b; Utne et al., 2019; Voshell et al., 2013; Wang & Tsai, 2010). To date, no studies were identified examining Australian emergency nurses' knowledge and attitudes towards pain (Table 3.6).

Table 3.6: Summary of findings from Knowledge and Attitudes Survey Regarding Pain studies of nurses

Author, country	Participants, specialty	Overall score (%)	Findings
Ahmadi et al. (2023), Iran	398 emergency nurses	40.3	• Higher levels of appropriate attitude towards pain were seen in nurses with more 'work experience' (60.9%; r= -.168, *p*=.001). Conversely, older nurses (r= -.153, *p*=.002) and those highly educated (r= -.126, *p*=.005) had significantly more negative attitudes towards pain. • Physician's perception of patient's reported pain or nurse's opinion primary barrier to effective pain management.
Admassie et al. (2022), Ethiopia	153 emergency nurses	52.8	• Higher levels of knowledge and positive attitudes towards pain in those with one or more years of work experience (AOR 1.8, CI 1.2-3.3, *p*=.02) • Lowest scored items concerned opioid administration, with 59.9%, 40.5% and 25.5% answering peak effect time, duration of low dose morphine and equivalent dose of 10mg IV pethidine correctly.
Innab et al. (2022), Saudi Arabia	124 nurses	49.5	• Education level was significantly associated with higher mean scores (t=3.06, *p*=.01)

Author, country	Participants, specialty	Overall score (%)	Findings
Al-Sayaghi et al. (2022), Saudi Arabia	291 nurses • ED n=58 • Inpatient wards n=85 • Outpatient department n=44 • Critical care units n=104	45.3	• Nurses working in outpatient setting had higher pain knowledge compared to emergency nurses (49.6% vs. 43.7%) • High proportion (72%) of respondents agreed with using placebo to assess true presence of pain. • During vignettes, when pain behaviours present, respondents correctly judged the patient's pain level (43.6% vs. 26.8%). • 82.5% relied on changes in vital signs as an objective indicator for true pain. • Pharmacotherapy knowledge was poor (24%).
Maribbay et al. (2022), Saudi Arabia	282 nurses	37.1	• Highest reported barriers were staff shortage (76.2%), restricted opioids regulations (66.7%); and unavailable comfort measures as alternatives (59.9%). • Less than half (46.1%) of respondents agreed that the patient as the best judge of pain. • One in five respondents (23.0%) agreed that patients should experience discomfort prior to analgesia.
Li et al. (2021), China	982 oncology nurses	54.4	• Lowest correct scores were associated with pharmacology, equivalence in dose between opioids, and judging pain intensity with minimal behavioural features.
Hadjisavva et al. (2021), Cyprus	31 nurses	51.1	• Least correctly answered questions related to non-pharmacological interventions (6%), and duration of pethidine IM (10%). • Higher knowledge scores were observed in respondents with >10years of nursing experience (mean score 94.3%).

Author, country	Participants, specialty	Overall score (%)	Findings
Ou et al. (2021), China	4,668 nurses • Medical n=1,608 • Surgical n=1,410 • Paediatrics n=551 • Intensive care n=146 • Oncology n=94 • Other n=859	40.3	• Age and years of experience were statistically associated with higher mean scores (H=31.7 and H=26.4; *p*=.001). • Majority (92.8%) of respondents indicated they would withhold opioid analgesia until the source of the pain was identified. • Majority (83.6%) of respondents indicated that they would administer placebo (sterile water) to determine if the reported pain was real.
Utne et al. (2019), Norway	312 oncology nurses	75.0	• Workplace culture (b= -.80) and completion of a pain management course (b=2.24) showed a positive statistically significant impact in mean score (*p*=.01).
Alnajar et al. (2019), Saudi Arabia	135 oncology nurses	51.5	• Higher percentage of correct answered concerned dose modification (81.5%), combining analgesics (80.7%) and patient as best judge of pain (74.1%). • Least correctly answered questions related to use of opioids (23% - 31.9%).
Kahsay et al. (2019b), Eritrea	126 emergency nurses	49.5	• Respondents with bachelor level qualification had higher mean scores compared to those with certificate (14.25) and diploma (11.90) education. • Most correct items answered (>80%) were use and administration of opioids, sedation assessment and equal use dose between analgesics.
Perri et al. (2018), Canada	31 palliative care nurses	72.0	• Questions with the most frequent incorrect answers were related to the route of opioid administration (96.8%), the side effect of opioids (80.6%), and the safe dosages of paracetamol (80.6%).

Author, country	Participants, specialty	Overall score (%)	Findings
Kiekkas et al. (2015), Greece	182 nurses • Orthopaedic n=66 • Surgical n=57 • Neurosurgery n=25 • Obstetrics/Gynaecology n=19 • Ear, nose and throat n=15	45.4	• Most incorrectly answered questions concerned the use of analgesia, specifically opioids. • Higher scores were significantly associated with personal experience of postoperative pain (*p*=.002), level of education (*p*=.015).
Alqahtani & Jones (2015), Saudi Arabia	320 oncology nurses	45.1	• Mean scores varied significantly between group differences for nurses' nationality, training in pain management and participation in pain research; no differences were noted for age, gender or years of experience.
Moceri et al. (2014), USA	99 emergency nurses	76.0	• No significant difference in mean total scores by age, education level, years of nursing or ED experience (*p*>.05). • Knowledge about opioids and dosage varied significantly between group differences for education (*p*=.005). • Knowledge about drug addiction/dependency significantly varied between group differences for education (*p*=.005). • Only 44% scored pain correctly for vignette questions.

Author, country	Participants, specialty	Overall score (%)	Findings
Eid et al. (2014), Saudi Arabia	593 nurses • Medical n=208 • Surgical n=174 • Outpatient services n=104 • Other n=106	42.5	• Items with poorest responses were knowledge about addiction/dependence, opioid administration, and not administering morphine to patients that appeared asleep despite severe pain. • 64.2% of respondents underestimated pain in the smiling patient vignette, and only 4.7% administered the correct dose of morphine. • 43.2% of nurses in the second vignette of the patient lying quietly grimacing accepted the patients self-report of pain, yet only 14.6% administered the correct dose of morphine. • Significant variance in mean scores was noted on comparing respondents' clinical areas and nationalities *p*<.005. • No significant variation in mean scores was noted for age, level of qualification, pain management training or nursing experience *p*>.06.
Tse et al. (2014a), China	88 residential aged care nurses	31.6	• Lower scores concerned pain management knowledge, route of morphine administration for patients in severe pain, and use of NSAIDs in joint pain. • 84.8% of respondents stated they have insufficient knowledge and training in pain management. • 75% of respondents stated that they could not distinguish whether an elderly patient was in pain or not. • 50% of respondents stated that the role of nursing staff in pain management is to report it to the physician or administrative personnel.

Author, country	Participants, specialty	Overall score (%)	Findings
Voshell et al. (2013), USA	96 nursing faculty members	77.9	• Despite most respondents (72.9%) recalling being taught pain management, most (64.6%) were not taught any specific pain management guidelines, and largely (60.4%) felt inadequately prepared. • Continuing education on pain management commonly involved reading journal articles (78.1%), attended meetings (44.8%) or reading a book (44%). • Age, level of education, years of teaching, years of experience and pain management education positively correlated with higher test scores (*p*<.01).
Duke et al. (2013), USA	162 participants • Nursing students n=146 • Faculty n=16	Students 68.0 Faculty 71.0	• Faculty scored slightly higher than students. • Pain scores varied between groups when rating two case vignettes: patient smiling and talking versus lying quietly and grimacing (*p*<.05). • No significance on analysis of variance for age, gender, ethnicity or personal experience of pain, intension to treat and mean score was found (*p*>.05).
Al-Khawaldeh et al. (2013), Saudi Arabia	240 baccalaureate nursing students	34.1	• Significant differences were found between student scores for pain management training and frequency of using a pain assessment tool *p*=<.005. • Frequently identified barriers identified were lack of knowledge and training regarding pain management, followed by not using a pain assessment tool.
Jarrett et al. (2013), USA	206 acute care nurses	27.7	• No analyses reported.
Keefe & Wharrad (2012), UK	164 nursing students	53.8	• Significant variation in scores between group differences for year of study and pain knowledge (*p*<.005).

Author, country	Participants, specialty	Overall score (%)	Findings
Wang & Tsai (2010), Taiwan	370 intensive care nurses	53.4	• Level of pain management knowledge negatively related to perceived barriers, meaning that respondents with greater knowledge of pain management principles saw little barriers toward managing pain optimally. • Variation in scores was noted between groups for level of qualification, clinical competence and hospital accreditation category. • Main barrier identified was: 'giving proper pain prescription needs doctor's approval; can't depend on me'.
Lui et al. (2008), Hong Kong	143 nurses, medical units	47.7	• Higher scores ±9% were significantly associated with years of experience (*p*=.001) and regular application of pain knowledge in practice (*p*=.032).
Yildirim et al. (2008), Turkey	68 oncology nurses	35.4	• Lowest scoring items concerned opioid administration, use of placebo injection to assess pain, route of analgesic administration in prolonged pain and clinical pain judgements. • Highest scored items were cultural considerations (72.1%), awareness of chronic cancer pain protocols (72.1%) and most accurate judge of patients' pain (69.1%).
Bernardi et al. (2007), Italy	287 oncology nurses	55.0	• More than 50% of oncology nurses underestimated patients' pain. • Variation in scores was noted between groups for location, with nurses from northern Italy scoring higher than nurses from the south or central Italy. • On multivariate analysis, higher test scores were associated with attending courses about pain management (*p*=.02). • No other variation in scores was noted between groups for age, gender, years of experience or level of qualification.

Author, country	Participants, specialty	Overall score (%)	Findings
Tsai et al. (2007), Taiwan	249 emergency nurses	49.2	• Nurses with better knowledge about pain management perceived fewer barriers to pain management (*p*<.001). • Test scores varied between groups for years of clinical practice (*p*=.02) and total hours of prior pain management education (*p*<.001).
Plaisance & Logan (2006), USA	313 nursing students • Baccalaureate n=210 • Associate-degree nursing students n=103	Baccalaureate 65.0 Associate-degree 60.8	• Baccalaureate nursing students performed significantly better compared to associate-degree prepared nursing students. • Knowledge of pharmacology was poor across both groups (54.7% vs. 49.5%; *p*<.001). • Very few respondents in vignette one and two would have administered analgesia 21.1% and 30.7% respectively, and in both instances, the remaining respondents who would administer analgesia, did so but at lower than recommended doses.
Patiraki et al. (2006), Greece	112 oncology nurses	45.1	• 88.9% of respondents incorrectly answered questions related to the analgesic properties of NSAIDs, nursing actions for patients reporting severe pain in the absence of abnormal vital and behavioural signs.
Erkes et al. (2001), USA	30 intensive care nurses	72.9	• Statistical difference was found between mean scores for years of nursing experience (*p*=.047). • No statistical difference was noted between scores for level of qualification (*p*=.575).

Key: IM, intramuscular; NSAIDs, non-steroidal anti-inflammatory drugs

Barrier 3: Subjectivity

Another barrier identified within the literature was subjectivity. Emergency nurses are confronted objectifying the subjective phenomena of pain in a myriad of contexts, to decide upon the right course of action. Subjectivity in the form of nurses' personal and professional experiences of pain shape individual nurses' perception and intervention decisions for managing pain. The impact of nurses' personal or professional experiences with pain on their pain management practice has been highlighted in previous empirical (Brunier et al., 1995; Dalton, 1989; Holm et al., 1989; Lenburg et al., 1970; O'Brien et al., 1996) and theoretical studies (Heye & Goddard, 1999). A study by Patiraki-Kourbani and colleagues (2006) reported that while positive professional pain experiences demonstrated a significant association with pain management knowledge (p=.038), personal pain experiences did not (p>.05). In addition to knowledge and personal experience, clinicians rely on their co-workers and clinical experts, for example physicians or nurse practitioners, to assist in forming complex judgements, such as pain management in critically ill patients (Chase, 1995; Lauzon Clabo, 2008).

Subjective norms, according to Fishbein and Ajzen (1975) are a function of the belief that specific individuals or groups known as referents approve or disapprove of performing behaviour. A decision to administer analgesia and the type of analgesic to be administered may be influenced by pressure exerted from the referents; a situation that emerges in hierarchical groups such as emergency clinicians. While the literature concerning nursing practice and subjective norms is not as prolific as that about the impact of attitudes and beliefs, there is sufficient evidence to support the importance of the influence of significant referents on inhibiting behaviours, actions and clinical decisions of others regarding the treatment of pain (Chase, 1995; Dufualt et al., 1995; Gerber et al., 2015; Johnson & Webb, 1995; Meehan et al., 1995). However, to date, little is known about the possible impact of emergency nurses' attitude towards acute pain and influence on future behaviours and the management of pain in critically ill patients.

Barrier 4: Communication

Communication between nurses and doctors has been identified as a barrier to providing optimal pain relief. Ineffective communication often goes undetected, negatively impacting on the quality of pain management (Australian Commission on Safety and Quality in Health Care, 2020; Hitawala et al., 2020). Nurses commonly rely on physicians to prescribe medication before it can be administered to the patient (Varndell et al., 2015c). Physicians' lack of trust in the assessment of pain in critically ill patients by nurses has however, shown to negatively impact upon the quality and frequency of communication between the nurses and doctors; ultimately hindering timely and optimal pain relief for patients reliant on the bedside nurse to advocate for their needs. While little is known about the quality and consistency of communication between emergency nurses and physicians regarding pain management for critically ill adult patients, a study by Batiha (2014, p.3), of American critical care nurses (n=37) indicated that "no trust from physician[s] in pain assessments, documentation and reports from nurses", made communicating with physicians to discuss treatment of pain challenging and significantly impeded timely and optimal administration of analgesia.

Similarly, issues of trust between nurses and physicians concerning the assessment of pain have been highlighted in previous studies examining ethical dilemmas faced by nurses in managing pain. Van Niekerk and Martin (2002) found that while American critical care nurses were significantly ($F_{[7, 7098]}$=189.19; p<.001) more likely to express concerns in relation to inadequate pain relief and under-medication, when consulted less by physicians about pain care, nurses felt their advice was not used to determine treatment strategies. In a later national survey in the USA examining nurses' (n=1,015) perceived barriers in pain management and their satisfaction with their professional relationships with physicians (Van Niekerk & Martin, 2003), the degree to which nurses were consulted by the patient's physician significantly interacted with nurses' perceptions of pain management barriers ($F_{[8,8088]}$=5.30; p<.001). On post-hoc analysis, nurses who did not feel adequately consulted by physicians were significantly more likely to: perceive insufficient knowledge of the patient's physician; insufficient cooperation by the patient's physician; inadequate prescription of analgesic medications; and lack of physician's knowledge and inappropriate perceptions of pain as barriers to optimal pain management compared with nurses who felt adequately consulted by physicians. To date no studies have explored Australian emergency nurses' knowledge, attitudes and communications practices concerning pain management in critically ill patients in the ED setting.

Barrier 5: Demographic and socioeconomic status

Disparities in pain management across different patients and groups have been well documented in multiple populations and settings (Neighbor et al., 2004; Todd et al., 1994; Todd et al., 1993). Jones et al. (1996) first identified age as a risk factor for inadequate analgesia in the ED. In their retrospective evaluation comparing analgesia administration between younger (n=122; 52.8 aged 20-50 years) and older (n=109; 46.9%, aged ≥70) patients, the former were more likely to receive analgesia (80% vs. 66%; p=.02), that was an opiate (98% vs. 89%; p=.03), within a shorter period of time mean (52 minutes vs. 74 minutes; p=.03), and at a higher dose (44% vs. 19%; p=.002) than older patients; issues potentially worsened in the presence of ED overcrowding (Hwang et al., 2006).

Sex disparities in pain management are also well established in the literature (LeResche, 2011; Robinson & Wise, 2003, 2004; Vallerand & Polomano, 2000). A study by Maram-Moore et al. (1994) found that women were prescribed less intravenous morphine than men, even after weight adjustment, yet the reason for this cognitive bias could not be explained (Arendts & Fry, 2006). One suggested explanation put forward in a study by Puntillo and Weiss (1994) involving 60 critical care patients, was that women were better able and more willing to describe their pain, especially to female nurses. However, later studies did not definitively bear this out. A study by Raftery and Smith-Coggins (1995) found that women (n=110; 57.9%) with a chief complaint of headache, neck pain or back pain, were provided with more potent analgesics (p=.03) and were less likely not to receive analgesia (p=.01) compared to men. Conversely, Phillips (1997) in their study evaluating ED patients (n=190) found that men usually received more aggressive treatment for medical conditions than women, including analgesics for pain.

Previous studies using Virtual Human technology found that participants rated male Virtual Human patients as having higher pain than female Virtual Human patients displaying the same pain behaviors (Hirsh et al., 2010; Wandner et al., 2013). Male Virtual Human patients were also more likely to have their pain treated more aggressively than female Virtual Human patients. Overall, the existing literature overwhelmingly reflects sex differences in both patient pain perception and provider management of pain (Wolf et al., 2023). However, none of these studies have explored clinician's attitudes, instead relying on retrospective chart reviews to explain the phenomena and influence of gender on pain management.

Within the literature there is significant evidence that socioeconomic status affects adequate pain management in the ED. Minority patients of lower socioeconomic status, tend to be most at risk for untimely and inadequate pain management (Anderson et al., 2000; Green et al., 2003; Mossey, 2011). This is especially evident in the ED setting (Heins et al., 2006; Miner et al., 2006; Todd et al., 1994). Reasons for inadequate pain management among these vulnerable groups have been cited as lack of trust (Tamayo-Sarver et al., 2003); perceived exaggeration of pain, or drug-seeking (Duignan & Dunn, 2008); lack of training; fear of side effects; and prejudice (Miner et al., 2006).

Ethnicity and race have been identified as impacting on pain management in the ED (Kposowa & Tsunokai, 2002; Luger et al., 2003; Mossey, 2011; Staton et al., 2007; Tamayo-Sarver et al., 2003). One compared African Americans (n=127; 58.5%) with limb fractures to similarly injured white Americans (n=90; 41.5%) with respect to the provision of analgesia, it was found that white patients were significantly more likely than black patients to receive analgesia (74% versus 57%; p=.01) despite similar reports of pain (Todd et al., 1994). Further, the risk of receiving no analgesia while in the ED was 66% (*RR* 1.66, 95% CI 1.11-2.50) greater for black patients than for white patients. In a longitudinal study conducted by Pletcher et al. (2008) between 1995 and 2005, racial and ethnic disparities in the administration of analgesia was evident. The results showed that white patients (31%) with pain were more likely to receive analgesia, than African American (23%), Hispanic (24%) or Asian/Other (28%). Further, disparities were more pronounced in patients reporting severe pain. Research undertaken by Shah and colleagues (2015) examining analgesia access for patients with acute abdominal pain who presented to an ED over a five year period, found that black patients and patients of racial and ethnic minorities were 22 to 30% less likely to receive analgesia. Further, black patients and patients of racial and ethnic minorities were 17 to 30% (p<.05) less likely to be administered opioid analgesia. Although pain is a near-universal experience, pain expression and beliefs are highly variable and can affect assessment and management of pain.

In a recent systematic review exploring pain management for Australian Aboriginal and Torres Strait Islander peoples (Arthur & Rolan, 2019), it was identified that aboriginal patients may receive less complex analgesia compared to nonaboriginal people (RR 0.45, 0.18–1.15). This is not an isolated finding. A study by McGrath et al. (McGrath et al., 2015) found Indigenous Australian patients within the Northern Territory were undermedicated for pain during vulvar cancer treatment. Similarly, Mitchell et al. (2018) found that while all clinicians believed care procedures could be painful, there was inconsistency in the use of pain reducing measures. When explored from the perspective of the patient, of those empowered to advocate for pain relief, it was linked with having a trusting relationship with clinicians.

In the absence of the patient's verbal report, nurses are encouraged to observe a patient's behaviour and seek input from the patient's family and carers in interpreting the patient's behaviour (Devlin et al., 2018; Fry et al., 2015; Herr et al., 2011). With over a fifth (n=47,507; 22%) of nurses practising in Australia originating from abroad (Australian Institute of Health and Welfare, 2013), the potential for misinterpreting and therefore, undertreating a patient's pain may still impact on care delivery. It is evident, given the literature concerning pain management in minority groups, while dated in some areas, that emergency clinicians need to re-examine personal belief systems regularly, and evaluate them against values and expectations of the patient and their family in order to provide quality health care for their patients.

Patient's age, socioeconomic background, ethnicity, race, and sex have therefore, all been identified as influencing nurses' pain management practices and analgesic choices. The ED is one of few clinical areas that manages patients across the lifespan, from birth to old age, and of every socioeconomic, cultural, ethnic and racial background. To date, how patient characteristics impact on emergency nurses' perception and the management of pain in the critically ill patient remains unknown.

Barrier 6: Emergency department overcrowding

Overcrowding is a global problem that has been identified since the late 1980s. (Ardagh & Rischardson, 2004), a (Bond et al., 2007; Department of Health, 2001; Department of Health and Children, 2005; Richardson & Mountain, 2009; Richardson et al., 2002; Trzeciak & Rivers, 2003) and shown to negatively impact on the safety and quality of patient care and pain management and resulted in suboptimal care for ED patients (Forero & Hillman, 2008; Richardson & Mountain, 2009).

The rate of patients presenting to ED continues to exceed the rate of population growth in Australia (Australian Institute of Health and Welfare, 2016) as well as in the UK (Health and Social Care Information Centre, 2016) and the USA (Carlson et al., 2013). One of the principal factors identified as the cause for overcrowding is the phenomena of 'access block'; patients are boarded in ED for greater than eight hours whilst awaiting for an inpatient bed (Australasian College for Emergency Medicine, 2018). Patients can be boarded in an ED bed, corridor or waiting area (e.g. reception area, ambulance bay) until an inpatient bed becomes available (Peltan et al., 2019). A number of studies have investigated the effects of overcrowding on time to administration of analgesia in the ED (Hwang et al., 2006; Keating & Smith, 2011; Motov & Khan, 2009; Pines & Hollander, 2008).

In evaluating timely access to pain assessment and analgesia, Hwang and colleagues (2006) conducted a retrospective review of patients (n=158) aged 65 years and over presenting to ED with hip fractures. The majority (81.0%; n=158) of patients waited on average 40 minutes (range 0-600min) from arrival to initial assessment of pain. Over two-thirds (n=83; 65%) received analgesia, yet mean time to administration was over two hours (141 minutes, range 10-525 minutes). On regression analysis, delay in pain assessment and administration of analgesia was significantly ($p<.01$) associated with ED overcrowding.

In a previous study examining delays in administration of analgesia in ED, Pines and colleagues (2008) found that patients (n=6,741; 49%) requesting analgesia waited over one hour (74 minutes, range 34-142 minutes) whilst at triage compared to those already in an ED bed (23 minutes, range 8-49 minutes). Following multivariate analysis, non-treatment of pain was independently associated with the number of patients waiting in the ED waiting room, with an odds-ratio of 1.05 (95% CI 0.99-1.04) for each additional patient, and an odds-ratio of 1.01 (95% CI 1.04-1.06) for each 10% increase in department occupancy. Increasing numbers of patients in the ED waiting room and departmental occupancy rate (i.e. crowding) also independently predicted delays in administering analgesia from triage (per additional patient, *OR* 1.05, 95% CI 1.04-1.06) and following placement within the ED (for each 10% increase in occupancy, *OR* 1.06, 95% CI 1.04 to 1.08). These findings were also supported in later ED studies that examined treatment delay during periods of over-crowding (Peltan et al., 2019; van der Linden et al., 2016).

ED overcrowding may also influence emergency nurses' attitudes and capacity to appreciate each patient's unique pain intensity experience and timely administration of analgesia; especially within a workplace that supports significant detachment from patients (Keating & Smith, 2011; Motov & Khan, 2009). This in turn may affect how nurses respond to patient self-reports of pain, including the type of analgesia selected and administered, such as opioids (Johnson, 2005; Joint Commission on Accreditation of Healthcare Organizations, 2010; Rupp & Delaney, 2004). To date, little is known as to how ED overcrowding impacts on the assessment, management and communication between clinicians regarding pain in critically ill patients delayed in the ED.

Barrier 7: Workforce culture

The final barrier details how workforce culture can influence timely and optimal pain management (Bennetts et al., 2012). Workforce culture is the "learned, shared and transmitted values, beliefs, norms and life ways of a particular group, that guide their thinking, decisions and actions in a patterned way" (Leininger, 1991, p. 22). Workforce culture has been shown to play a significant role when assessing pain. Within EDs there is an identifiable departmental culture with a system of shared values and beliefs, which provides a framework within which the work and decisions of the department are accomplished (Akbar et al., 2019; Fry, 2012; Jeffrey et al., 2017; Tetteh et al., 2021b). EDs in Australia, like those in the USA, Canada, UK and other Western European countries, function primarily within western values. These values underpin many of the decisions made in Australia by nurses whose culture is Anglo-Celtic and who function in EDs where it is the predominant culture. The face of Australia – both in general and within health care professions - is changing, with ethnic minorities from over 240 countries represented in the population (Australian Bureau of Statistics, 2023b), and the increasingly internationalisation of the nursing workforce (Australian Government, 2022; Parker & McMillan, 2007). It is presently not understood how pain management practices of emergency nurses are shaped or informed by workplace culture in collaborating and managing critically ill patients.

Healthcare provider characteristics potentially contribute to disparities in pain management, further highlighting the need for research in this area. Some evidence shows that provider age, sex, and years of experience are correlated with pain management decisions. Evidence suggests that the gender of the clinician may influence pain treatment. Three separate studies (Heins et al., 2006; Raftery et al., 1995; Safdar et al., 2009) revealed that male and female clinicians prescribe more analgesics to same sex patients. However, there is a paucity of literature exploring this subject and much of which is dated.

Summary

This Chapter presented an integrative review that examined the many factors that influence acute pain management in the ED, acute pain management standards, instruments used to assess pain, and the barriers to optimising pain management. Seven barriers were identified unique to the environment of ED. These barriers, combined with the unpredictable patient demand for emergency care, hinder clinician's attention to pain assessment and potentially blunt decision-making capacity, leading to unrelieved acute pain and suboptimal intervention. To date, no studies have explored Australian emergency nurses' knowledge and attitudes towards pain in critically ill patients, or examined clinician-related barriers in pain management of the critically ill patient in ED. It further remains unclear if critically ill patients benefit from nurse-initiated analgesia despite growing evidence of effectiveness and safety in other ED patient cohorts. Importantly, the research practice gap concerning how emergency nurses provide or optimise pain management for critically ill patients in their care remains unanswered.

Emergency nurses are ideally placed to monitor, assess and manage pain in critically ill patients. However, it is unclear as to whether emergency nurses' assessments are visible within the decision-making process or can influence pain management of critically ill patients. The next Chapter describes the methodology used in this study to explore how emergency nurses assess, monitor and manage pain for critically ill adult patients in the ED.

CHAPTER 4: METHODOLOGY

Introduction

This Chapter describes mixed-methods as the methodology used to guide and inform the study, which sought to explore emergency nurses' perceptions and practices in assessing and managing acute pain in critically ill adult patients. The Chapter first details the emergence of mixed-methods and provides an overview of common research designs, including the theoretical foundations of pragmatism. Explanation and rationale of the explanatory sequential mixed-methods research design selected for this study is then described, along with the analytical lens adopted. This Chapter concludes with discussion on the challenges of establishing rigour in mixed-methods research.

The methodological approach

Mixed-methods research is a methodology for conducting research that involves collecting, analysing and integrating qualitative and quantitative research approaches, and has unique philosophical assumptions and inclusive methods of inquiry (Mertens, 2023). Historically, mixed-methods research has been referred to by an array of labels, including: 'multi-method', 'integrated', 'hybrid', 'combined', and 'mixed-methodology research' (Creswell & Miller, 2000). This notion of integrating methods and/or data in a study is however not new (Campbell & Fiske, 1959). From a contemporary perspective, mixed-methods research incorporates many diverse viewpoints. As Creswell and Plano (2017) and Bergman (2008) described, the core characteristics, and therefore, the definition of mixed-methods research, flows from the researcher and is reflected in their actions in conducting the study; the researcher selects and analyses persuasively and rigorously both qualitative and quantitative data as they pertain to the research question, and then decides upon how the data are integrated, thus reflecting the priority of each phase in answering the research question.

Mixed-methods research is more than a combination of quantitative and qualitative methods/data in an ad hoc fashion in a single study (Andrew & Halcomb, 2006). The approach incorporates a distinct set of ideas and practices that separate it from other research paradigms, although debates concerning its methodological foundations continued, escalating to what was referred to as the 'paradigm wars' (Lincoln & Guba, 1985).

The emergence of mixed-methods research

The history of mixed-methods developed in the 1970s - 1980s, when the positivist (quantitative research) paradigm was under criticism as reductionist and limited by social scientists supporting qualitative research, and proposing constructivism (or variants thereof) as an alternative worldview (Reichhardt & Rallis, 1994).

Smith (1983) asserted at the height of these epistemological wars that combining the two paradigms as proposed in mixed-methods research would be incommensurable. This belief enforced the notion that the two paradigms were mutually exclusive and in opposition (Valsiner, 2000).

Today, methods of data collection and their associated philosophical assumptions are not as tightly bound (Mertens, 2023). In their overview of qualitative research methods, Denzin and Lincoln (2005) highlighted a shift towards accepting different types of methods being associated with different types of philosophies or worldviews. In mixed-methods research, three paradigmatic stances of marked philosophical distinction have been proposed to address arguments about incompatibility of paradigms and their associated methods: 1) dialectical pluralism that stands at the nexus of the constructivist and post-positivist paradigms (Greene & Hall, 2010), 2) the transformative paradigm (Mertens, 2023) and 3) the pragmatic paradigm (Biesta, 2010). Of the three paradigms, pragmatism has been adopted as the philosophical stance for the purposes of this study.

Emergency healthcare occurs across a complex sequence of intricate interactions that are difficult to assess with strictly quantitative or qualitative research methods. Pragmatism, the belief that multiple paradigms can be used to address research problems (Rossman & Wilson, 1985), is orientated '*to solving practical problems in the "real world"*' (Feilzer, 2010, p. 8), rather than on assumptions about the nature of knowledge, and therefore forms the basis of this study for several reasons.

First, emergency nursing practice and research are both diverse and pluralistic in roles, settings, applications and in knowledge that is generated and applied across paradigmatic boundaries and disciplinary lines (McCready, 2010). Second, emergency nursing practice is founded upon the principle of best evidence, using diverse sources of knowledge to discern what works best to improve patient safety and well-being. Similarly, pluralism, the hallmark of pragmatism takes an all-inclusive approach which is open to multiple sources of knowledge; operating on the principle of 'best-available evidence' (Talisse & Aikin, 2008). Third, nursing research / practice and pragmatism have a shared goal: the social-moral-ethical imperative towards considering and bettering others in determination of 'usefulness' and in actions based on best available knowledge (International Council of Nurses, 2021; Nursing and Midwifery Board of Australia, 2018; Talisse & Aikin, 2008). In emergency nursing, nurses are in the business of caring, healing, helping and bettering the lives of those we care for; which is inherently and essentially nursing (Nightingale, 1860). Finally, a universal ideology of pragmatism is the interconnectedness and iterativeness of theory and practice, where what works (i.e. truth) informs and revises practice and visa-versa. Pragmatism's core contribution to mixed-methods research has been two-fold; to provide a rationale for combining methods from diverse paradigms (Johnson & Onwuegbuzie, 2004), and promote the use of diverse research approaches to best answer the research question.

While pragmatism has gained considerable support as a philosophical framework for mixed-methods research (Feilzer, 2010; Maxcy, 2003; Morgan, 2007; Onwuegbuzie & Leech, 2004), it is not without criticism. During its infancy, Russell (1910, 1945) argued that pragmatism equated truth with utility, that is truth is what works, and ignored the antecedent conditions, which informed the researcher's set of methods. Greene and Caracelli (1997) and Bergman (2011), echoing Russell's earlier concern, stressed that in order to assess the appropriateness of the methods selected and the manner in which they have been used, researchers must be explicit when and how each is used. Bergman goes on to emphasise that the choice of data collection and analysis methods is crucial to how researchers make sense of study findings, as each alters the 'landscape of meaning' (Bergman, 2011 p. 99). As Johnson and Onwuegbuzie (2004) suggested, selection of the data collection and analysis methods must fit with the research question(s), the purpose and nature of the study; and what the type of information or data is required to best understand the phenomena under investigation.

The inherent complexity of human phenomena that has arisen from vast variations in human demography, culture, politics, values, mores, spirituality, as well as the material conditions of human existence has been conceptualised and engaged in different ways (Greene & Hall, 2010). Paradigms serve as philosophical frameworks that guide researchers in their approach to examining human phenomena, and assist in the identification and clarification of their beliefs with regard to ethics, reality, knowledge and methodology (Feilzer, 2010). The differing philosophical assumptions associated with qualitative and quantitative paradigms have had a major influence on mixed-methods research discussions to date (Morgan, 2007; Sale et al., 2002), although the underlying philosophical positions of qualitative and quantitative methodologies are not necessarily so distinct or controversial as the stereotypes suggest (Creswell & Creswell, 2022; Maxwell, 2010).

Mixed-methods research has developed from the realisation that neither a qualitative or quantitative design is sufficient to capture the depth and richness of detail of particular phenomena under investigation (Ivankova et al., 2006; Onwuegbuzie & Leech, 2004). Both qualitative and quantitative methods have strengths and weaknesses, which can be ameliorated by combining and synergistically integrating the most appropriate quantitative and qualitative techniques together. By combining quantitative and qualitative techniques, the scope or breadth of research can therefore, be expanded to deepen the researcher's understanding of the phenomena of interest (Creswell & Creswell, 2022).

Mixed-methods research designs

Common mixed-methods study designs presented in the literature are: embedded, concurrent, integrated and sequential (Tashakkori & Teddlie, 2003). Several authors have attempted to explain a typology of mixed-methods research designs using four dimensions: data integration, priority, timing and mixing (Creswell & Plano Clark, 2010; Doyle et al., 2009; Tashakkori & Teddlie, 2010; Teddlie & Tashakkori, 2009).

The level of integration relates to the degree the different datasets interact with each other (Greene, 2007). An independent level of integration occurs when the quantitative and qualitative phases are implemented independent of each other. Mixing of quantitative and qualitative data at this level of interaction occurs only when drawing conclusions during the overall interpretation at the conclusion of the study. Conversely, quantitative and qualitative data can be fully integrated throughout the study at different points and in different ways, with both datasets being analysed together and interactively prior to study conclusion.

Priority refers to the relative significance or weighting between quantitative and qualitative data in relation to answering the study's questions (Creswell & Creswell, 2022). There are three common weighting options in mixed-methods designs to address the research problem: equal priority (QUAN→QUAL), where both quantitative and qualitative data play an equal role; quantitative priority (QUAN→qual) where a greater emphasis is placed on the quantitative methods, with qualitative methods used in a secondary role; and, qualitative priority (quan→QUAL) where a greater emphasis is focused on the qualitative methods, and the quantitative methods are used in a secondary role (Tashakkori & Teddlie, 2010).

Within mixed-methods designs, timing can be classified in one of three ways: concurrently, when both the quantitative and qualitative data are collected during a single phase of the research study; sequentially, where implementation of the quantitative and qualitative data occurs in two distinct phases and leads to the collection and analysis of one type of data occurring after the collection and analysis of the other type; or, in the case of multiphase combination mixed-methods study designs, multiple phases are implemented sequential and/or concurrently across a broad programme of study (Creswell, 2021).

Mixed-methods designs are categorised by the approach taken when mixing quantitative and qualitative phases. Mixing, the explicit interrelating of the study's quantitative and qualitative strands, can occur at four possible points during the studies research process: interpretation, data analysis, data collection and design, and are supported by employing mixing strategies that directly relate to these points of interface. Four mixing strategies have been proposed to assist in the integration of quantitative and qualitative data, these are: merging of two datasets; connecting from the analysis of one set of data to the collection of a second set of data; embedding of one form of data within a larger design; or using a framework to bind together the datasets (Morse & Niehaus, 2009). These will be discussed in the following sections.

Explanatory sequential mixed-methods design

For the purposes of this study an explanatory sequential mixed-methods design was selected from the Tashakkori and Teddlie (2003) typology of multi-strand mixed-methods research; an approach successfully used by other researchers exploring nursing practices (Cameron, 2009; Gulmans et al., 2007; Nastasi et al., 2007; O'Cathain et al., 2004). The overall purpose of an explanatory sequential mixed-methods design is to use qualitative data to explain or build upon quantitative results in an iterative process (Christ, 2010).

Explanatory sequential mixed-methods designs have been emphasised in most writings about mixed-methods study designs, and have been labelled as a sequential model (Tashakkori & Teddlie, 2010) sequential translation (Morse, 1991) and iteration design (Greene, 2007). Although these terms apply to any sequential two-phase approach, irrespective of beginning quantitatively or qualitatively, the explanatory design typically commences with a quantitative strand in phase 1 and is followed up on specific results with a qualitative strand in phase two. This arrangement has also been called a qualitative follow-up approach (Morgan, 1998), and forms the methodological framework for this study.

A number of advantages are associated with using an explanatory sequential mixed-method design, and have been widely discussed in the literature (Creswell & Plano Clark, 2010; Creswell et al., 2003; Greene & Caracelli, 1989; Greene, 2007). Advantages include the straightforward nature of the design, and the opportunities it provides to explore quantitative results in more detail, especially useful when unexpected results arise (Morse, 1991). Additionally, the design is strongly orientated towards quantitative data collection methods and analysis, which may favour quantitative research problems, novice researchers and may be more acceptable to quantitative-based audiences (Collins & O'Cathain, 2009; Teddlie & Yu, 2007).

Common challenges in conducting mixed-methods research include time management and data integration (David et al., 2018; Halcomb, 2019). To ensure the success of this explanatory sequential mixed-methods research study, the researcher prepared with their supervisors a clear timeline, that included check-points for developing a clear and coherent rationale for undertaking an explanatory mixed-methods research design, a mixed-methods research question, as well as transparent and consistent reporting processes of the methods, results, data integration processes and implications of the research to communicate the value and credibility of the research, which has been detailed within this chapter.

Mixed-methods data integration

Within healthcare research, quantitative methodologies are typically used to address questions about causality or magnitude, with qualitative methodologies applied to explore why or how a phenomenon occurs. A key distinction between mixed-methods and multi-method research is the intentional integration of quantitative and qualitative data to capture a more complete understanding of the phenomena under examination (Halcomb, 2019). Within sequential explanatory mixed-method studies data analysis occurs sequentially, with quantitative data being collected and analysed first followed by qualitative data collection and analysis, which helps to determine what quantitative results need further explanation. Data integration within sequential explanatory mixed-methods study designs occurs once all data collection has been completed, findings analysed and inferences are drawn (Tashakkori & Teddlie, 2010). Inferences from each study, as well as across the quantitative and qualitative data are then integrated and interpreted to form meta-inferences. The data integration process is influenced by the rationale for conducting a mixed-methods study. As early as 1989, several rationales for conducting a mixed-methods have been advanced (Greene & Caracelli 1989), which include: triangulation, initiation, development, expansion and complementarity (Table 4.1).

Table 4.1: Rationales for conducting mixed-methods research

Rationale	Description
Triangulation	Uses multiple methods to explore whether similar findings were obtained to answer the research question (Greene et al., 1989).
Initiation	Seeks new perspectives by recasting questions and findings from one method with questions and or findings with the other method (Bryman, 2006).
Development	Questions or hypothesis to be tested in the subsequent phase emerge from the inferences of the previous method (Bazeley, 2018a).
Expansion	To expand the breadth and the range of the research by using different methods for different lines of enquiry (Creswell & Plano Clark, 2010).
Complementarity	Results from one method are used to enhance, elaborate, or clarify results from another method (Fetters et al., 2013).
Diversity	Seeks to identify divergent views of the same phenomena (Tashakkori & Teddlie, 2008).
Corroborative / Confirmation	Seeks to assess the credibility of inferences obtained from one phase to the other.

One of the most common purposes for mixing methods within a sequential explanatory design examining complex multifaceted practice is complementarity, which guides the integration of data in this study (Greene 2007; Onwuegbuzie & Collins 2007). By using method findings in a complementary fashion, the researcher can tap into different aspects of the same complex phenomenon, by measuring overlapping but also different facets to gain a broader, deeper and more comprehensive understanding of the phenomenon (Greene & Caracelli 1989). Results from the different methods elaborate and enhance the overall interpretations and meta-inferences of the study.

Methodological rigour in mixed-methods research

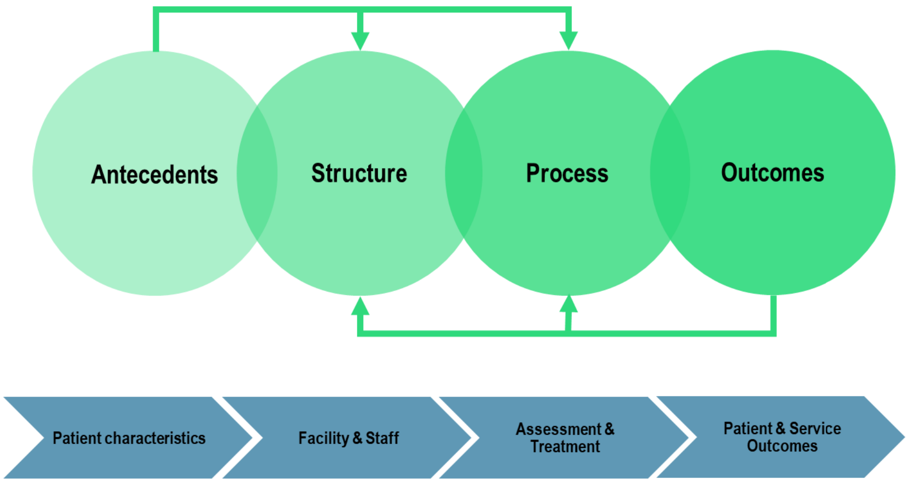
Evaluation of methodological rigour in mixed-methods research presents unique challenges to researchers, due to mixing or combining differing philosophical paradigms, the use of multiple research methods requiring different skill sets, and the need to combine research at different points in the research process. Methodological rigour in mixed-methods research can be strengthened by incorporating a validation framework to address two intertwined goals, that being: i) conducting and reporting research that is scholarly and defensible, substantiating results and validation of conclusions; and, ii), ensuring that the conduct of the research is transparent in terms of clarifying the logic underpinning the inquiry (Bressan et al., 2017). Several theoretical frameworks for evaluating rigour in mixed-methods have been published that focused on measurement validation (Adcock & Collier, 2001), dissemination (O'Cathain et al., 2008) and reporting (Andrew & Halcomb, 2009; Collins & O'Cathain, 2009) mixed-methods research. Only two theoretical frameworks have been identified within the literature that address evaluating rigour across the whole of the whole mixed-methods research study in addition to its individual components: the Unified Validation Framework and the Instrument Development and Construct Validation framework.

From their review of existing terminology regarding rigour and validity from the quantitative, qualitative and mixed-methods literature, Dellinger and Leech (2007) introduced their Unified Validation Framework. Traditional approaches to rigour for quantitative (e.g reliability, validity) and qualitative (e.g. credibility, dependability) methods are at the centre of the framework, which is surrounded by distinctive yet interconnected elements that critically examine the philosophical assumptions and rationale for selecting a mixed-methods approach, study design, legitimation (i.e. validation of inferences), interpretive rigour, inferential consistency, utilisation of findings and acceptability of mixed-methods findings (Archibald, 2016; Panlilio et al., 2022). A second meta-framework was proposed by Onwuegbuzie et al. (2010) that consisted of a 10-phase process called Instrument Development and Construct Validation, which aimed at optimising quantitative instrument development within mixed-method studies. Using the different types of validity, corresponding crossover analyses were proposed, with qualitative methods used to analyse quantitative data, and quantitative methods used to analyse qualitative data (Koskey et al., 2018). Contained within the framework were separate quantitative and qualitative analysis phases, and then phases where both methods were combined in crossover analysis. These procedures were designed to enhance instrument fidelity, reflecting an instrument's appropriateness or utility.

These two frameworks were the only frameworks identified that explicitly evaluated rigour across the entire mixed-methods research process. They vary in focus and the degree to which they specify procedures. The Unified Validation Framework focuses on researcher introspection, validity, transparency and cross-over (i.e. construct validity) processes within quantitative, qualitative and mixed-methods traditions. Whereas the IDCV framework focused on quantitative instrument development. Of the frameworks described, Dellinger and Leech's (2007) Unified Validation Framework appears the most suitable, as it addressed the complete mixed-methods research process, and was therefore used in this study.

Analytical lens

To further enhance mixed data integration, interpretation and understanding, Caelli et al. (2003) advocated that an analytical lens be incorporated into the mixed-methods study design. Donabedian's quality and safety framework was selected as the analytical lens to support and guide data understanding. Donabedian's original framework published in 1980 has been applied to problems both broad and narrow, such as examining clinical practice in healthcare (Battles & Lilford, 2003), clinician communication (Sayer, 2010) and evaluating healthcare technology (Ancker et al., 2012), and designing nurse educational programs (Liu et al., 2011). The framework is comprised of three interacting elements: structure, process and outcome (Donabedian, 1980). In the context of this study, structure refers to the setting where emergency care takes place, including the resources needed to support the delivery of emergency care, such as the number of resuscitation beds and availability of equipment (for example syringe drivers to deliver continuous intravenous medications) (Mitchell et al., 1998; Wubker, 2007). The second element, process, examines the provision of care and factors that most influence the safety and quality of patient outcomes (Naranjo & Viswanatha Kaimal, 2011), such as how pain is assessed and managed by emergency nurses at the patient's bedside, or how clinicians interact (i.e. medical officer and nurse) to manage acute pain. The third and final element, outcome, refers to changes in the patient (Wubker, 2007), for example the reduction or return of pain. The original Donabedian Structure-Process-Outcome framework has, however been criticised for being too linear; limiting its utility for recognising how the three domains influence and interact with each other (Carayon et al., 2006; Mitchell et al., 1998), and for failing to incorporate patient characteristics or environmental factors (Coyle & Battles, 1999) (Figure 4.1).



Adapted from Kim et al. (2022)

Figure 4.1: Revised Donabedian Framework

In their proposed revision of the framework, Coyle and Battles (1999) suggest that patient characteristics and environmental factors, referred to as antecedents, are vital to fully understanding the safety and quality of care (Kim et al., 2022). Patient factors include culture and preferences, while environmental factors include use of resources and the physical characteristics of the clinical area. Each domain reciprocally influences the others, yielding continually improving healthcare services. Donabedian quality and safety framework was used as the analytical lens to guide data interpretation. The Donabedian framework has been applied to problems both broad and narrow, such as examining antimicrobial stewardship (Fonseca Medeiros et al., 2023), healthcare response to COVID-19 pandemic (Binder et al., 2021), nurse delegation, (Standing & Anthony, 2008), clinical communication (White et al., 2022), evaluating integration of technology into healthcare (Tossaint-Schoenmakers et al., 2021), and pressure ulcer care (Amir et al., 2017).

Summary

This Chapter discussed the methodology and provided an overview of method techniques that underpin a mixed-methods research study. The theoretical underpinnings of pragmatism embedded within mixed-methods research makes it well suited to understanding clinical phenomena. The choice of a mixed-methods design and the underlying research paradigm of pragmatism was explained and justified as an appropriate approach to answer complex research questions. The specific explanatory sequential design study was then described and justified for selection in this thesis.

Mixed-methods research assists to compare and contrast datasets from which new knowledge can be generated. Through a mixed-methods approach of complementarity adopted within the interpretative phase, findings will be elaborated on, enhanced by and clarified between different datasets and the literature. The quantitative, qualitative and integration of data analyses were explained. Methodological rigour has been discussed. The following Chapter describes the methods used for phase 1 and phase 2 of this mixed-methods research study.

CHAPTER 5: METHODS

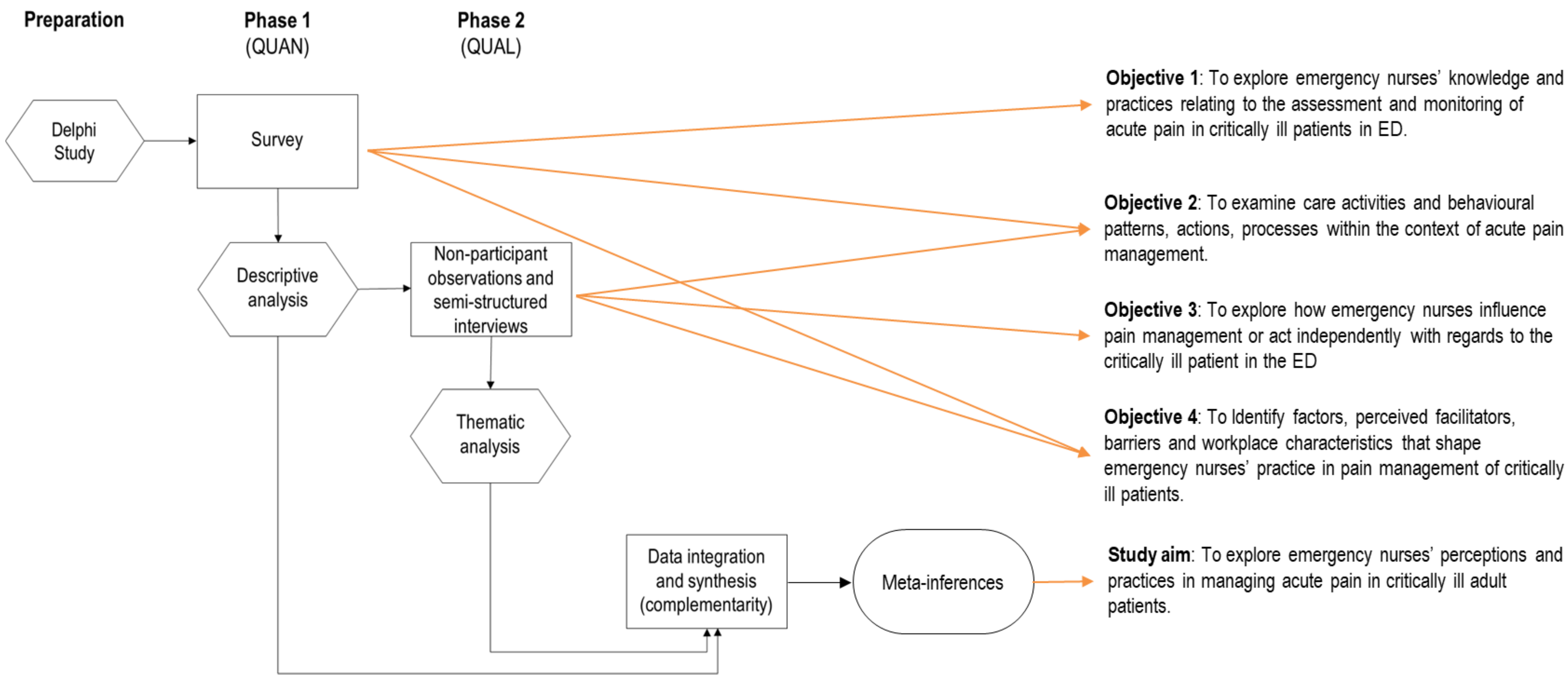
Introduction

This Chapter describes the methods used within the explanatory sequential mixed-methods study and is divided into six sections, covering the study design; phase 1, including description of the setting, sample recruitment, method, development and piloting of a survey instrument; phase 2, detailing the choice of study sites, sample recruitment, methods and development of schedules used during non-participant observation and participant interviews; an overview of the data collection and analysis approach adopted in this study; description of the storage and management of study data; the process undertaken to generate meta-inferences is presented; description of the steps taken to establish validity and rigour in the mixed-methods study; and the ethical considerations of the study including researcher as observer. Key aspects of the methods have been published:

> Varndell, W., Fry, M. & Elliott, D. 2021, 'Applying real-time Delphi methods: development of a pain management survey in emergency nursing', BMC Nursing, vol. 20, no. 1, p. 149.
>
> Varndell, W., Fry, M., Lutze, M. & Elliott, D. 2021, 'Use of the Delphi method to generate guidance in emergency nursing practice: A systematic review', International Emergency Nursing, vol. 56, p. 100867.
>
> Varndell, W., Fry, M. & Elliott, D. 2017, 'Exploring how nurses assess, monitor and manage acute pain for adult critically ill patients in the emergency department: protocol for a mixed-methods study', Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine, vol. 25, p. 75.

Study design

An explanatory sequential mixed-methods design was chosen for this study, as it best enabled the researcher to answer the research questions on the perceptions and practices of emergency nurses managing acute pain in critically ill patients. The study involved complex research questions that could not be adequately investigated through use of quantitative or qualitative research approaches alone. Emergency healthcare occurs across a sequence of complex interactions that are difficult to assess with strictly quantitative or qualitative research methods. Thus, an explanatory sequential mixed-methods research design (QUAN→QUAL) was conducted that comprised of a survey, non-participant observations and semi-structured interviews. Due to the relative complexity involved in mixed-methods research, descriptive diagrams are strongly encouraged to clearly communicate the procedures and products of the study. The selected mixed method design, data collection methods and objectives of this study are summarised in Figure 5.1.



Key: QUAN, quantitative; QUAL, qualitative

Figure 5.1: Summary of the explanatory sequential mixed-methods study

The use of a descriptive study diagram further allows the reader to assess the validity or value of the results in relation to the methods used to obtain them and the intended aim or objective (i.e. design quality, construct validation, rigour), and permits other researchers to replicate the study. In phase 1 a survey technique was used as method to collect quantitative data.

Instrument development for Phase 1

Given the lack of literature to assist in developing and designing an appropriate survey, the Delphi technique was used to develop a national contextually based acute pain management survey for use in phase 1. The following section opens with a description of the Delphi technique, setting and recruitment strategies used in the preparation phase to develop a national survey that would be used in phase 1. Aspects of this following section have previously been published:

> Varndell, W., Fry, M., Lutze, M. & Elliott, D. 2021, 'Use of the Delphi method to generate guidance in emergency nursing practice: A systematic review', International Emergency Nursing, vol. 56, p. 100867.
>
> Varndell, W., Fry, M. & Elliott, D. 2021, 'Applying real-time Delphi methods: development of a pain management survey in emergency nursing', BMC Nursing, vol. 20, no. 1, p. 149.

The Delphi Technique

The Delphi technique is a commonly used method, developed by Dalkey and Helmer (1963) at the Rand Corporation in the 1950s, for achieving convergence of opinion concerning real-world knowledge solicited from experts within certain topic areas. The Delphi technique has become popular with researchers exploring a wide range of topics including role delineation in nursing (Duffield, 1988; Roberts-Davis & Read, 2001; White & Wilkes, 1998), nursing research priorities (Annells et al., 2005; Bayley et al., 2004; Considine et al., 2018), standards of nursing practice (ENA NP Validation Work Team et al., 2010; Okuwa et al., 2005), tool development (Wilkes et al., 2010) and survey development (Fry & Burr, 2001). Studies employing the Delphi technique assemble a panel of experts who have knowledge and experience of the topic being investigated (Nasa et al., 2021). The Delphi method enables collection of opinions without needing to bring participants together physically, and is a reliable and creative method to explore ideas, share knowledge and co-design instruments (Nasa et al., 2021).

Four main characteristics of the Delphi method are: anonymity in the process, controlled feedback, iteration and statistical aggregation of group response (Rowe & Wright, 2011). In contrast to other consensus building methods such as the nominal group technique or consensus conferences, a large number of individuals across diverse locations and areas of expertise can be included anonymously. Participant anonymity allows for free expression of opinion and open critique; diminishing the effect of social pressures, bias and domination of the consensus process by one or a few experts (Jairath & Weinstein, 1994). Controlled feedback returned to participants between rounds is also an important feature. Here, group opinion is summarised by the researcher and presented back to participants, prior to commencing the next round. This allows participants to either retain or change their earlier opinion in the light of other participants' views. By iterating the questionnaire, participants can anonymously change their opinions in view of the aggregated group response without reprisal.

Mullen (2003) lists over 20 variations of the Delphi technique where researchers have modified the approach to suit their needs. More recently, with the development of new technologies, the use of Delphi has expanded from classic paper and pen, to computer and online-based software systems. In this study, an advanced form of the Delphi method utilised called real-time Delph was selected. Real time Delphi, is a consultative process conducted using an online-based software to increase efficiency of the Delphi process (Varndell et al., 2021a).

In a real-time Delphi process, participants are provided with access to an online questionnaire portal for a certain amount of time. Whenever the expert panel members' login, they see all their quantitative and qualitative responses to items and the ongoing, hence real-time, anonymised responses of other panel members. The core innovation of real-time Delphi studies is the real-time calculation and feedback. Unlike traditional Delphi methods, in a real-time Delphi participants do not judge at discrete intervals (i.e. rounds), but can change their opinion as often as they like within the timeframe set (Aengenheyster et al., 2017). Item responses are visualised in mean, median and interquartile range, and a variety of charts. Consequently, a participant can find out to what extent their response to a question from an earlier point of time compares to the current overall group opinion (Figure 5.2).

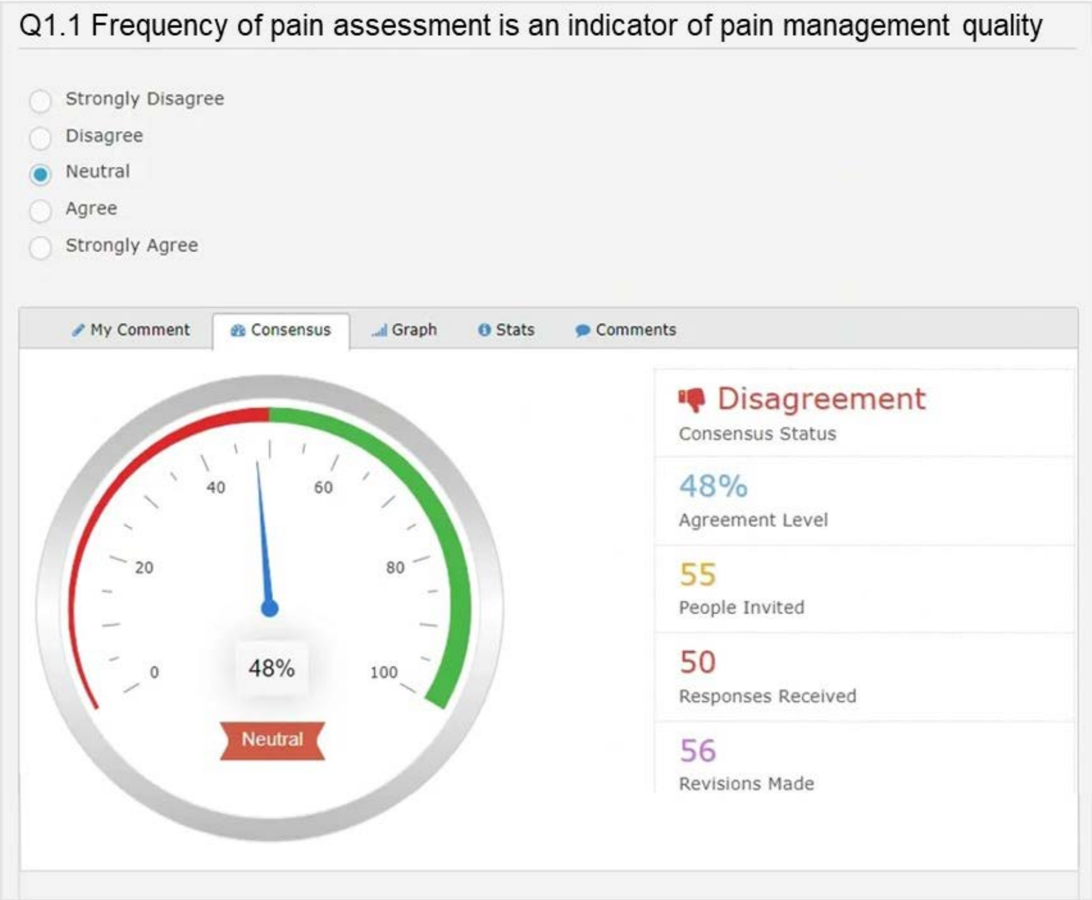


Figure 5.2: Panellist feedback screen

The real-time Delphi approach was selected as it has several advantages compared to the traditional approach. First, the number of experts participating in the real-time study can be increased due to a higher degree of automation during and improved possibilities for analysis after the study. Additionally, an online Delphi platform such as Surveylet (Calibrum, 2019, St George) used in this study, enables timely invitation of experts from different countries and across large geographical areas to participate (Aengenheyster et al., 2017). Second, the degree of interaction among the experts can be increased as they can immediately react to others' comments. Further, the timeframe between giving their own answers and receiving insights into others' responses is very short, which encourages stronger cognitive examination with the respective issue in question; maximising validity of the results (Keeney et al., 2011).

Challenges associated with conducting a real-time Delphi are principally related to technology and cost (Avaella, 2016). Internet accessibility, system navigation difficulties and the inconvenience of entering data into a computer-based data screens are recognised as challenges (Donohoe & Needham, 2009). The internet is a tool for extending the potential research population and sample, however navigating a virtual landscape may frustrate panel members and therefore limit the number of completed surveys (Hall et al., 2018). To minimise this, panel members were sent detailed written instructions on how to access and navigate the online survey platform. In addition, the researcher was available to panel members via teleconference (one-on-one) to assist in accessing the platform (Donohoe et al., 2012; Rowe & Wright, 2011).

Trustworthiness of the Delphi technique

For the Delphi study, trustworthiness was strengthened by using Lincoln and Guba's (1985) criteria for qualitative studies to ensure credible interpretations of the findings (Hasson et al., 2000). The criteria are based on four major issues: credibility, transferability, dependability and confirmability. Delphi was based upon consensus amongst experienced clinicians familiar with the phenomena being explored both within metropolitan and regional ED settings (transferability). Decisions regarding the development of survey questions was achieved through structured documented processes (credibility and dependability); using thematic reporting frameworks that linked data with interpretation (Tong et al., 2007), which were reviewed by the research team and an independent senior emergency nurse (confirmability). The anonymous and continuous process of real-time Delphi research fosters honesty and verification of panellist responses, as panellists could provide feedback and 'member-checking' without fear of reprisal from their colleagues (credibility) (Keeney et al., 2011). Further, the final version of the survey was piloted for the purposes of assessing its robustness (transferability). Prior to launching the national online survey, the final survey was reviewed by the researcher's supervisors and an independent pain management clinical nurse consultant not associated with the study (i.e. face validity).

Expert panel

Selection of panel experts in Delphi studies typically involve purposive sampling techniques (Hsu & Sandford, 2007; Rowe & Wright, 2011). Hence, the aim for this preparation phase of the study was to recruit emergency nurse experts with in-depth knowledge and experience in the phenomena being explored (Polit & Beck, 2017). Further, according to Taylor (2019), when a panel is homogenous, that is, members hold similar educational, professional and clinical experience, such as emergency nurses, a panel of 10-15 members is adequate.

Expert selection is an important part of the Delphi method as validity of the final results is directly related to the knowledge of the experts (Joyner & Smith, 2015). Who qualifies as an 'expert' is therefore of critical importance. Melynk et al. (2009) outlined a minimum qualification threshold for participation as an expert on a Delphi panel. Importantly, participant invitation criteria should include measurable characteristics that each participant group would acknowledge as those defining expertise, while still attempting to recruit a broad range of individual perspectives within those criteria. Therefore, purposive sampling was used to select clinicians from the specialist area of emergency care so as to capture the necessary e informed opinion (Eubank et al., 2016).

Hence, panel participants were selected using the following criteria: i) Registered Nurse; ii) working in an ED; iii) postgraduate qualification in emergency nursing or higher; iv) at least five years clinical experience; v) seen as a leader in education and/or clinical practice within their ED setting; and/or, recently (<3 years) published emergency related research in a peer-review journal.

The Delphi sampling plan used in this study was as follows. First, an initial list was developed containing names and email addresses of individuals engaged in postgraduate education in emergency nursing, such as coordinators or faculty members. Added to this initial list, were the names and electronic contact information of clinical nurse consultants and educators who were members of the College of Emergency Nursing Australasia. Next, names and email addresses of authors who had published emergency nursing related research within the last three years were included. A letter of invitation along with study information and written consent form was then emailed to 30 potential participants. Of those that responded (n=15, 50%), 12 participants were selected for the Delphi expert panel (Table 5.1).

Table 5.1: Expert panel characteristics

Characteristic	N (%)
Gender	
Female	7 (58.3)
Male	5 (41.7)
Age (years, SD)	37.6 (7.5)
Role	
Clinical Nurse Consultant	7 (58.3)
Clinical Educator	3 (25.0)
Academic	1 (8.3)
Clinical Academic	1 (8.3)
Years of nursing experience, mean (SD)	15.6 (6.3)
Years of emergency nursing experience, mean (SD)	11.9 (4.5)
Highest postgraduate qualification	
Master of Nursing	7 (58.3)
Doctorate	3 (25.0)
Diploma	1 (8.3)
Certificate	1 (8.3)
State/Territory	
New South Wales	4 (33.3)
Victoria	3 (25.0)
South Australia	2 (16.7)
Western Australia	2 (16.7)
Northern Territory	1 (8.3)

Keeping Delphi expert panel participants fully engaged once recruited, is one of the challenges of conducting an online Delphi survey (Hsu & Sandford, 2007; Khodyakov et al., 2020). High attrition rates can negatively impact on the clarity and validity of the results (i.e. item consensus and selection) (Hasson et al., 2000). To maintain engagement, a variety of methods were employed, beginning with the participant information sheets. The participant information sheet was designed in line with the literature to ensure straightforward messaging regarding the importance and appeal of the study, aims, processes, timeframe and benefits which were provided in clearly marked subsections (Ennis & Wykes, 2016; Hall et al., 2018). For ease, the expert participant information sheet also included the consent form. To further encourage potential experts who may have had little experience in participating in an online Delphi study, we detailed how participants would be introduced to the study, the Delphi method, the availability of technical support and one-on-one training by Calibrum, the proprietors of Surveylet. Reminder emails were sent at weekly intervals to encourage experts to (re)assess items in a timely fashion. These emails emphasised that their views mattered and that for the results to be meaningful, it was important to complete the Delphi process. On completing the real-time Delphi, panel members were given a certificate thanking them for their commitment to the study (Hall et al., 2018), and to provide evidence for their professional development records (Nursing and Midwifery Board of Australia, 2016).

Development of the survey

The survey was developed using the online platform Surveylet (Calibrum, 2019, St George) between 1st February and March 14th 2018. Similar to other studies using modified Delphi techniques (Joyner & Smith, 2015), initial survey items were generated by a detailed search of the literature (Varndell et al., 2017; Varndell et al., 2018a; Varndell et al., 2021b) guided by the following six questions:

i. What indicators would signify that acute pain in the critically ill adult patient has or has not been adequately detected?
ii. What indicators would signify that acute pain in the critically ill adult patient has or has not been adequately assessed?
iii. What indicators would signify that acute pain in the critically ill adult patient has or has not been adequately managed?
iv. What indicators would signify that acute pain in the critically ill adult patient has or has not been communicated adequately?
v. What indicators would signify that acute pain in the critically ill adult patient has or has not been adequately controlled?
vi. What indicators would signify that emergency nurses are able or not able to manage acute pain in the critically ill adult patient?

Panellists were asked to rate the importance of questions generated from the literature (1, extremely unimportant to 9, extremely important), and whether the question could be modified to improve its relevance or clarity (Yes/No). For questions derived from validated instruments, panellists were asked if the question was appropriate in the context of acute pain management in critically ill patients in the ED setting (Yes/No), and whether the question could be modified to improve its relevance (Yes/No). Panellists were invited to provide an example of how the proposed question could be modified (Figure 5.3).

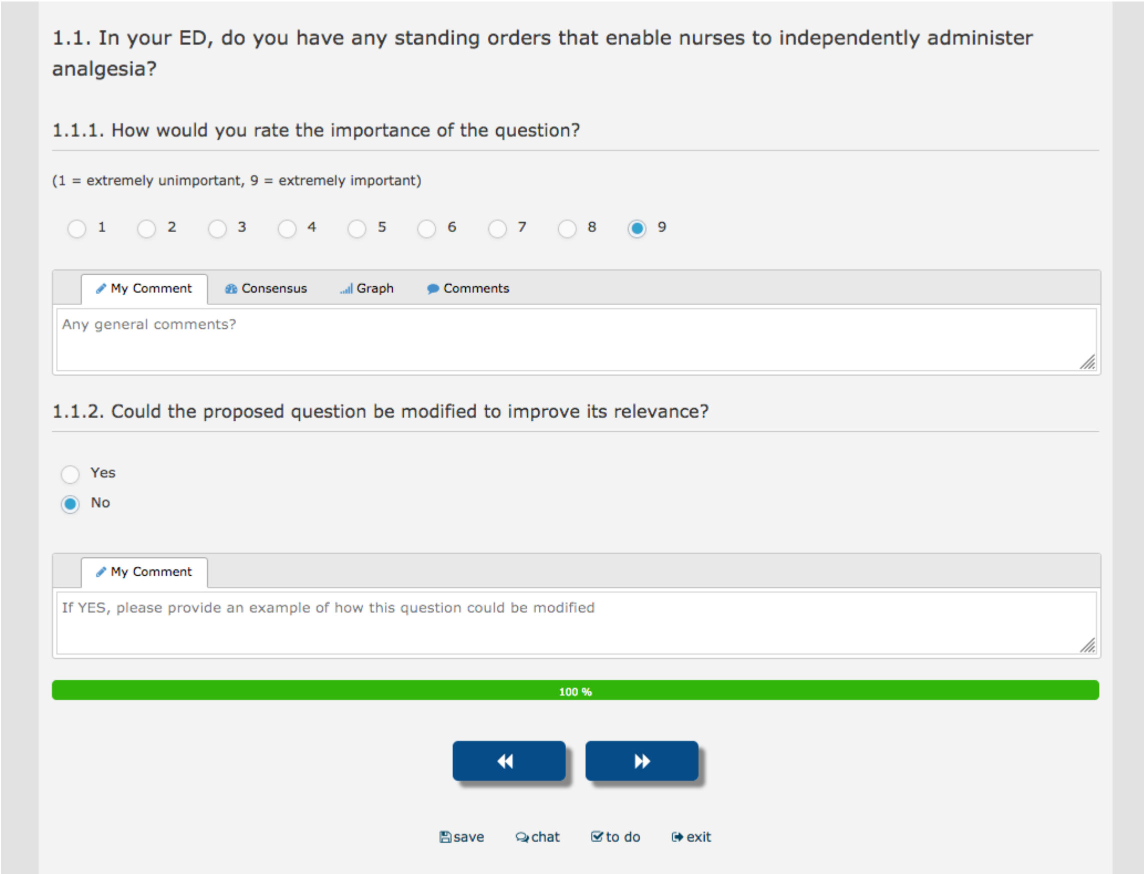


Figure 5.3: Panellist review screen

Delphi consensus level and stability

Traditionally, Delphi studies stop when the survey procedure reaches a pre-determined consensus level (Clibbens et al., 2012). However, as Dajani et al. (1979), and more recently Birko et al. (2015) have highlighted, while consensus is important, it is also meaningless if group stability has not been reached beforehand. As Scheibe et al. (1975) first suggested, stability should be evaluated in Delphi studies to look for resistance to natural centralisation of participant views, rather than simply reporting a percentage of expressed views, which does not reflect the nature of Delphi. In this real-time Delphi study, based on a recent critical review of the literature (Varndell et al., 2021b), an a priori consensus level of 83% (10 out of 12 panel members) was selected. Further, group stability of 1.0 standard deviation or less (De Meyer et al., 2019b) and a Coefficient of Quartile Variation (CQV) value less than 5% was used. This degree of variation is appropriate for a small sample size (<15) with non-binary distribution (Altunkaynak & Gamgam, 2019), and was selected and expressed as:

$$CQV = \left(\frac{Q_3 - Q_1}{Q_3 + Q_1}\right) \text{x } 100$$

Currently, there is no agreement about the Likert scale range to be used in Delphi studies; despite being a common reason cited for study failure (De Meyer et al., 2019a; Diamond et al., 2014; Lange et al., 2020). Likert scales used in Delphi studies exploring aspects of emergency nursing practice have ranged from 4 to 11 (Varndell et al., 2021b). While 5 and 7-point scales are the most common forms of Likert scales used in surveys (Revilla et al., 2013; Weijters et al., 2010), 9-point Likert scales are frequently used in Delphi studies, particularly during the consensus process (De Meyer et al., 2019a; Diamond et al., 2014; Williamson et al., 2017). For this study therefore, a 9-point Likert scale, anchored at each end (1 – extremely unimportant, 9 – most important) was used. Descriptive statistics were then developed in tabular form (Appendix 1).

Of the 75 items initially proposed, 58 (85.3%) reached consensus in the first week of the real-time Delphi. Following feedback from the expert panel members, of the initial 75 items proposed, 12 (16.2%) were modified to improve clarity, and two items were rejected. The items rejected unanimously by the panel were part of the Nurses' Knowledge and Attitudes Survey Regarding Pain survey (Ferrell & McCaffery, 2014), and addressed pain management knowledge in paediatric patients. A further 23 items were added by the expert panel to improve survey scope and depth. The final survey consisted of 98 items divided into four domains: demographics, training and clinical governance, practice, knowledge, belief and values, factors influencing practice and perceptions and piloted prior to being distributed.

Piloting of developed survey

The survey was pilot tested on 40 emergency nurses who regularly worked in the resuscitation area. Pilot participants were recruited from four NSW EDs to pilot test the survey: metropolitan (n=1), regional (n=1) and rural (n=2) area (Table 5.2).

Table 5.2: Characteristics of emergency nurses for survey pilot

Nurse	N (%)
Registered Nurse	22 (55.0)
Clinical Nurse Specialist	8 (20.0)
Nurse Unit Manager	3 (7.5)
Nurse Educator	2 (5.0)
Clinical Nurse Educator	2 (5.0)
Clinical Nurse Consultant	2 (5.0)
Nurse Practitioner	1 (2.5)

Pilot participants were invited to provide feedback on the readability, structure, and flow of the survey using a ten-point Likert scale (1, not appropriate at all to 10, highly appropriate). Questions with a mean score above 5.5 were considered acceptable (Dikken et al., 2015). Average time to complete the survey was 43 minutes (SD 7 minutes). All items had a mean score of 5.5 or greater, and no changes were recommended concerning readability, structure, and flow to the final survey.

The final survey consisted of 98 items. Items 1 to 14 collected demographic information, which included age, gender, role, qualifications, membership to the College of Emergency Nursing Australasia and workplace characteristics. Items 15 to 30 collected information regarding clinical governance, which included information on the use of analgesic standing orders, range of analgesics able to be independently initiated by emergency nurses, and monitoring of acute pain management. Items 31 to 51 collected information regarding the practice of emergency nurses in the assessment and management acute pain. Items 52 to 75 tested respondent's knowledge of acute pain management using the Nurses' Knowledge and Attitudes Survey Regarding Pain survey (Ferrell & McCaffery, 2014) that included three pain management case scenarios. Items 76 to 97 examined the modified Nurse Sedation Practices Scale (NSPS) (Guttormson et al., 2010). The NSPS explored respondent attitudes and factors influencing respondents' acute pain management behaviour and comprised of six subscales: attitudes; subjective norms; analgesia orders and goals; perceived behaviour control; analgesia practices; and intention to use analgesia in mechanically ventilated patients.

Each subscale was scored on a five-point scale ranging from one to five. High scores within each subscale reflected the following:

- Attitudes: a positive evaluation of the efficacy of analgesic medications for relieving acute pain in mechanically ventilated patients
- Subject norms: a strong influence of other emergency nurses on administration of analgesia
- Perceived behavioural control: high degree of influence of non-patient factors on analgesia practices
- Analgesia orders and goals: high degree of perceived independence to determine administration of analgesia
- Analgesia practices: an increased tendency to administer analgesia

The NSPS was modified with permission from the author, items were reviewed and adapted by the panel to the context of the critically ill adult patient. No original items were rejected.

Item 98 of the final survey prompted respondents to reflect on their clinical experience, and to rate the level of pain intensity they believed patients experienced in relation to 26 common resuscitation care procedures performed by or assisted by emergency nurses (Appendix 2).

Phase 1: Cross-sectional survey

Phase 1 was a quantitative, cross-sectional survey conducted between 1st September- 31st October 2018 to (objective 1) explore emergency nurses' knowledged and practices relating to the assessment and monitoring of acute pain in critically ill patients; (objective 2) examine care activities and processes in managing acute pain in the ED; and, (objective 4) examine how emergency nurses influence acute pain management in the ED.

Survey method was chosen for phase 1 as it provided a quantitative description of trends, attitudes, practices and opinions of the population of interest, by studying a sample of that population. Surveys have long been used to assess the knowledge, views and attitudes of healthcare professionals (Edwards et al., 2002), and have frequently been employed to answer questions, or solve problems related to nursing practice (Polit & Beck, 2017). There are several different ways to conduct a survey. The most common methods traditionally have sent written survey questions through the mail or hand-distributing them through a network, asking survey questions over the telephone or conducting face-to-face interviews. However, with the proliferation of computers and smart phones that can access the World Wide Web, the internet is now a popular means of collecting survey data via internet-based survey platforms and electronic surveys (Couper, 2017). Electronic surveys are therefore increasingly used as an alternative survey mode compared to paper, postal or telephone surveys due to their ease of use and cost effectiveness. Hence, the electronic survey data collection technique was selected for Phase 1.

Setting

The setting for phase 1 involved all emergency care facility levels operating within Australia, inclusive of multipurpose services (level 1), through to major metropolitan and trauma designated EDs (level 4).

Sample

Purposive sampling was used to identify potential participants. The target study population consisted of all College of Emergency Nursing Australasia (CENA) members (n=1,157) and attendees at the 16th International Emergency Nursing Conference (n=331). Participants inclusion criteria included: registered nurse currently employed in an emergency care setting in Australia, working independently in the resuscitation area and had managed a critically ill (ATS category 1 or 2) adult patient (aged 16 years or older) in the last 6 months.

Recruitment

All potential participants were sent an email detailing the purpose of the study and a link to the online survey. Three strategies were used to optimise recruitment. First, the survey was released to coincide with International Emergency Nursing Week (October 8th – 14th 2018), to capitalise on a time when the emergency nurse community comes together to celebrate and share knowledge. Second, the lead professional body representing emergency nurses in Australia, the College of Emergency Nurses Australasia (CENA) gave permission (CENA/RC/2018/06) to advertise the survey directly to its members (n=1,157) via email and through its social media accounts. Finally, the researcher was given permission to advertise the study to attendees (n=331) at the 16th International Conference for Emergency Nursing (October 10th – 12th 2018), by placing a postcard (Appendix 3) into conference satchels. Both the email and postcard were sent to CENA members and conference attendees. To support recruitment, the survey was adverstised on the conference's social media platforms.

Survey distribution

The online survey was hosted by Qualtrics (Qualtrics, 2019, St George), an internet-based survey platform designed to capture research data in a secure environment. The survey was recreated online by the researcher. The accuracy of the online survey was then verified by the researcher and their supervisors. Information regarding the purpose of the survey and data management was provided to potential participants on the survey's introduction page. Prior to entering the survey, participants were asked to confirm that they met all inclusion criteria, and to affirm that they were willing to participate in the survey.

Use of an online survey was chosen for distribution for several reasons. First, an online survey was an economical and efficient way of covering a large study population geographically dispersed across Australia (Scott et al., 2011). Second, using an online survey gave the participant anonymity (Braun et al., 2021); an important ethical consideration. Finally, participants had the opportunity to choose the time and place that was most convenient to them, to complete the survey. Such a method is relatively free of bias on the part of the researcher with the participants usually feeling free to answer as honestly as possible (Couper, 2017). Rates of return are important in survey method research, with a higher response rate reflecting a truer representation of opinions of a target group, and decreasing the risk of bias (Robson & McCartan, 2015). Response rates to electronic surveys are known to be lower than those of postal surveys although, response rates have been reported to vary from 11% to 88% (Meyer et al., 2012; Varndell et al., 2019). However, a response rate of 30% or greater is generally considered acceptable (Jirojwong et al., 2014).

While data collected in a quantitative survey can be comprehensive and informative, participants are limited to standard responses. Thus, quantitative surveys, by themselves, do not have a great level of explanatory power as qualitative methods. In a mixed-methods study, the qualitative phase therefore, offers the opportunity to explore such areas in depth with observation and interviews (Bazeley, 2018b).

Phase 2: Non-participant observations and semi-structured interviews

Phase 2 built upon the findings of phase 1, by conducting non-participant observations and semi-structured interviews to (objective 2) investigate the practices and behaviours of emergency nurses in management of acute pain in critically ill patients in the resuscitation area; (objective 3) examine how emergency nurses influence acute pain management in the ED; and, (objective 4) identify possible factors or barriers influencing acute pain management by emergency nurses. Non-participant observations and semi-structured interviews were conducted between 16th November and 11th December 2020 at two NSW EDs not directly associated with the researcher. This section opens with a description of the impact of COVID 19 pandemic had on the study, then the setting and recruitment strategies used.

COVID-19 impact on phase 2

In January 2020, prior to commencement of phase 2, the COVID-19 pandemic emerged in Australia (Rockett et al., 2020). The emergence of such a highly contagious disease resulted in strict infection prevention and control precautions with community restrictions being mandated, including restricting non-urgent travel and minimum social distancing requirements. As part of the Australian Health Sector Emergency Response Plan for Novel Coronavirus COVID-19 (Australian Government Department of Health, 2020), access to hospitals including emergency departments were restricted, and available treatment spaces divided into two or three zones: cold, warm and hot. Cold and hot zones included resuscitation beds, with patients confirmed or suspected of being infected with SARS-CoV-2 would be treated. The impact of COVID-19 meant that phase 2 was delayed until the rate of infection and risk of COVID-19 transmission in the community was deemed low and manageable through safety planning (Appendix 4).

Setting

Two NSW metropolitan trauma designated EDs, each with a 2020 patient census of approximately 80,000 emergency presentations (Table 5.3).

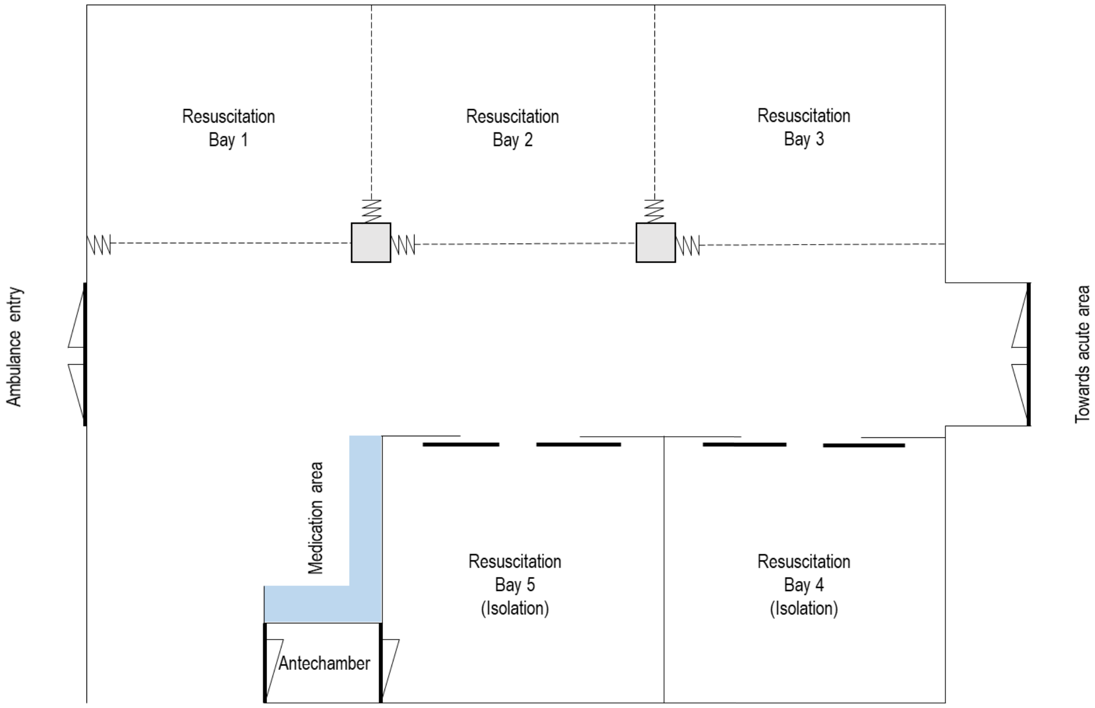
Table 5.3: Total number of patient presentations in 2020 by triage category per study site

ATS category	Site 1	Site 2
1	685 (0.9)	1115 (1.4)
2	10453 (13.1)	16774 (20.7)
3	35440 (44.3)	23352 (28.8)
4	23313 (29.1)	28381 (35.0)
5	10106 (12.6)	11423 (14.1)
Total	**79997 (100.0)**	**81045 (100.0)**

Source: Bureau of Health Information (2023)

Site 1

Site 1, located in the southern suburbs of Sydney, provided emergency care for adult and paediatric patients. At the time of data collection, the nursing staffing allocation was 154 full-time equivalent (FTE) nurses. The department operated 58 treatment spaces divided across the resuscitation area (n=3), acute area (n=31), fast track zone (n=6), paediatric area (n=8) and an ED short stay unit (n=10). The resuscitation area was located at one end of the department, with direct access from the acute area and ambulance bay parking area. The resuscitation bay comprised three open planned treatment areas separated by a curtain, with two further resuscitation beds with isolation capabilities facing them. Each resuscitation bay was equipped with overhead lighting, cardiac arrest trolley, mechanical ventilator and vital sign monitoring equipment (Figure 5.4).

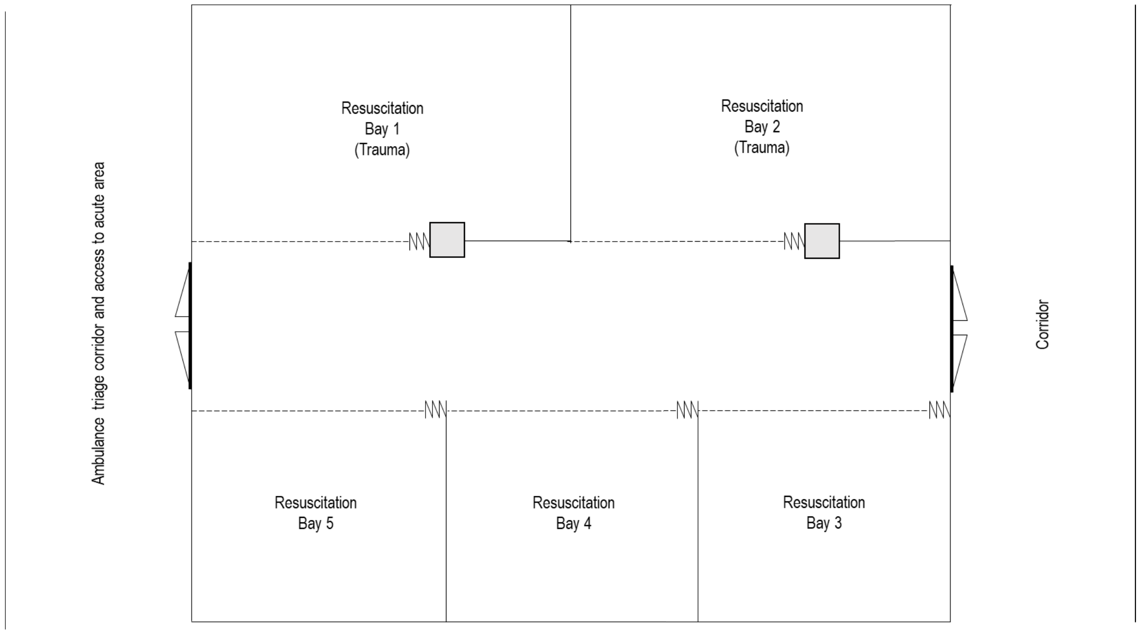


Key: curtain and track, door, pillar, sliding door, solid wall.

Figure 5.4: Site 1 emergency department resuscitation area

Site 2

Site 2 was in situated in north Sydney and provides emergency care to adult and paediatric patients. At the time of data collection, the nursing staffing allocation was 145 FTE nurses. The department operated 82 treatment spaces divided across the resuscitation area (n=5), acute area (n=29), fast track zone (n=16), paediatric area (n=18) and an ED short stay unit (n=14). The resuscitation area was located adjacent to the ambulance triage area and an administration corridor. The resuscitation area comprised of five individual bay areas, with two bays designed specially to manage trauma (Figure 5.5).



Key: curtain and track, door, pillar, solid wall.

Figure 5.5: Site 2 emergency department resuscitation area

Each resuscitation bay area was equipped with overhead lighting, cardiac arrest trolley, mechanical ventilator and vital sign monitoring equipment. Two of the resuscitation bays had overhead gantry X-ray machines. Specialised trolleys were arranged around the bay area and provided storage for clinical equipment used in the care of patients. The ambulance radio was located in resuscitation bay 4.

Sample

A purposive sampling strategy was used for the non-participant observation and semi structured interview data collection. Purposive sampling was selected to capture a range of clinical experiences from emergency nurses. However, the relationship between the quantitative and qualitative samples must be considered (Palinkas et al., 2015) in mixed-methods research. For explanatory sequential designs, it is suggested that participants in the qualitative phase be drawn from either those who participated in the quantitative phase, or selected using similar inclusion criteria; as new participants may cause inconsistencies in the inferences (Collins et al., 2007). Consequently, only permanently employed ED staff were invited to participate in non-participant observation and semi structured interviews. Participant inclusion criteria included: registered nurse with over 12-months experience working independently in the resuscitation area, and managing a critically ill (ATS category 1 or 2) adult patient (aged 16 years or older).

In qualitative research, the sample size must be large enough to identify themes and concepts within the data (Schreier, 2012). As noted earlier, the focus of qualitative methods is about a phenomenon or event rather than a person, so the emphasis was on the quality of data obtained rather than the number of participants (Sandelowski 1995).

The length of observation cannot be determined a priori in qualitative studies. However, it is necessary to collect data until saturation is reached; that is, when no new themes or concepts emerge from the data (DeWalt & DeWalt, 2002). Therefore, for the purposes of non-participant observation, the researcher observed over 40 critically ill patients, spending approximately 160 hours over a 4-week period in the two departments. This timeframe was selected to allow sufficient opportunity to observe a wide variety of critically ill patients being managed in the resuscitation area, as well as for the researcher to be accepted within a sub-culture and come to learn and understand the way emergency nurses view their world (Schwartz-Barcott et al., 2002) in the study settings.

Following observation, all participants were invited to take part in a semi-structured interview. Determining an appropriate sample size for semi-structured interviews with experience in managing acute pain in critically ill adult patients was guided by available literature and data saturation. From the literature, sample size recommendations ranged from 5 to 60 (Constantinou et al., 2017; Guest et al., 2006; Hagaman & Wutich, 2017) for in-depth interviews. A sample size of 12 to15 per study site was considered appropriate. To ensure data saturation was achieved, the researcher adopted a cyclical approach during collection of interview data; continually comparing and contrasting findings until no new patterns were identified (Hennink & Kaiser, 2022).

Recruitment

At each study site the researcher was introduced by the emergency nursing leadership team and became familiar with each department. Information about the study was distributed at department meetings, and posters were placed on staff information boards by the clinical nurse consultants (CNCs) at each study site prior to commencing data collection.

In order to recruit potential participants, the researcher first sent a formal letter outlining the study to the CNC, Nurse Manager and ED Director of Research. A follow-up meeting with each of the above senior staff was then arranged. The meeting lasted one hour and took place two months before the planned start date to provide ample opportunity for consideration of the study, build positive relationships and identify a suitable timeframe to recruit for interviews. Next, following site governance approval to conduct the study, the CNC and Nurse Manager discussed the study during nursing in-service sessions, and placed posters advertising the study on the staff information board. Following this, the researcher approached potential participants on duty in the resuscitation area throughout the study period. The researcher explained the study and obtained written consent prior to observing potential participants working in the resuscitation area, and again prior to being interviewed. Written information was provided to potential participants in the form of a study information sheet. The information sheet explained that the overarching purpose of the study was to examine how emergency nurses cared for critically ill patients. The specific focus of the study, nurse management of acute pain, was omitted to avoid unduly influencing participant's performance (e.g. Hawthorn effect) (Baxter et al., 2015). The researcher allowed them time to read this information and answer any questions they had. Participants were made aware that the observation or interview could be ceased at any time upon request, or when in the resuscitation room by closing the curtains around the patient's bed area. If the participant agreed, they then signed a consent form prior to being observed and again prior to being interviewed. Participants were observed prior to being interviewed. Prior to commencing data collection, the researcher verbally confirmed the participant's consent.

Non-participant observations

Non-participant observation involves observing participants without actively participating, and is a commonly used data collection method in emergency healthcare research (Busetto et al., 2020; Jamshed, 2014). Non-participant observation is a qualitative research strategy that offers the unique opportunity for researchers to be immersed in the context they are studying and understand a social scene without interacting directly. Researchers may engage in non-participant observation for a number of reasons. In this study, non-participant observation was selected to examine nursing practice, behaviours and interactions as they happened naturally in the resuscitation area, without interfering with or changing it (Eldh et al., 2020). Data from non-participant observations records naturally occurring events and contextual factors such as processes, environmental, personal and social features, and builds understanding of the influencing structures and processes that can impact on nurses and patient outcomes (Walshe et al., 2012). By combining observational and interview data, it can therefore highlight disparities between reported practice and actual practice (Busetto et al., 2020; Eldh et al., 2020; Jamshed, 2014).

Non-participant observation data collection can be structured or unstructured, depending on the research question/s (Mulhall, 2003). For this study, unstructured observation was selected, to provide a clearer and a more in-depth understanding of the reality, agency and behaviour of emergency nurses' practice in the resuscitation area; observing what nurses do in everyday practice (Bunkenborg et al., 2013; Luck et al., 2007; Ogunlade et al., 2020). Consenting participants during observation were also encouraged to talk and explain their actions. This provided data from which to understand the participant's thought processes, particularly the outcomes of their pain management decision-making processes (Aitken et al., 2011).

A common concern regarding observation methods, is that participants may alter how they would otherwise naturally behaviour because they are aware of being observed; potentially jeopardising the validity and reliability of the study. This effect, first described in a study conducted in 1924 at Western Electric's Hawthorn Works plant in Illinois, USA, for which the phenomena is named after (Landsberger, 1957), has long since been criticised for overstating the influence of observation on participant behaviour (Adair, 1984; Levitt & List, 2011; McCambridge et al., 2014). Indeed, studies in healthcare environments have found any influence of observation on clinicians' behaviour to be minimal (Gilmartin-Thomas et al., 2018; Svensberg et al., 2021). The presence of the researcher in the resuscitation area over a prolonged period, and the exceptional busyness of the clinical environment, made it unlikely there were any significant or ongoing behavioural changes thus reducing the Hawthorn effect.

Field notes

The qualitative method of field notes was used to capture and contextualise nursing activities and behaviours, such as the assessment and management of acute pain, that cannot be easily quantified during observation (Phillippi & Lauderdale, 2018). Field notes are an unobtrusive way of recording events and interpretations of data, which can place participants at ease (Tracy, 2019), and are an important data source that can strengthen analysis and depth of understanding (Saks & Allsop, 2013).

Field notes were handwritten in a A4 notebook. Field notes involved descriptive observations on entering the scene, allowing the researcher to become immersed in the variety of events that occurred within the resuscitation bay of each study site. This information assisted the researcher to identify where best to position themselves to observe nursing practice without being a hindrance. Further, questions to prompt the researcher during observations were guided by the work of LeCompt et al. (2000) and Dewalt and Dewalt (2002). This strategy forms the use of the 'who', 'what', 'where', 'when' and 'why' questions to explore and interpret the flow of emergency nurses' interactions and behaviours in everyday contexts within the field (i.e. resuscitation area/environment) under the conditions in which they would naturally occur. Field notes become a record and a data point during the data analysis and writing process. As such, it was important that observations, descriptions and interpretations were clearly indicated and differentiated throughout writing field notes with personal memos; ensuring the phenomenon recorded and analyses were credible and had authentic merit (Billups, 2020). Table 5.4 illustrates how field notes were analysed throughout the research process.

Table 5.4: Nine dimensions of observation

Observation dimension	Description
Space	Physical layout of the place(s)
Activity	A set of related activities that occur
Act	Single actions people undertake
Time	The sequencing of events that occur
Actor	Range of people/staff involved
Object	The physical things that are present
Event	Activities that people carry out
Goal	Things that people are trying to accomplish

Source: Ayton et al. (2023)

Field note data ensured names of departments/wards, staff and patients were coded to ensure anonymity, and were transcribed into a Microsoft Word document after the observation period, to ensure accuracy and strengthen data quality. For dependability and audibility purposes, each entry was coded to the study site and period of observation. Following advice by Neuman (2011) descriptive information was kept separate from personal reflections for data validity and reliability purposes (Deggs & Hernandez, 2018). Descriptive information included for example, observed nursing activities, frequency of nursing pain management practices, the number and type of critically ill patients in the resuscitation area, staffing, nurse-patient interactions, responses to informal questions and conversations.

The field notes also provided opportunity for personal reflections that included thoughts on any bias or ambiguities the researcher was aware of, or any assumptions or inferences about how the observations may relate to the study aim and objectives. To strengthen rigour and reduce potential observer bias, the researcher's suppositions regarding the data were reviewed in concert with the researcher's supervisors, to explore for alternative interpretations and meaning, and to ensure that the researcher's reflections were sufficiently supported by contextual information (Mc Sweeney, 2021).

Informal questioning

During non-participant observations, clarification and probing using informal questioning can strengthen understanding and ensure accuracy and understanding of field note data. Informal questioning are natural conversations, and are different from semi-structured interviews, where discussions occur in a more formalised way (Swain & King, 2022). Informal questioning during observation enabled the researcher to explore the cognitive processes behind nursing practices that were not directly observable (Phillippi & Lauderdale, 2017). To avoid distracting the nurse at a critical time, the researcher waited until the participant stepped away from the patient's bedside to indicate (raised hand) that they had a question. Responses were documented within the field note associated with the observation. During observations, informal questioning enabled the researcher to obtain as full a picture of the context surrounding nurse-patient interactions, patient characteristics (e.g. age, sex) and acuity (e.g. triage category, presenting complaint) of the critically ill patient. Participant responses to informal questions concerning patient characteristics and acuity were de-identified, and have been placed in the appendix (Appendix 5) for reference, and linked to their respective quote within the thesis (e.g. field note, date, care episode #12).

Researcher as observer

The researcher is a Clinical Nurse Consultant (CNC) with extensive experience in emergency and critical care nursing and so being in the clinical field is not without its challenges. In addition to being time consuming, there is the potential for a nurse researcher to experience role conflict (Baillie, 1995). For example, conflict can arise when incorrect nursing practice is observed or when the department is strained to meet patient's needs (e.g. short staffed, surge in patient presentations) and the researcher experiences guilt for not helping in the care of patients (Robertson and Boyle, 1985). Nurse researchers have a tendency to go into work mode (Morse and Lipson, 1989). The dilemma occurs when these two roles are confused and the nurse researcher feels a need to advocate on a patient's behalf (Roper and Shapira, 2000). While the researcher conducted the research in a different setting, it is a clinical setting that was familiar to the researcher. The participants in the proposed observational study are emergency nurses and not patients; however, the role of the researcher is to observe nurses' practices and interactions with critically ill patients and the care team. Observing practice can be stressful (Pincombe et al., 2003), even as a non-participant observer a *"…duty of care with regards to the patients being observed"* exists (Pincombe et al., 2003, p15). Several strategies were developed in consultation with supervisors to guide the researcher should an emergency situation (e.g. medical emergency) arise. These strategies were then shared with the study site leadership team. Any such incidences were recorded in the researcher's field notes and reflected upon with the research team and has formed part of this thesis (Table 5.5).

Table 5.5: Strategies to guide research actions during an emergency situation

Situation	Intervention
General enquiry from patient/visitor	• Direct patient/visitor towards nearest nurse • Guide patient/visitor in how to summon a nurse using the nurse call bell
A patient/visitor is experiencing a life-threatening event, e.g. cardiac arrest	• Activate emergency call bell • Commence basic life support • Handover to emergency care team
Patient's/visitor's lives are at risk e.g. a fire	• Activate nearest fire alarm • Follow instructions of department staff
No nurse is present, and the patient is in immediate danger of sustaining an injury, e.g. a fall	• Activate nurse or emergency call bell • Communicate with and orientate the patient • Handover to emergency care team

Reflection is a very important mental activity, both in professional life and when conducting qualitative research to account for how subjectivity shaped nuanced judgements concerning real-world data (Olmos-Vega et al., 2023). As an instrument for data collection, the values, attitudes and biases of the researcher can distort the design, conduct, selection and interpretation of data (Mortari, 2015); what Hesse-Biber refers to as altering *"the context of discovery"* (Hesse-Biber, 2010, p.188). In this study the researcher maintained a journal to recall and evaluate actions, reactions, thoughts and feelings when undertaking observations in the resuscitation area and when being debriefed. Importantly, the researcher adopted a reflexive stance, to maintain awareness of and to critically reflect upon their prior knowledge, experiences, skills and voice within the analysis which may impact on the study (Lichtman, 2014). As the researcher is a CNC in emergency care and planned to observe and interview emergency nurses it was important to remain aware of the researcher's presence in the research, the possible influence and power brought to bear upon the work observations and interviews, and how the participant was presented within text (Bott, 2010). Finally, a higher research degree is more than just completing this research project, it is about developing as a researcher and growing transferrable skills. Recording such professional development and the events and interactions that led to it, is important to understanding the self in context (Greene, 2007).

Document review and artefacts

To assist the researcher's understanding of an environment during non-participant observations, secondary data sources such as documents and artefacts can strengthen understanding of the context (Allen, 2017).

Document review and artifacts collected included training materials, medical forms, and posters. Within the ED and specifically the resuscitation areas of each site, the researcher obtained permission to acquire copies of documents and to photograph the layout of clinical spaces and positioning of artefacts used by emergency nurses while working in the resuscitation area. Importantly, checklists, flow sheets and charts are individualised to a clinical setting, and sometimes to a type of clinician such as a nurse, and can be taken to reflect and represent that clinical setting, practice or person. Exploring what a checklist, flow sheet and chart emphasises can provide important insight into the type of care expected in the context of the clinical environment. Further, observing an artifact in everyday use can also provide valuable insight into when they are used and by whom (Silverman, 2020). Documents, such as orientation nursing workbooks, are products that reflect the interests and perspectives of the clinicians / nurses and carry the collective values and expected outcomes of the department reference. These document types provided insight into expected knowledge, skills, and practices of those working in the resuscitation area. Blank copies of checklists, flow sheets and charts (i.e. artefacts) used in daily nursing routines, or to guide practice in the resuscitation area were obtained with permission to support reflections and analyses (Edwards & I'Anson, 2020).

Semi-structured interview

Semi-structured interview was also a selected data collection technique for Phase 2. Semi-structured interviews assisted the researcher to expand upon observations made in the resuscitation area, to further: (objective 3) identify factors, perceived facilitators, barriers and workplace characteristics that influence emergency nurses' practice in pain management of critically ill patients; and (objective 4) explore how emergency nurses influence pain management decisions or act independently when caring for a critically ill patient. Interviews were commenced within a few minutes after observation so as to assist with contextual understanding and become familiar with the scene.

Interviewing is the most common format of data collection in qualitative research (Newington et al., 2022). The use of semi-structured interview format, provided the opportunity to introduce more detail and nuance into questions incorporate participant responses in order to probe experiences/opinions and increase rapport and participant engagement (DeJonckheere & Vaughn, 2019). In addition, the semi-structured interview format enabled areas of uncertainty or ambiguity to be clarified by the researcher in participants' own words, thereby avoiding misunderstanding and possible anticipation of conclusions that might arise in other qualitative techniques such as a self-report questionnaire. To further limit researcher bias, the researcher adopted an active listener position to further reduce any influence on participant responses (Silverman, 2020). Participants were interviewed as soon as practicable following the observation period; ensuring patient care or staff breaks were not interrupted whilst reducing participant recall bias.

A conversational style interviewing technique was used to optimise participant understanding of the topic area (Anderson & Jack, 2013; Kelly, 2011), and to promote engaging discussion regarding participants' clinical experiences of managing acute pain in critically ill adult patients. Open–ended questions were used to allow a deeper and more enriched telling of each participant's clinical experiences, by not restraining or confining their responses (Heaton, 2004; Silverman, 2020). To facilitate building rapport with participants, the researcher wore plain civilian clothing and introduced themselves as a research student. Throughout the interview, if a participant became distressed, the interview would be stopped and comfort measures initiated (e.g. glass of water, tissues). The participant would then be directed to the organisation's employer assistance program.

All interviews were audio-recorded and scheduled in a private room adjacent to the study site, to allow for staff to return to the clinical floor if required. Before each interview the researcher ensured that the room was available, clean and tidy, with chairs arranged appropriately. In order to reduce interruptions, a sign was placed on the door to ensure that other staff members were aware that interviews were being conducted. Each interview lasted no more than 40 minutes (range 19 to 38 minutes) and was guided by an interview schedule comprising of predetermined questions. All interviews were completed without interruption.

Development of interview schedule

Within explanatory sequential mixed-methods design, the phase 2 interview guide was developed following analysis of phase 1 data, to connect the two phases of the study. This was achieved by seeking, comparing, and contrasting participant's views to confirm, disconfirm, or explain aspects of phase 1 survey findings and phase 2 non-participant observations, as well as being informed by the objectives and aim of the study and analytical lens.

The interview schedule was also developed in concert with the researcher's supervisors (n=2) and an external Clinical Nurse Consultant in pain management, not associated with the study. All advisors had over ten years' experience in the field of emergency and/or critical care nursing and pain management. Prior to conducting participant interviews, the interview schedule was piloted with the researcher's principal supervisor to assist in estimating the time involved, as well as in pre-empting any problems that may arise during the actual interviews (Malmqvist et al., 2019). Quinn's (2014) framework for semi structured interviews was also used to guide development and includes: background, knowledge, sensory, behaviours/experiences, opinions/values and feelings/emotions questions.

The interview schedule used in this study began with some simple background questions to help put participants at ease (Pope & Mays, 2020). Other questions were either behaviour/experience or opinions/values. Behaviour/experience questions sought to explain phase 1 findings and observations made in the resuscitation area. For example, participants were asked to explain their experience and decision-making processes (i.e. behaviours) around managing acute pain in critically ill patients. Opinions/values questions asked participants' opinions around the role of the emergency nurse in managing acute pain in critically ill adult patients. For example, participants were asked their opinion about nurses' contribution to pain management in the resuscitation area.

Interview schedule

The interview schedule consisted of 18 questions (14 open-ended questions and 4 self-rating questions), designed to explore the clinical experiences of assessing, monitoring and managing acute pain in critically ill adult patients. Questions were structured to be open-ended to enable participants to respond in their own words, and the freedom to describe their everyday experiences with as much detail as needed (Semyonov-Tal & Lewin-Epstein, 2021). Finally a 10-point Likert scales anchored at either end (1=no confidence and 10=highly confident) were used as a means to quantify the participant's level of confidence in relation to the previous question (Maxwell, 2010). The responses were then used to describe the sample and highlight any divergent cases. The interview schedule questions described as follows demonstrates a further element of how the sequential mixed-methods approach was used within the study.

Question one invited participants to describe what they viewed as the role of analgesia in critically ill patients in ED. The impetus for this initial question was to focus the participant to the topic of study (Bernard, 2017). Responses to this question were expanded upon to explore what participants attributed to the role of analgesia from their experiences of caring for critically ill patients in the ED.

Question two built upon question one and positioned the participant to consider the role of the emergency nurse in the resuscitation area, and how important it may be in managing acute pain in critically ill patients; the purpose was to expand on what direct and indirect care was provided in relation to pain management.

Question three asked participants to report on how they assess for pain in critically ill patients; the purpose was to expand upon phase 1 findings regarding what pain management training nurses received, what pain assessment instruments they used that guide their assessment and management of acute pain in critically ill patients, and to further compare and contrast observations made in the resuscitation area.

Question four then asked participants to draw on their experience to provide examples of the nurses' role in managing acute pain in critically ill patients. This question was added to position the participant as the care provider in the resuscitation area.

Question five required participants to detail what pain management knowledge they thought an emergency nurse would require, in order to safely care for a critically ill patients in the resuscitation area.

Question six then addressed what skills emergency nurses required to safely deliver analgesia to critically ill patients. From searching the Australian literature, no recommendations were found regarding the knowledge and skills emergency nurses needed to work in the resuscitation area and manage acute pain in critically ill patients. Given the lack of available evidence, questions three, four, five and six were added to the interview schedule to explore what essential knowledge and skills needed to be mastered by nurses transitioning into the resuscitation bay and to manage acute pain in critically ill patients.

Question seven asked participants to discuss and then rate (1 = no at all confident, 10 = extremely confident) their level of confidence in managing acute pain in critically ill patients. Further, in this question, the researcher compared the participants responses to question four through to six regarding their knowledge, skills and safety issues experienced in managing acute pain in critically ill patients in the resuscitation area.

Question eight built on question seven, and asked participants to describe what resources they used to make decisions regarding managing acute pain in critically ill patients.

Questions nine through to eleven invited participants to highlight situations in which they felt supported or unsupported in managing acute pain in critically ill patients.

This was followed by questions twelve and thirteen that asked participants to describe what made managing acute pain in critically ill patients easier or more difficult respectively. From Phase 1 findings, emergency nurses indicated what factors influenced their administration of analgesia to critically ill patients, including staffing, workload, and communication of pain management goals, so questions eight through to thirteen were added to expand upon the area of support.

Question fourteen invited participants to talk about and then rate (1 = no at all confident, 10 = extremely confident) their level of confidence in managing difficulties associated with acute pain in critically ill patients. Additionally, in this question, the researcher contrasted participants' responses regarding their experiences around support, barriers, and enablers in managing acute pain in critically ill patients in the resuscitation area.

Question fifteen asked participants to discuss how they determined the adequacy of pain management in critically ill patients.

Question sixteen invited participants to discuss and rate (1 = no at all confident, 10 = extremely confident) their confidence in altering analgesia being administered to critically ill patients. In phase 1, participants were asked how often they request analgesia to manage acute pain in critically ill patients, and how they would recognise if critically ill patients were under or over analgesed. Findings also highlighted the importance to explore the experiences that emergency nurses had in relation to safe administration of analgesia in the resuscitation area.

Question seventeen asked participants to discuss what analgesia they would use to relieve pain in critically ill patients. This was followed by question eighteen, which invited participants to discuss and rate (1 = no at all confident, 10 = extremely confident) their confidence in initiating analgesia to manage acute pain in critically ill patients. In phase 1, participants were asked a range of question concerning choice of analgesia, pharmacokinetics and detecting potential adverse effects.

Data management and analysis

The explanatory sequential mixed-methods study selected for this thesis used a variety of data collection methods, which included survey, non-participant observation and semi-structured interview. The management and analysis of data related to each method will now be discussed.

Data management

Quantitative data such as survey data were compiled into a separate dataset in SPSS for analysis (IBM, 2016, Armonk) and stored on a restricted-access server at the University of Technology Sydney. Qualitative data (field notes and interview data) were transcribed into a text document and then important into NVivo (version 12) (QRS International Pty Ltd, 2018, Burlington). All electronic data, including Delphi survey data, was stored in a password protected data file stored on a restricted-access server at the University of Technology Sydney. Identifiable documents such as consent forms and the study code master list were stored in a locked filing cabinet at the University of Technology Sydney. All research data was kept secure, and remains protected for five years in line with ethical approval.

Phase 1 data analysis

Phase 1 survey data analysis initially involved the reporting of categorical variables as frequency counts (n) and proportions (%), with mean and standard deviation (SD) or median and inter-quartile range used to describe central tendency for continuous variables. Respondents' acute pain knowledge scores were reported as a percentage and graded using specified criteria: good (≥85%), fair (75-84%) and low (<75%) (Ferrell & McCaffery, 2014). The six subscales of the NSPS were calculated by adding the scores of all items within a subscale and dividing by the number of items answered by each respondent within that subscale. Interpretation of subscale scores was as follows: low, 0-35%; moderate, 36-75%; and high, 76-100%. Internal reliability testing of the NSPS and subscales with seven or more items was assessed using Cronbach alpha, for which 0.6 to 0.8 is acceptable (Rubin, 2009). For subscales containing less than seven items, subscale scores were compared to the combined score of all subscales using Spearman's rank correlation coefficient to highlight linear relationships.

Spearman's rank correlation coefficients (r_s) were calculated to highlight linear relationships between item responses. Interpretation of correlation values were as follows: small, r_s=.10 to .29; medium, r_s=.30 to .49; and, large, r_s=.50 to 1.0 (Cohen, 1988). Potential relationships between item responses were confirmed by scattergrams (Pallant, 2020). Differences in subscale scores by respondent and workplace characteristics were analysed using Kruskall-Wallis tests. A Holm-Bonferroni method was then applied to reduce the possibility of Type I errors (Salkind, 2010), where the corrected P-value for the ith-test denoted $P_{Bonferroni,}\ i|C$ was computed as:

$$P_{Bonferroni,}\ i|C = (C - i + 1) \times P$$

Phase 2 data analysis

Analysis of the qualitative data were conducted in two stages: data preparation and a thematic analysis. The process of data preparation was initiated by transcribing verbatim the observational field notes and recorded spoken works taped during interview into text using Word (Microsoft, 2010, Redmond). On completion of the transcript, the Word document files were then imported into NVivo (version 12). Qualitative data were then analysed thematically and was guided by the process outlined by Braun and Clarke (2006).

First, the researcher familiarised themselves with the data by reading and re-reading interview transcripts until an understanding of the data was achieved. Second, a two-step process was undertaken to generate initial codes. Textual data were segmented into smaller units: groups of words, sentences or paragraphs that contained particular aspects related to the study purposes. After that, each data segment were (re-)read and coded according to the essence identified from the unit of the data; allowing data to be thought of in new and different ways. During this stage, data were from a range of perspectives. Codes were first grouped together according to a commonality or relationship within a group of codes. After codes were categorised, the researcher reviewed each cluster of codes in order to confirm patterns and meaning that accurately connected and expressed the grouped codes. Third, the researcher clustered the codes (patterns) to begin generating themes. Theme generation was supported by memo writing - a constant flow of free writing, reflections and notes. During this fourth step, the researcher reviewed all the themes, codes and supporting interview narratives to ensure that these were logically developed. Themes, codes and supporting narratives were then reviewed and discussed by the researcher in consultation with supervisors to ensure integrity of the data analysis. Finally, rich, thick descriptive narratives were provided to support the themes generated. This process assisted to increase transferability, credibility and trustworthiness of qualitative research findings; allowing other researchers to assess their applicability to other contexts and settings (Younas et al., 2023). Written notes made by the researcher when examining the data were also coded to the period of observation or interview to which they pertained.

Meta-inferences

In the final phase of the explanatory sequential mixed-methods study, findings from phase 1 and phase 2 were integrated into coherent and meaningful meta-inferences (Tashakkori & Teddlie, 2010), and addressed the overall aim of the study to explore emergency nurses' perceptions and practices in managing acute pain in critically ill adult patients. The meta-inference process, guided by complementarity, involved moving inductively and deductively between the Phase 1 and Phase 2 findings and supported by the theoretical lens (Teddlie & Tashakkori, 2009). The complementary process of generating inferences from examining, contrasting and integrating (i.e. weaving or merging) of findings from each of the phases was guided by the work of Bazeley (2018a) (Figure 5.6).

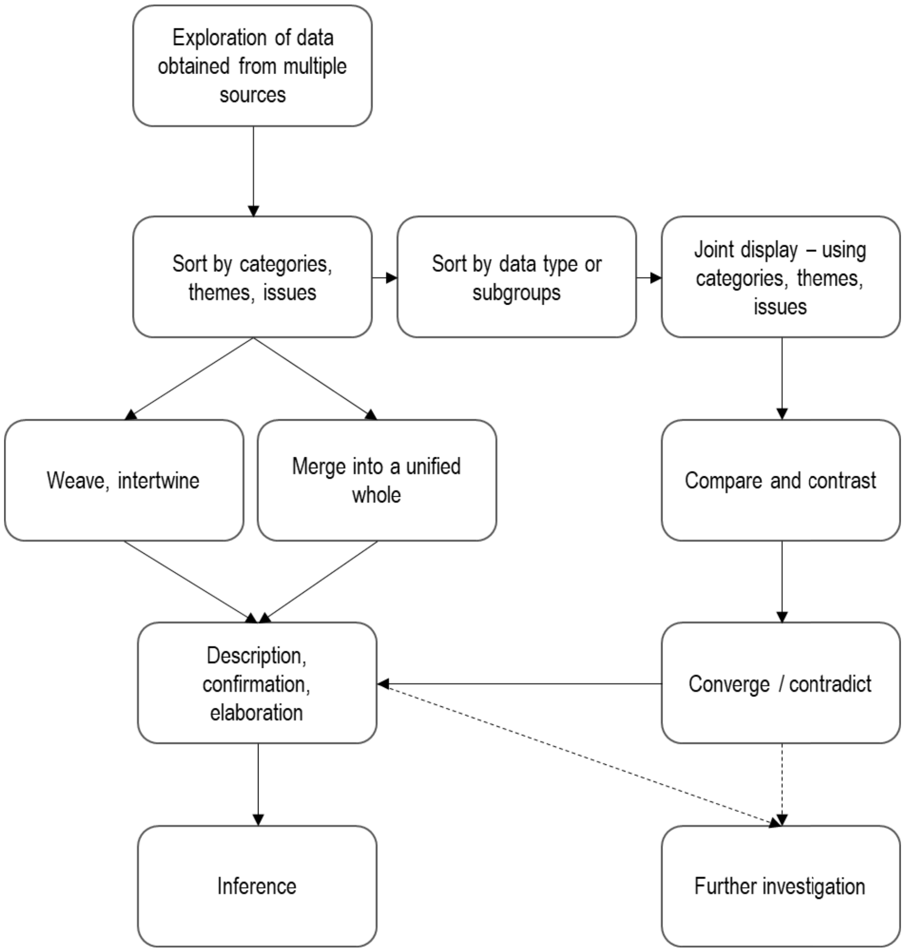


Figure 5.6: **Complementary strategy for developing inferences**

To further enhance mix data integration, interpretation and understanding, the analytical lens was incorporated into the mixed-methods study design. Specifically, items were assigned to the relevant domain of the conceptual model according to Donabedian's list to understand aspects of nurses' perceptions and practices associated with acute pain management in the resuscitation area (Donabedian, 2003).

Validity and rigour

Establishing validity and rigour in mixed-methods study design is achieved through careful and transparent linking of the research objectives, study design and methods (Bazeley, 2012; Greene, 2007; O'Cathain & Thomas, 2006). To enhance study rigour and trustworthiness of findings, the unified validation framework for mixed-methods research can be used in sequential mixed-methods study (Dellinger & Leech, 2007). To strengthen rigour for phase 1 the unified validation framework was used and is comprised of five elements: i) the foundational element; ii) the construct validation element; iii) the inferential consistency element; iv) the utilization/historical element; and, v) the consequential element. The foundational element refers to grounding of the study in existing research and theory.. The foundational element was established through a comprehensive review of the theoretical and empirical literature relating to the assessment and management of acute pain in critically ill adult patients, from which to situate the purpose of this mixed-methods study, data collection methods, findings and inferences (Beach et al., 2006).

The construct validation element refers to the validity of qualitative, quantitative and the mixed-method study design employed within the study (Grand-Guillaume-Perrenoud et al., 2023), and this was addressed using several strategies. First, content validity of the national survey was established through an expert panel (Polit & Beck, 2017). Second, in phase 2, to identify any potential problems the researcher piloted the survey with a representative sample of emergency nurses (Strydom & Delport, 2002). Third, threats to external validity, that the drawing of "incorrect inferences on the sample data to other persons, other settings, and past or future situations" (Creswell et al., 2003, p.171), was minimised by including within the thesis a limitations section reminding readers to use caution in applying the results of this study to other contexts. Fourth, to further improve the transferability of phase 1 and phase 2 findings, analysis and interpretation of both data sets occurred in tandem with the research team (Dellinger, 2005). Fifth, credibility of the development of the national survey findings was established by maintaining an audit trail; demonstrating the origins of theme development (Shenton, 2004). Finally, each question that formed part of the national survey and interview schedule was linked to findings (dependability) from the literature, the Delphi and phase 2 observations (Creswell, 2007), and then evaluated by the expert panel to reduce researcher bias (confirmability) (Joacobsen, 2011).

Similar strategies were used to enhance the construct validation element in phase 2 interviews. First, the researcher read and re-read all interview transcripts in conjunction with listening to the original audio-recording for accuracy, thereby further building upon the credibility and dependability of findings (Lincoln & Guba, 1985). Second, the researcher met with the principal supervisor, an expert in qualitative data analysis to discuss analysis throughout the study and to debrief. Debrief meetings were conducted in a manner consistent with Sandelowski's (1998) conceptualization of outside experts as a resource as opposed to validating findings. These meetings were conducted to explore and minimise researcher biases, and to clarify the basis of interpretation to ensure confirmability in relation to coding and theming of the data (Lincoln & Guba, 1985). Third, thick descriptions of the setting in phase 2 were provided to establish the context for transferability (Lincoln & Guba, 1985). Fourth, credibility of the development of the national survey findings was established by maintaining an audit trail; demonstrating the origins of theme development in the data (Shenton, 2004).

Construct validation also applies to the mixed method study design (Tashakkori & Teddlie, 2010). The researcher address this in several way. First, the proposed explanatory sequential mixed-methods study design was consistent with Tashakkori and Teddlie's (2010) typology of mixed-methods designs. Second, selecting an explanatory sequential mixed-methods study design to examine complex nursing practice phenomena, was consistent with other published peer-reviewed studies (Cameron, 2009; Gulmans et al., 2007; Morgan, 1998; Nastasi et al., 2007; O'Cathain et al., 2004). Third, to enhance the validity and quality of the study design, the researcher published for peer scrutiny the mixed-methods approach used in this study (Varndell et al., 2017). Feedback from peers was noted within a reflexive diary and discussed with the researcher's principal supervisor. Fourth, sampling across two ED sites enhanced the design quality and legitimation (Dellinger & Leech, 2007) of the study and its findings, and was consistent with current mixed-methods research sampling strategies and published research (Onwuegbuzie & Collins, 2007).

The inferential consistency element refers to the degree to which a study's findings agree with previous research (Grand-Guillaume-Perrenoud et al., 2023). In this study, quantitative and qualitative data were integrated sequentially in a systematic manner as per the selected mixed-methods design (Onwuegbuzie & Teddlie, 2003) to form meta-inferences, thereby improving inferential consistency of the study (Dellinger & Leech, 2007). In addition, the researcher presented preliminary findings of the study at peer-reviewed conferences to assess the extent to which the findings resonated with emergency nurses practicing in similar settings (Shenton, 2004).

The utilization/historical element refers to data and inferences that can be used in various circumstances (Dellinger & Leech, 2007), whereas the consequential element refers to the resulting changes from the study, such as changes in practice, behaviour or processes. Data collection methods were selected to enable the mixed-methods research question to be answered. Mixed-methods was selected to explore a unique practice situation, that being emergency nurses' experiences and practices in managing acute pain in critically ill adult patients.

Ethical considerations

The study was conducted in accordance with the values and principles set out in the National Statement on Ethics Conduct in Human Research (National Health and Medical Research Council, 2018), the University of Technology Sydney Research Ethics and Integrity Policy (University of Technology Sydney, 2018), and guided by a universal bioethical framework (Beauchamp & Childress, 2012). Given the sequential nature of the study phases, ethical approval was sought consecutively for each phase. All data were kept secure and protected for five years in keeping with National Statement on Ethical Conduct in Human Research (National Health and Medical Research Council, 2018).

Phase 1 research activities commenced, once permission to conduct the study was granted by the South Eastern Sydney Human Research and Ethics Committee (17/162) as a low-and-negligible-risk study, and ratified by the University of Technology Sydney Human Research and Ethics Committee (ETH17-1915). Following this, site specific approval was then granted by the South Eastern Sydney Human Research and Ethics Committee (17/G/214). Phase 2 research activities commenced, permission to conduct the study was granted by the South Eastern Sydney Human Research and Ethics Committee (ETHI01114) also as a low-and-negligible-risk study, and ratified by the University of Technology Sydney Human Research and

Ethics Committee (ETH17-5135). Following this, site specific approval was then granted by the relevant local Human Research and Ethics Committee at stie 1 (STE03579) and site 2 (STE04480).

All identifiable features of the participants were coded to maintain confidentiality and privacy. As noted earlier, opportunities were provided to explain the study to the nursing and medical team with the assistance of the ED leadership team. The researcher notified the Nurse Manager or a delegated member of the ED leadership team prior to attending the site. An information sheet and consent form were provided to each emergency nurse. Participants were assured that records of observations, interviews and discussions would be kept in a secure place and that they could withdraw or decline to be observed at any time.

Finally, ethical consideration during field work was given to maintaining the integrity of the participants' narratives and interpretations. The methods for data collection and analyses were intended to ensure that the participants' voice and experiences were captured accurately, and reflected the participants' perceptions. To ensure the privacy, confidentiality and comfort of the patient when the researcher was observing in the resuscitation area, the researcher did not enter a closed treatment space (i.e. closed curtains or door). Further, if the clinician, patient or researcher, decided that the presence of the researcher was not appropriate for clinical or privacy reasons, the researcher either waited outside the closed area and coded the activity as 'privacy' or suspended the observation session entirely. It was also made clear to patients that they may also ask the observation to cease at any time although, written consent was given by the nurses.

Summary

The Chapter presented the methods employed in a sequential explanatory mixed-methods design. The quantitative and qualitative study methods were described in detail. In the preparatory phase a quantitative survey was developed using the real-time Delphi method. Phase 1 distributed the survey nationally. In phase 2, non-participant observations and semi-structured interviews were conducted in two metropolitan trauma designated emergency departments. The sampling methods, and data collection and analysis processes were detailed for each phase. The processes employed to collect and analyse data across this mixed-methods study were then described. The following Chapter presents the phase 1 survey results.

CHAPTER 6: PHASE 1 SURVEY RESULTS

Introduction

In this Chapter, the phase 1 survey results are presented. Respondent characteristics are initially presented, detailing the background, carer experience and workplace of the emergency nurses' participants. Findings relating to the training, clinical governance and knowledge of emergency nurses in acute pain management are then described. The findings relating to the beliefs and values of participants are then presented. A description of how emergency nurses assess acute pain and the factors influencing the administration of analgesia is then detailed. Perceptions of emergency nurses are reported concerning the degree of pain intensity of common critical care tasks they believed would be experienced as a patient are then presented. Aspects of phase 1 findings have been published:

> Varndell, W., Fry, M. & Elliott, D. 2020, 'Pain assessment and interventions by nurses in the emergency department: A national survey', Journal Clinical Nursing, vol. 29, no. 13-14, pp. 2352-62.

Respondent characteristics

A total of 488 surveys were returned, with 450 (92.2%) fully completed. Of the completed surveys, 45.8% (n=206) were from members of CENA, 30.4% (n=137) were conference attendees (non-CENA members), and 23.8% (n=107) were completed by Australian nurses accessing the survey via a social media post. Respondents were largely female (85.7%) registered nurses (78.0%), with an average age of 37.5 years (SD 10.7 years), 7 years (IQR 3.5 years) emergency nursing experience, with postgraduate qualifications (n=191; 42.2%).

Respondents commonly (37.5%) worked in major tertiary referral hospitals in NSW (n=246; 54.7%) providing emergency care to both adults and paediatric patients (n=278; 75.5%), that had an annual census of over 75,000. Over half the respondents reported that they worked in non-trauma designated emergency care settings (n=200; 54.6%), with critically ill patients frequently (33.8%) transferred from their ED to other hospitals (Table 6.1).

Table 6.1: Survey respondent characteristics

Characteristic	N (%)
Gender	
Female	386 (85.7)
Male	60 (13.3)
Prefer not to say	4 (0.9)
Role	
Registered Nurse	366 (81.3)
Nurse Manager	31 (6.9)
Nurse Educator	28 (6.2)
Nurse Practitioner	12 (2.7)
Nurse Consultant	11 (2.4)
Nurse Researcher	2 (0.4)
Years of nursing experience, mean (SD)	19.6 (10.9)
Years of emergency nursing experience, mean (SD)	9.6 (7.9)
ED level	
4 – Major tertiary referral hospital	246 (54.7)
3 – Regional hospital	87 (19.3)
2 – Base hospital	72 (16.0)
1 – Multi-purpose service	45 (10.0)
Location	
New South Wales	151 (33.6)
Victoria	98 (21.8)
Queensland	78 (17.3)
South Australia	43 (9.6)
Tasmania	34 (7.6)
Northern Territory	26 (5.8)
Western Australia	26 (5.8)
Australian Capital Territory	20 (4.4)

Of the 450 respondents, 323 (71.8%) were able to independently initiate analgesia to patients using a standing order. Remaining respondents (n=127; 28.2%) unable to initiate analgesia, commonly worked in ED settings based in Western Australia (n=40; 31.5%), Queensland (n=29; 22.8%) and Victoria (n=22; 17.3%).

Training and clinical governance

Respondents able to initiate analgesia using a standing order (n=323; 71.8%) were first required to gain a period of clinical experience and complete a local training program. Emergency nurses typically required 1 to 3 years of clinical experience (n=127; 50.6%), and to have completed a local learning package (n=183; 44.1%), face-to-face course (n=103; 24.8%) or an online learning module (n=87; 21.0%) prior to being able to independently initiate analgesia. Overall, the period of training lasted up to 8 hours (n=181; 40.2%). Training programs commonly included topics such as use and application of standing orders (n=158; 14.1%), pain assessment (n=152; 13.6%), pharmacology (n=120; 10.7%), managing potential side-effects of analgesia (n=101; 9.0%) and alternative pain management strategies (n=90; 8.0%). Less common topics included identifying potential opioid dependency (n=40; 3.6%), judicious use of opioids (n=34; 3.0%), alternative pain management interventions (e.g. nerve blocks) (n=24; 2.1%), use of patient-controlled analgesia (n=22; 2.0%) and assessing pain mechanically ventilated patients (n=14; 1.2%) (Figure 6.1).

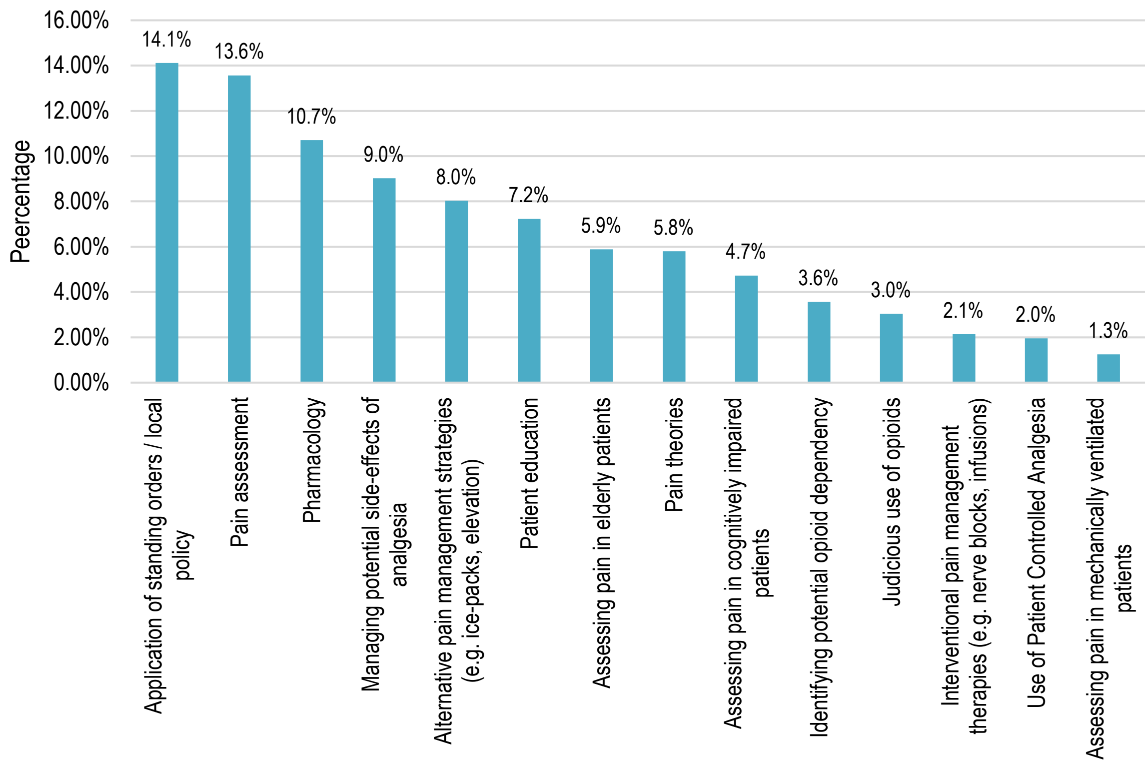


Figure 6.1: Contents of nurse-initiated anaglesia training curriculum

A range of methods were used to assess pain management competency, including completion of a written exam (n=132; 40.9%), clinical scenarios (n=107; 33.1%) and supervised clinical practice (n=86; 26.6%). Most respondents (n=247; 76.5%) received ongoing education regarding pain management as part of the departmental education program, although this occurred infrequently (Sometimes and never, n=149; 46.1%). In addition, regarding department pain management education, over half of respondents (n=165;

51.1%) had attended a pain management course in the previous two years. Respondents delegated to initiate analgesia reported receiving little (never and rarely, n=124; 38.4%) ongoing education or feedback (n=122; 37.8%) on the use and application of analgesic standing orders, once deemed competent.

Once respondents had the required clinical pain management experience and education, they were able to administer a wide range of analgesics according to standing orders; both non-opioid based (n=232, 51.6%), and opioid-based (n=217, 48.2%) (Figure 6.2).

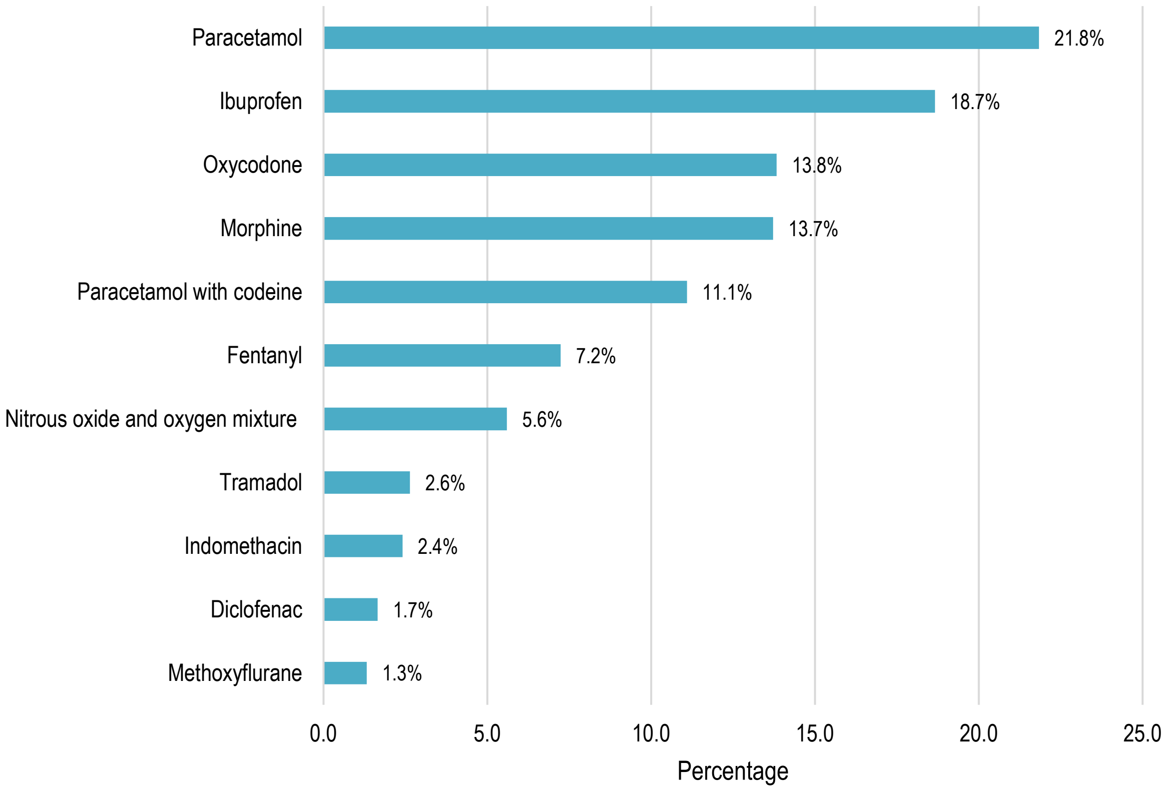


Figure 6.2: Type and percentage of analgesics able to be nurse-initiated

The minimum patient age ranged from 1 to 18 years (11.1% and 37.1% respectively), with maximum patient age ranging from 65 to 75 years (33.3% and 35.8% respectively). The ability to administer additional analgesics following the first episode of nurse-initiated analgesia was low. Few (n=124, 27.6%) respondents were able to administer a repeat dose of analgesia. However, the majority (n=333, 74.0%) believed that the analgesic standing orders used within their ED setting were adequate in managing acute pain, and rarely (n=44, 9.8%) associated with patient harm.

Knowledge domain

Respondents' knowledge of acute pain management was evaluated using the Nurses' Knowledge and Attitudes Survey Regarding Pain survey (Ferrell & McCaffery, 2014). Internal consistency was high (α=.819), with a corrected item-total correlation alpha ranging from .781 to .852.

While over half the respondents (n=263; 58.5%) scored 85% or greater (good), the overall mean score was 60.4% (SD 31.2%), reflecting wide variability in knowledge. Compared to respondents who received little to no (never and sometimes, 60.5%) workplace education on pain management, respondents who received regular (always and most of the time, 39.5%) education had statistically significant (X^2=8.645, df=1; p=.003) higher scores (mean score 69.1% vs. 88.1%) (Figure 6.3).

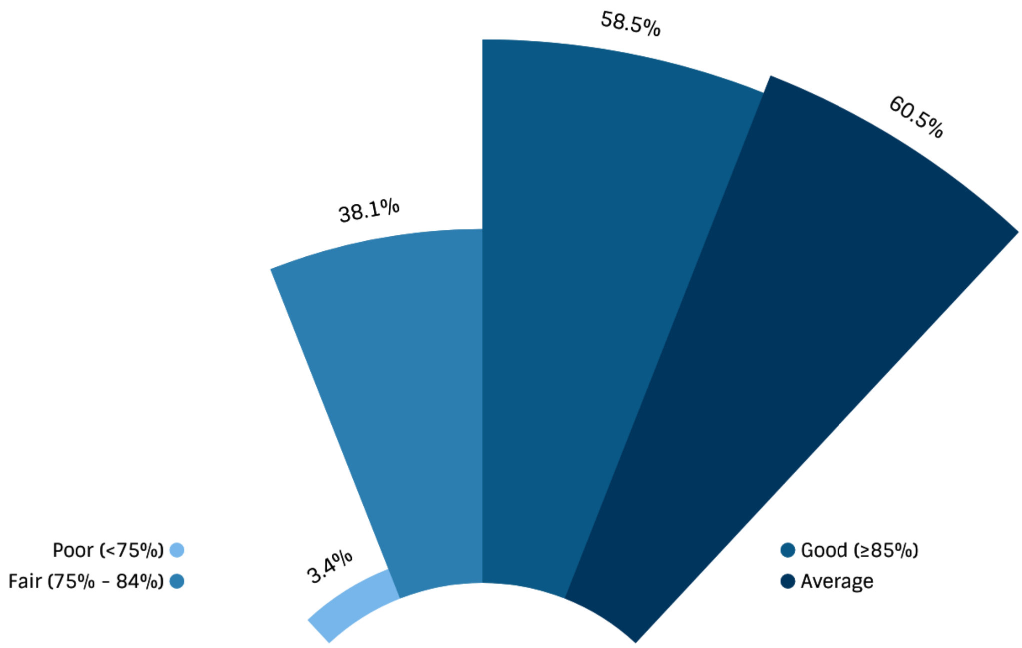


Figure 6.3: Respondents level of acute pain management knowledge

On assessing acute pain management knowledge, respondents broadly demonstrated that they understood the concept that pain is subjective, the presence and intensity of pain is best judged by the patient (n=446, 99.1%) and should not be validated using a placebo (n=432, 96.1%), and the perception of pain is not affected by aging (n=438, 97.4%). Respondents agreed that whether a diagnosis or a source for the pain was known, this should not delay the administration of analgesia (n=434, 96.5%). Conversely, respondents demonstrated moderate to low levels of knowledge regarding the peak and duration of the opioid analgesic morphine (n=374, 83.2%), the acceptableness of using opioid analgesics in elderly patients (n=320, 71.1%), and that patients are not in severe pain if they can be distracted or are able to sleep (n=305, 68.1%) (Table 6.2).

Table 6.2: Respondents acute pain knowledge scores, in order of correct response

Question	Correct answer (%)
Patients should be encouraged to endure as much pain as possible before using an opioid.	False (100.0)
After an initial dose of opioid analgesic is given, subsequent doses should be adjusted in accordance with the individual patient's response.	True (99.1)
A diagnosis is required prior to administering analgesia to the critically ill patient.	False (97.8)
Combining analgesics that work by different mechanisms (e.g. combining an NSAID with an opioid) may result in better pain control with fewer side effects than using a single analgesic agent.	True (97.8)
Due to the ageing process, elderly patients feel less pain.	False (97.4)
If the source of the patient's pain is unknown, opioids should not be used during the pain evaluation period, as this could mask the ability to correctly diagnose the cause of pain.	False (96.5)
Giving patients sterile water by injection (placebo) is a useful test to determine if the pain is real.	False (96.1)
Sedation assessment is recommended during opioid pain management because excessive sedation precedes opioid-induced respiratory depression.	True (96.1)
Opioids should not be used in patients with a history of substance abuse.	False (94.8)
Providing analgesia impairs accurate assessment of the critically ill patient.	False (94.4)
Opioid addiction is defined as a chronic neurobiological disease, characterized by behaviours that include one or more of the following: impaired control over drug use, compulsive use, continued use despite harm, and craving.	True (93.9)
Vital signs are always reliable indicators of the intensity of a patient's pain.	False (90.9)

Question	Correct answer (%)
Regular scheduled analgesia is more effective in controlling acute pain compared to PRN (i.e. when necessary) analgesia	True (90.9)
Patient's spiritual beliefs may lead them to think pain and suffering are necessary.	True (90.1)
The usual duration of analgesia of 2.5-5 mg morphine IV is 4-5 hours.	True (85.8)
The approximate time to peak effect for morphine given IV is less than 20 minutes?	True (83.2)
The term 'equianalgesia' means approximately equal analgesia and is used when referring to the doses of various analgesics that provide approximately the same amount of pain relief.	True (82.7)
Opioid-induced respiratory depression can be easily assessed using intermittent pulse oximetry	False (80.6)
Patients who can be distracted from pain usually do not have severe pain.	False (71.6)
Elderly patients cannot tolerate opioids for pain relief.	False (71.1)
Patients may sleep in spite of severe pain.	True (68.1)
Aspirin and other nonsteroidal anti-inflammatory agents are not effective analgesics for painful bone metastases.	False (63.8)
Benzodiazepines are not effective in relieving acute pain.	True (58.2)
Respiratory depression rarely occurs in patients who have been receiving stable doses of opioids over a period of months.	True (47.4)

Beliefs and values

Most respondents agreed or strongly agreed that it was important to assess for the presence of pain (n=445, 98.9%), and that patients were the most accurate in judging the presence and intensity of pain (n=444, 98.7%); compared to a family member/relative (n=151, 33.5%), attending emergency nurse (n=104, 23.2%) or physician (n=20, 4.9%). The importance of assessing pain amongst patients with life-threatening conditions such as trauma (n=446, 99.1%), burns (n=446, 99.1%), those sedated requiring mechanical ventilation (n=438, 97.3%), or as part of end-of-life care (n=444, 98.7%) was high. Respondents agreed or strongly agreed (n=405, 90.1%) that ‘patient’s spiritual beliefs may lead them to think pain and suffering are necessary’, and that patient’s spiritual beliefs concerning pain should be explored as part of pain management (n=423, 94.1%). Most respondents (n=412, 91.5%) recognised that a patient’s ethnicity or socioeconomic status (n=431, 95.7%) do not predict how a patient will perceive, experience or react to pain.

The majority of respondents did not believe (n=413, 91.8%) that patients with a history of substance abuse should not receive an opioid analgesic, or that administering a placebo (saline injection) would validate whether pain being reported was real (n=432, 96.1%). All respondents (n=450, 100.0%) strongly indicated that administration of an opioid should not be withheld until sufficient pain has been endured by the patient, and that following the initial dose of an opioid analgesic, subsequent doses should be adjusted in accordance with the patient’s response (n=446, 99.1%),even if the source of the pain was unknown (n=435, 96.6%).

Regarding the intensity of pain and nursing response, in the three case scenarios the correct level of pain in the first two scenarios was eight, with the final scenario being eight or above (Appendix 2). In the first case scenario that involved a smiling, joking, and talking patient, 44.0% (n=198) scored the intensity of pain correctly (target score 8, mean score 5.2/10) and 37.1% (n=167) selected the correct analgesic intervention. There was an improvement in performance for the second scenario involving a quiet and grimacing patient, with 53.1% (n=239) correctly scoring the intensity of pain (target score 8, mean score 6.9/10) and 49.1% (n=221) selecting the correct analgesic intervention. In the third scenario that involved an intubated and mechanically ventilated patient grimacing, wincing and scrunching eyes, more nurses (n=266, 59.1%) scored the intensity of pain correctly (target score 8 or above, mean score 7.2/10), with a greater number of participants (n=266, 59.1%) providing the correct analgesia intervention.

While the majority (n=234, 52.1%) of participants correctly scored the level of pain across all three scenarios, less than half (n=218, 48.4%) indicated giving the correct dose of analgesia. Nearly one in three (n=135, 30.1%) elected to give the lowest dose of analgesia, with one in five (n=97, 21.5%) indicated they would not administer or adjust any analgesia.

Pain assessment

Respondents used a variety of pain assessment instruments when evaluating the intensity of pain in adult patients presenting to ED, the most common being the Numerical Rating Scale (32.3%), the Faces Pain Scale (21.2%) and the Verbal Rating Scale (20.7%) (Figure 6.4).

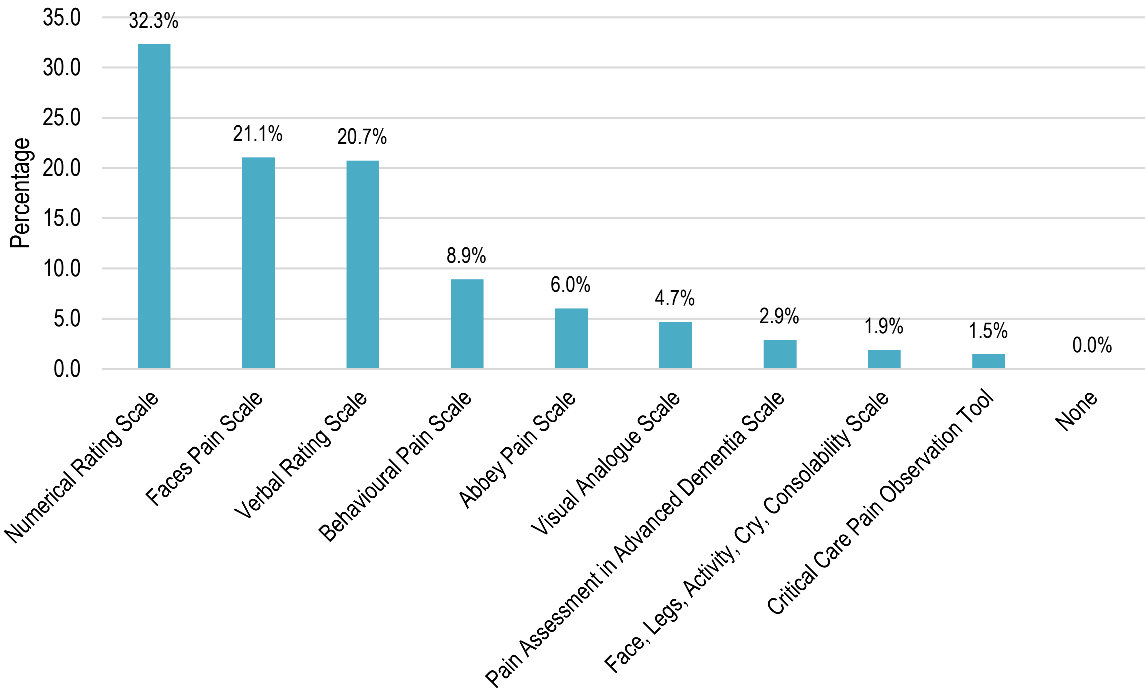


Figure 6.4: Pain assessment instruments used to measure pain intensity

When assessing pain intensity in adult patients requiring mechanical ventilation, a cohort unlikely to be able to verbally communicate, most respondents (n=239, 53.1%) reported using no instrument to assess for the presence or intensity of pain. Specific pain assessment instruments that were used included the Behavioural Pain Scale (12.7%), Critical Care Pain Observation Tool (13.8%) and Faces Pain Scale (11.9%). Respondents (n=54, 11.9%) also reported judging the presence and intensity of pain by monitoring changes in patient vital signs (e.g. respiratory and heart rate, blood pressure) (Figure 6.5).

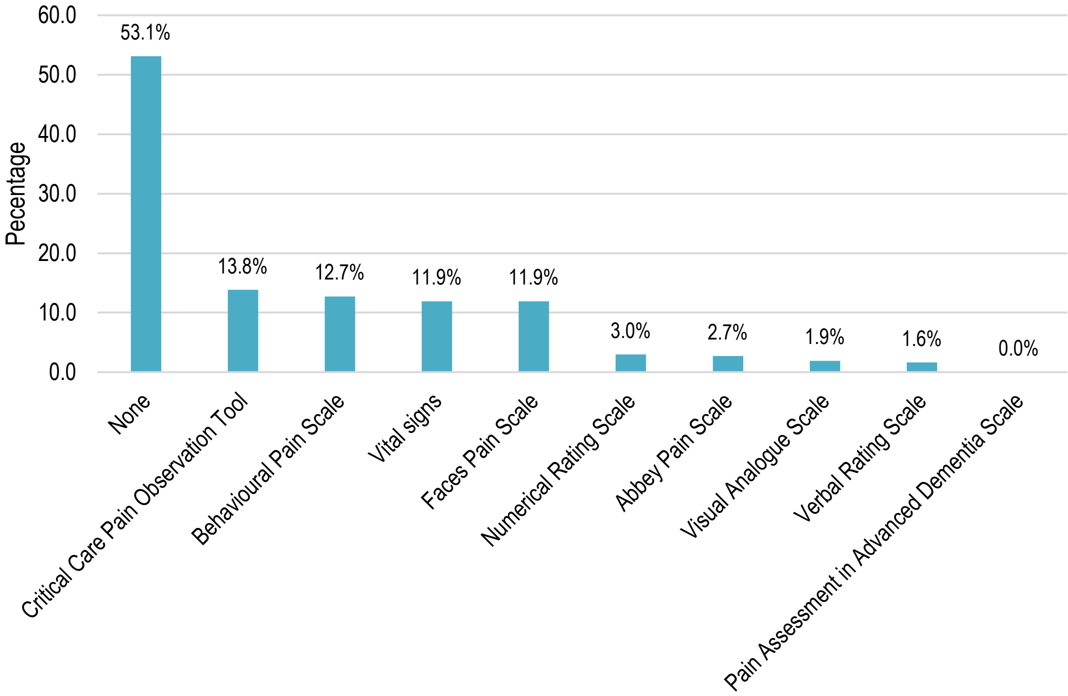


Figure 6.5: Pain assessment instruments used to measure pain intensity in mechanically ventilated adult patients

While self-reporting may be possible in some non-intubated critically ill patients in the resuscitation area, the majority of respondents detecting and assessing acute pain did so in the absence of using an evidence-based behavioural observational instrument.

Factors influencing administration of analgesia

Internal consistency of the NSPS was high (α=.788), with a corrected item-total correlation alpha ranging from α=.717 to α=.891. Reliability coefficients of the subscales for *attitudes*, *subjective norms*, *analgesia orders and goals*, and *analgesic practices* ranged from α=0.611 to α=0.812, with *perceived behavioural control* and *intention to administer analgesia* also demonstrating high internal reliability (r_s=*.672* and r_s=*.664* respectively) (Table 6.3).

Table 6.3: Nurse Analgesia Practices Scale reliability and responses

Subscale and items	Reliability	Median	Disagree or strongly disagree (%)	Neutral (%)	Agree or strongly agree (%)
Attitudes	α=.812	5	14.5	4.9	80.6
Administration of analgesia to patients is necessary for patient comfort.		5	1.8	4.0	94.2
It is easier to care for a pain-free patient than one that is in pain†		1	1.3	10.3	88.4
If I were a critically ill patient, I would want to be pain-free		5	0.0	0.9	99.1
Limiting a critically ill patient's suffering is a desired outcome of pain management		5	0.9	0.4	98.7
Mechanical ventilation as uncomfortable		5	0.8	15.4	93.8
Mechanical ventilation as stressful		5	9.8	12.1	78.1
All mechanically ventilated patients should receive analgesia		3	21.8	10.0	68.2
Subjective norms	α=.612	4	14.9	20.0	65.0
Influence of other nurses' knowledge on analgesia practices		4	15.5	20.3	64.2
Influence of other nurses' attitudes on analgesia practices		3	17.1	31.3	51.6
Patient's family request analgesia		4	4.1	5.7	90.2
Influence of patient's family on analgesia administration		4	15.9	23.1	61.0

Subscale and items	Reliability	Median	Disagree or strongly disagree (%)	Neutral (%)	Agree or strongly agree (%)
Pain management orders and goals	α=.611	4	30.0	20.0	50.0
When requesting analgesia, physicians consider my assessment of the patient's needs		4	34.0	5.3	60.7
Analgesia is prescribed with broad parameters that allow me to titrate the amount administered		4	39.3	9.8	50.9
Goals of patient pain management are clearly communicated between physicians and nurses		4	30.0	34.6	35.4
Perceived behavioural control	r_s=.672*	2	72.7	24.0	3.3
I use analgesia more readily due to communication difficulties with critically ill patients†		2	26.8	44.7	28.5
Availability of nursing staff has influenced my administration of analgesia to critically ill patients†		2	23.6	18.3	58.1
I have administered analgesia in order to complete other essential nursing functions†		2	14.3	7.3	78.4
I often disagree with physicians regarding appropriate analgesia for my critically ill patient†		2	36.1	28.9	35.0
Analgesia practices	α=.769	4	26.7	24.4	48.9
An intubated patient requires less opiate analgesia if they do not have a cough reflex on suctioning		3	28.9	32.5	38.6

Subscale and items	Reliability	Median	Disagree or strongly disagree (%)	Neutral (%)	Agree or strongly agree (%)
An intubated patient requires less opiate analgesia if they respond only to noxious stimuli		3	30.1	32.5	37.4
An intubated patient requires less opiate analgesia if they do not follow simple commands		2	47.2	37.8	15.0
An intubated patient requires more opiate analgesia if they are spontaneously moving hands and feet		4	25.7	28.9	45.5
An intubated patient requires more opiate analgesia if they are moving their trunk or lifting their legs		4	25.7	28.0	46.3
An intubated patient requires more opiate analgesia if they are reaching for their lines or endotracheal tube		3	15.5	20.7	63.8
An intubated patient requires more opiate analgesia if their heart rate and blood pressure are elevated		5	1.6	6.9	91.5
An intubated patient requires more opiate analgesia if they are grimacing		5	1.6	6.9	91.5
Intention to administer analgesia	r_s=.664*	5	1.6	6.9	91.5

Key: †Negatively-keyed items were reversed scored, *p<.001

Attitudes Domain

The attitudes subscale score was high (n=363, 80.6%), indicating that respondents held a strongly positive evaluation regarding the efficacy of analgesia administration in relieving pain in mechanically ventilated patients. Most respondents agreed / strongly agreed that analgesia was necessary for patient comfort (n=424, 94.2%), and characterised mechanical ventilation as uncomfortable (n=422, 93.8%) and stressful (n=351, 78.1%). Respondents (n=446; 99.1%) strongly indicated that they would prefer analgesia if the patients were mechanically ventilated and reported that caring for a patient who was not in pain is easier. Most (n=307, 68.2%) respondents agreed or strongly agreed that 'all mechanically ventilated patients should receive analgesia'; although one in five (n=98, 21.8%) disagreed and 10% (n=45) remained neutral.

Subjective norms

The subjective norms subscale score was 65.0%, indicating that respondents' individual pain management practices were moderately influenced by the knowledge and attitudes of other emergency nurses in their work environment. Respondents (n=289, 64.2%) agreed or strongly agreed that other emergency nurses' knowledge influenced their individual practice regarding analgesia, compared to the attitudes (n=232, 51.6%) of other nurses. However, direct requests from family members to provide analgesia to the patient had greater (n=406, 90.2%) influence on respondent's decision to administer analgesia, than in-direct comments (n=275, 61.0%). Respondents that received frequent (always and most of the time, n=178, 39.5%) pain management education in their workplace, reported higher levels of influence (median 3.11 vs. 4.27) from other emergency nurses on their analgesia administration (X^2=5.706, df=1; p=.002).

Analgesia orders and goals subscale

The analgesia goals and orders subscale was 50.0%, demonstrating that respondents partly had a level of ability to determine the need for and use of analgesia in the care of their critically ill patients. Over half of respondents (n=273, 60.7%) agreed or strongly agreed that physicians considered their assessments when prescribing analgesia, while over a third (n=153, 34.0%) disagreed. Half (n=229, 50.9%) of respondents agreed that analgesic medication orders were prescribed with broad parameters allowing for nurse discretion and independent determination for and of administration. However, a proportion of respondents disagreed or strongly disagreed (n=177, 39.3%).

Perceived behavioural control subscale

The perceived behavioural control subscale was 72.7%, indicating that respondent's pain management practices and administration of analgesia were negatively impacted on by non-patient related factors (e.g. workload). Respondents indicated that non-patient related factors, such as staffing (n=261, 58.1%) and workload (n=353, 78.4%) negatively impacted on analgesia administration to critically ill patients. Self-reported perceived behavioural control subscale scores increased in relation to emergency nursing experience (R^2=0.207; 45.5%). On comparing emergency nursing experience and influence of perceived behavioural control on administering analgesia, a moderate (r_s=.311, 95% CI 0.198 to 0.401; p<.001) and statistically significant correlation was demonstrated. This indicates that as emergency nurses became more senior, the negative impact of non-patient factors increased (Figure 6.6).

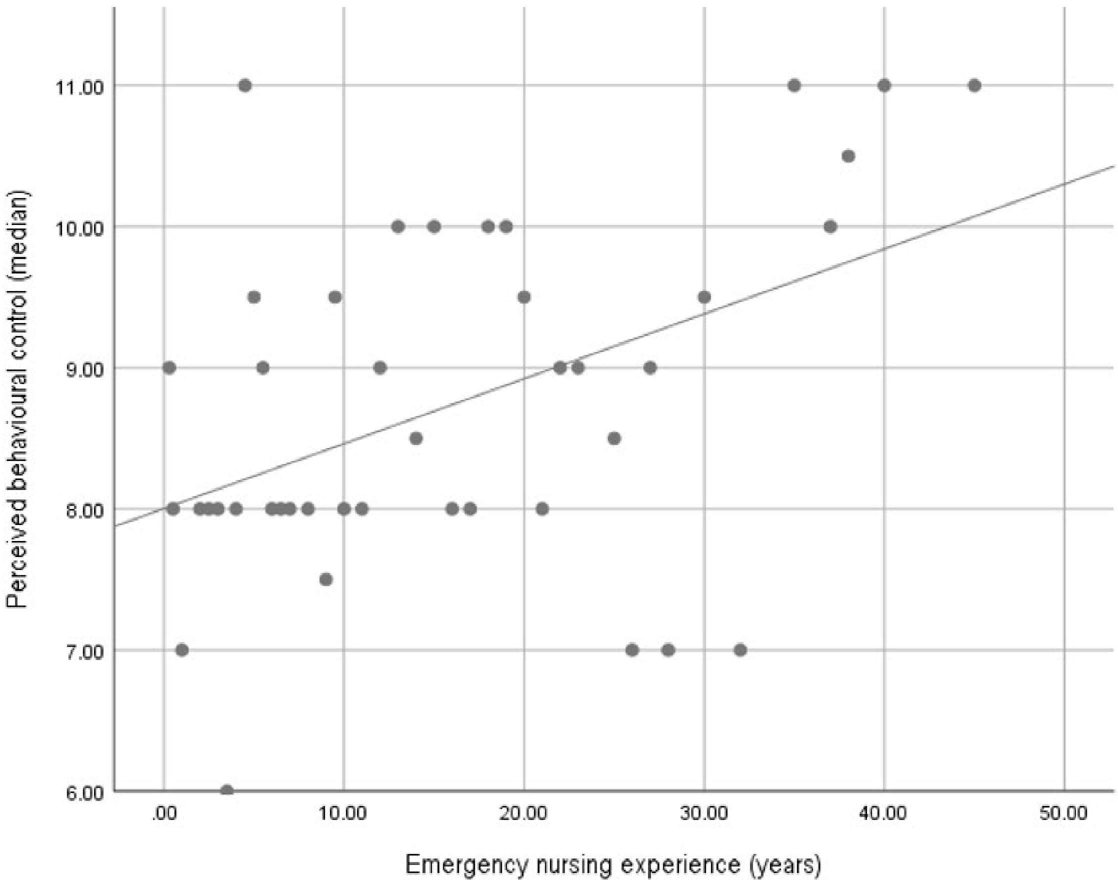


Figure 6.6: Years of emergency nursing experience and perceived behavioural control

Analgesia practices domain

The behaviour of mechanically ventilated patients had a moderate (n=304, 67.5%) but variable influence on respondents' administration of analgesia. Respondents were largely neutral in relation to whether the absence of a cough reflex (n=174, 38.6%) or responding only to noxious stimuli (n=168, 37.4%) inferred that a mechanically ventilated patient had received too much analgesia. The majority of respondents (n=412, 91.5%) interpreted (agreed or strongly agreed) grimacing as undertreated pain in mechanically ventilated patients, compared to elevated blood pressure or heart rate (n=397, 88.3%), reaching for endotracheal tube or vascular access lines (n=287, 63.8%), moving their trunk or legs (n=208, 46.3%), or hands and feet (n=205, 45.5%). Of the respondents, the majority (n=401, 89.2%) were highly likely to administer analgesia to all mechanically ventilated patients, while 6.1% (n=27) were unsure.

Nurses' attitudes toward the mechanically ventilated patient had a moderate correlation with analgesic practices (r_s=.347, 95% CI 0.289 to 0.401; *p*<.01) and intention to administer analgesia (r_s=.341, 95% CI 0.288 to 0.400; *p*<.01). While statistically significant, other subscales demonstrated only small correlations with the analgesia practices subscale and intention to administer analgesia item. A negative correlation was observed between perceived behavioural control (r_s= -.138, 95% CI -0.098 to -0.198; *p*<.01) and analgesia orders and goals (r_s= -.207, 95% CI -0.144 to -0.299; *p*<.01), and the intention to administer analgesia (Table 6.4).

Table 6.4: Correlation between analgesia practices and intention to administer analgesia subscales

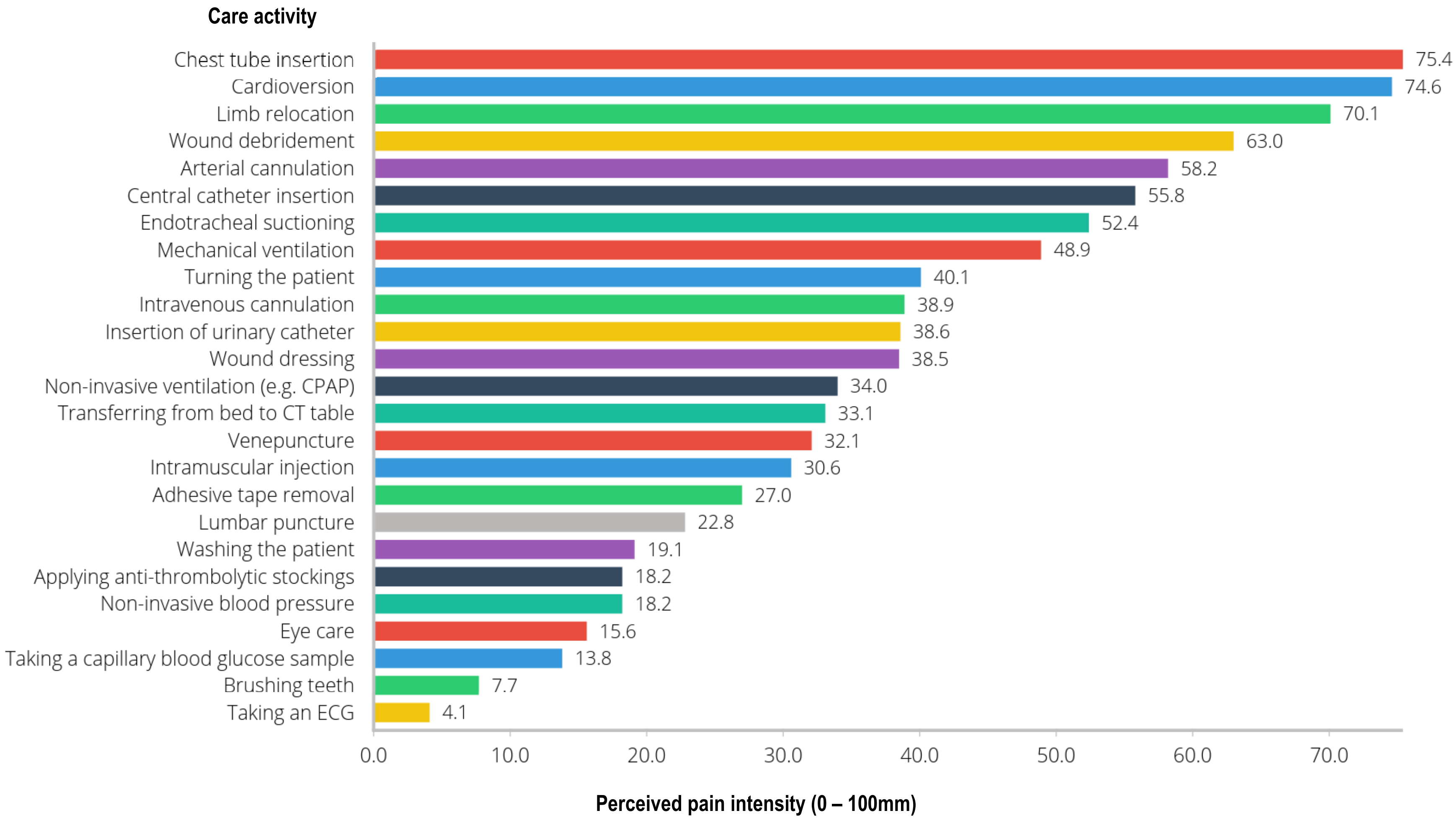
	Attitudes	Subjective norm	Analgesia orders and goals	Perceived behavioural control
Analgesia practices	.347*	.379*	.295*	.100‡
Intention to administer analgesia	.341*	.050‡	-.207*	-.138*

**p*<.01; ‡*p*<.05

Perception

Based on their perception, all respondents (n=450, 100%) rated the intensity of pain that critically ill patients were likely to experience during 26 common resuscitation activities. Respondents rated each critical care activity using a 0-100mm scale, with 0 indicating no pain present to 100, meaning maximum pain present. Overall average pain intensity was 36.8 (IQR 10.0) across the procedures.

Of the 26 common resuscitation activities, the majority (46.1%) were rated as causing mild pain (10.0-39.9mm). Only three (11.5%) of the 26 activities were rated as potentially causing severe pain (≥70.0mm) in critically ill adult patients, which included insertion of a chest drain, cardioversion and limb relocation. Eight (30.8%) activities were rated as causing moderate pain (40.0-69.9mm) and included: endotracheal suctioning, arterial cannulation, mechanical ventilation, wound debridement, central catheter insertion, lumbar puncture, intravenous cannulation and non-invasive ventilation. Ten (38.5%) were rated as causing mild pain (10.0-39.9mm), and comprised of turning the patient, venepuncture, urinary catheter insertion, transferring patient from bed to radiology scanner tables, wound dressing, intramuscular injection, applying anti-thrombolytic stockings, measuring blood pressure, washing the patient and taking a capillary blood glucose sample. Three (11.5%) activities were rated as causing no pain or very little pain (0-9mm), which included brushing patient's teeth, performing eye care, and taking an 12 lead electrocardiograph (ECG) (Table 6.7).



Key: CPAP, continuous positive airway pressure; CT, computer tomography; ECG, electrocardiogram.

Figure 6.7: Average perception of pain intensity of resuscitation activities by respondents

A small positive correlation between emergency nursing experience and degree of pain intensity associated with common resuscitation activities was observed (r_s=.280, 95% CI 0.152-0.309; p=.001) (Figure 6.8).

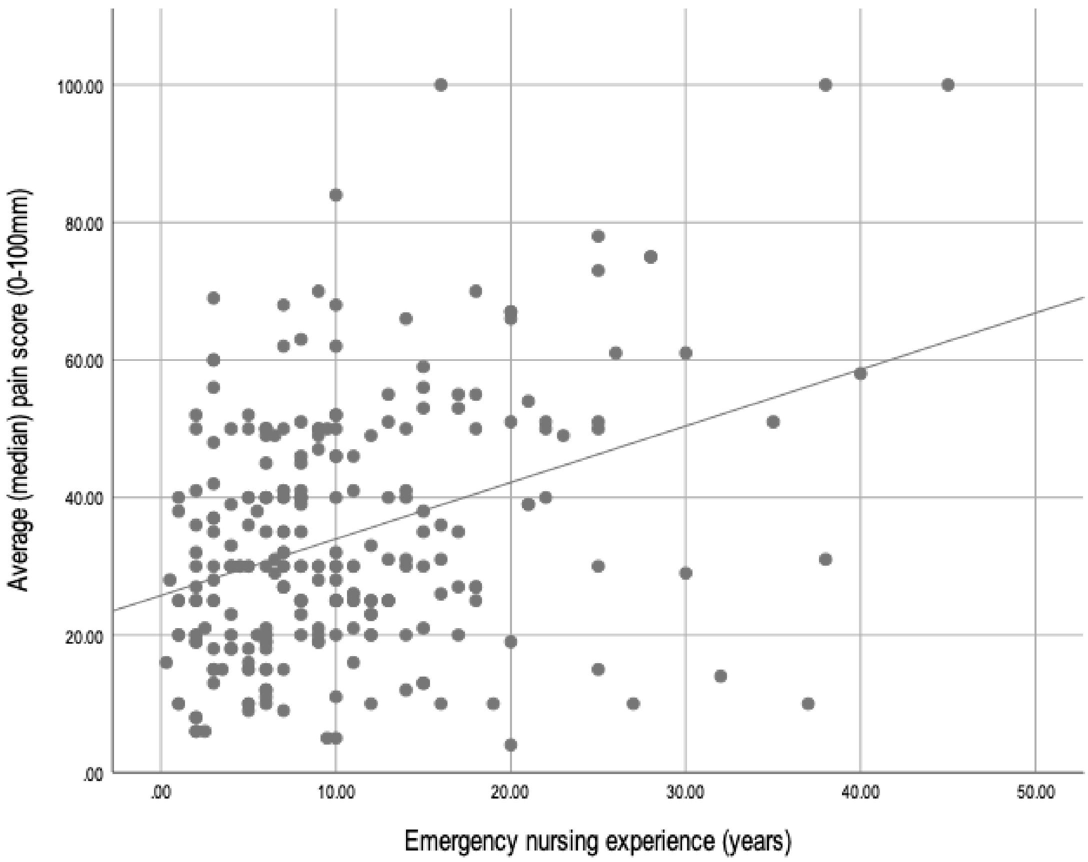


Figure 6.8: Years of emergency nursing experience and average pain intensity score

Emergency nurses' perception of patients' pain intensity experienced during common resuscitation activities increases (R^2=0.129; 35.9%) in relation to the years of emergency nursing experience.

Summary

This Chapter detailed the results of the phase 1 online national survey. Survey results established that the majority of respondents were able to initiate analgesia to patients within their ED setting using standing orders. The findings detailed variation in the training and clinical governance processes enabling nurses to independently initiate analgesia. Importantly, the range of analgesics able to be administered by emergency nurses for critically ill patients varied across Australia. Ongoing education and feedback to nurses authorised to initiate analgesia was infrequent. While pain assessment instruments were frequently used to assess pain intensity in adult patients, emergency nurses largely relied on verbal communication. Very few valid instruments were reported to be used in guiding analgesia administration in nonverbal critically ill patients and specifically those requiring mechanical ventilation. The next Chapter presents the phase 2 non-participant observation and interview findings of this explanatory sequential mixed-methods study.

CHAPTER 7: PHASE 2 OBSERVATION AND INTERVIEW FINDINGS

Introduction

This Chapter presents findings from the non-participant observation and interviews. While phase 1 results were pivotal in providing understanding of the landscape and quantifying current emergency nurses' practices relating to the management of acute pain in patients presenting to ED, they were not able to explain the practices and experiences of emergency nurses in managing acute pain in critically ill adult patients. Phase 2 therefore, provided a means for a deeper understanding of Phase 1 findings while also gaining a rich insight into the actual behaviours and practices of emergency nurses. Importantly, these findings also present the perceptions and practices of nurses responsible for acute pain management in critically ill adult patients.

Observation sample and participants' characteristics

Non-participant observations were conducted from November 16th to December 11th 2020, Monday to Friday between 07:00hrs to 12:30hrs (n=24, 52.2%) and 13:00hrs to 20:00hrs (n=22, 47.8%). A total of 156.5 hours were spent observing emergency nurses (n=46) caring for a wide range critically ill adult patients in the resuscitation area (Appendix 5). Each participant was observed for an average of 3.3 hours (range 2.1h – 4.4h); generating 90 pages (A4, 1.5cm spacing) of field notes. The majority of participants (n=35, 76.1%) were female with an average age of 37.3 years (SD 8.9, range 24-57), nearly 8 years of emergency nursing experience (mean 7.3, SD 2.9, range 3-15) and over 5 years' experience working in the resuscitation area (mean 5.2, SD 2.6, range 2-13). The majority held a postgraduate qualification in nursing (93.5%) (Table 7.1).

Table 7.1: Participant characteristics

					Experience (years)				
Site	**Reference**	**Gender**	**Role**	**Highest qualifications**	Emergency nursing	Resuscitation area	**Observation duration (h:mm)**	**Interviewed (Yes/No)**	**Interview duration (h:mm)**
1	S1-CNC1	F	CNC	MN	12	9	03:15	Y	00:36
	S1-CNC2	F	CNC	MN	20	15	03:13	Y	00:36
	S1-CNE1	F	CNE	PGCert	10	8.5	03:48	Y	00:21
	S1-CNS1	F	CNS	MN	15	13	03:53	Y	00:31
	S1-CNS2	M	CNS	PGCert	9	7	03:34	Y	00:38
	S1-CNS3	F	CNS	PGCert	15	13	03:30	Y	00:23
	S1-CNS4	F	CNS	PGCert	13	10	03:05	N	
	S1-CNS5	F	CNS	MN	6	4.5	03:01	Y	00:31
	S1-CNS6	M	CNS	PGCert	7	8	03:39	Y	00:38
	S1-RN1	M	RN	PGCert	6	4.5	03:23	Y	00:36
	S1-RN2	F	RN	BN	5	4	03:09	N	
	S1-RN3	F	RN	MN	4	5	03:11	Y	00:35
	S1-RN3	M	RN	MN	4	2	03:52	Y	00:39
	S1-RN4	M	RN	BN	4	2	03:53	Y	00:31
	S1-RN5	F	RN	PGCert	2	2	02:58	Y	00:37
	S1-RN6	M	RN	PGCert	4	4	04:20	Y	00:31
	S1-RN7	F	RN	BN	10	8	03:35	N	

Site	Reference	Gender	Role	Highest qualifications	Experience (years) Emergency nursing	Experience (years) Resuscitation area	Observation duration (h:mm)	Interviewed (Yes/No)	Interview duration (h:mm)
	S1-RN8	F	RN	PGCert	7	4	03:01	N	
	S1-RN9	F	RN	BN	3	2	03:05	N	
	S1-RN10	F	RN	PGDip	11	8	03:22	Y	00:33
	S1-RN11	M	RN	BN	5	3	03:39	N	
2	S2-CNE1	F	CNE	PGCert	7	5	03:04	N	
	S2-CNE2	F	CNE	MN	5	4	02:56	Y	00:28
	S2-CNS1	F	CNE	BN	4	2	03:29	N	
	S2-CNS2	F	CNE	PGCert	7	5	03:45	N	
	S2-CNS3	M	CNE	MN	11	10	03:53	Y	00:41
	S2-CNS4	F	CNE	PGCert	7	6	04:25	N	
	S2-RN1	F	RN	PGCert	19	18	03:00	N	
	S2-RN2	F	RN	PGCert	7	5	02:59	Y	00:31
	S2-RN3	F	RN	GradDip	8	6	03:32	Y	00:29
	S2-RN4	F	RN	BN	4	2	03:59	N	
	S2-RN5	F	RN	MN	9	7	03:11	Y	00:36
	S2-RN6	F	RN	PGCert	5	4	03:11	N	
	S2-RN7	F	RN	PGCert	15	11	03:51	Y	00:36
	S2-RN8	M	RN	PGCert	4	3	03:39	Y	00:44

					Experience (years)				
Site	**Reference**	**Gender**	**Role**	**Highest qualifications**	Emergency nursing	Resuscitation area	**Observation duration (h:mm)**	**Interviewed (Yes/No)**	**Interview duration (h:mm)**
	S2-RN9	F	RN	PGCert	5	5	02:18	Y	00:43
	S2-RN10	F	RN	BN	5	3	02:56	Y	00:38
	S2-RN11	M	RN	MN	9	7	02:28	Y	00:36
	S2-RN12	M	RN	MN	8	8	02:32	Y	00:38
	S2-RN13	F	RN	PGCert	8	6	03:23	Y	00:27
	S2-RN14	F	RN	PGCert	6	5	03:14	Y	00:35
	S2-RN15	F	RN	PGCert	6	5	02:08	N	
	S2-RN16	F	RN	MN	11	7	03:30	Y	00:37
	S2-RN17	F	RN	PGCert	12	9	03:35	N	
	S2-RN18	F	RN	PGCert	4	2	03:01	N	
	S2-RN19	F	RN	MN	4	2	03:05	Y	00:31

Key: BN, Bachelor of Nursing; CNC, Clinical Nurse Consultant; CNE, Clinical Nurse Educator; F, female; GradDip, graduate diploma; M, male; MN, Master of Nursing; RN, Registered Nurse; PGCert, postgraduate certificate.

During informal questioning, participants described to the researcher the patient's presenting complaint, acuity (e.g. ATS category), mechanisms of injury and priorities of care (Appendix 5). Of the critically ill or injured patients categorised as ATS 1 or 2 (n=308; 13.1%), 108 (35.1%) were managed in the resuscitation area during data collection. Emergency nurses were observed providing care to 46 critically ill patients (Site 1 n=22, Site 2 n=24) in the resuscitation area; patients were typically male (n=26; 56.5%), in their 50s, with immediate life-threatening (ATS 2; n=38, 82.6%) traumatic injuries (n=28, 60.8%), cardiac arrhythmias (n=7, 15.2%), neurological (n=4; 8.7%) or toxicology (n=4, 8.7%) emergencies. Patients commonly presented to the resuscitation area by ambulance (n=27, 67.4%) (Table 7.2).

Table 7.2: Characteristics of patients managed in the resuscitation by study participants

Characteristics	N (%)
Age, years (mean, SD, range)	51.2 (19.1, 16 – 93)
Sex	
Male	26 (56.5)
Female	20 (43.5)
Australasian Triage Category	
ATS 1	8 (17.4)
ATS 2	38 (82.6)
Mode of arrival	
Ambulance	26 (56.5)
Walked in	15 (32.6)
Helicopter	4 (8.7)
Transfer	1 (2.2)
ED Length of stay, hours (mean, SD, range)	6.1 (SD 4.2, 1.3 – 22.4)
Intubated and ventilated	16 (34.8)
Primary presenting problem	
Trauma	26 (56.5)
Cardiac	7 (15.2)
Toxicological	4 (8.7)
Neurological	4 (8.7)
Systemic infection	2 (4.3)
Gynaecological	1 (2.2)
Burns	1 (2.2)

Summary of observed participants pain management activities in the resuscitation area

Across both sites, the majority (63%, n=29) of patients received some form of analgesia, although pain history or measurement of pain intensity was observed to be obtained in just under half of all patients (48%, n=22). The focus of any pain history largely involved identifying the site of pain (54%, n=25) and the events that led to the incident (inciting incident, 30%, n=14). In observed instances when patients (n=16) could not self-report pain, participants monitored for changes in the patient's vital signs (54%) or behaviour (46%). While intravenous analgesia was provided to most patients (63%, n=29), few were observed to be re-assessed within 60 minutes to evaluate if pain had reduced (35%, n=16). While the pain management plan was communicated to the patient (61%, n=28), it was less frequently observed to be discussed at handover (35%, n=16), or with family members (4%, n=2) (Figure 7.1).

Key: VPS, Verbal Pain Scale (e.g. mild, moderate, severe)

Figure 7.1: Summary of observed participants pain management activities in the resuscitation area

Of the 46 patient cases managed by participants, 16 received analgesia in the pre-hospital setting. The remaining patients (n=30) first received analgesia within 20 minutes (mean 18.2 minutes, SD 11.0 minutes) of arriving in the resuscitation area. While re-assessment of pain occurred in over half (56.7%) of non-intubated critically ill patients (blue dots, mean 71.8 minutes, SD 26.1 minutes), re-assessment of pain rarely occurred (n=2, 6.6%) in those who were intubated (orange dots) (Figure 7.2).

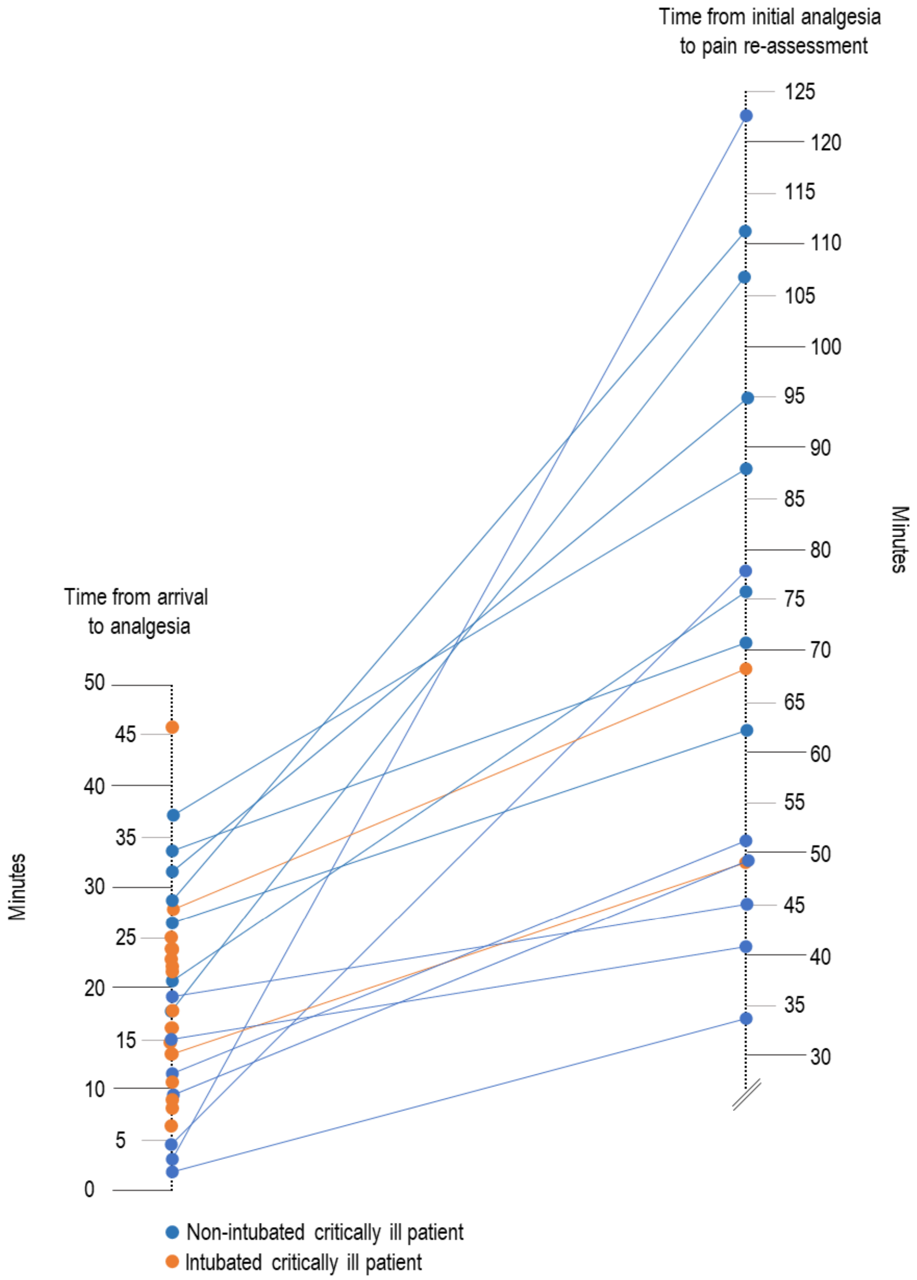


Figure 7.2: Slopegraph showing time (minutes) from patient (n=30) arrival to first administration of analgesia in the resuscitation area and re-assessment of pain.

Interview participants

Of 46 participants observed, 30 (65%; site 1 n=15, site 2 n=15) were interviewed to achieve data saturation. Interview participants were mostly female (n=20; 67%), seven years of emergency nursing experience (mean 7.5, SD 4.1, range 2-20), five years of experience working in the resuscitation area (mean 5.9, SD

3.5, range 2-15) and held postgraduate nursing qualifications (n=27; 90.0%). Audio-recording interviews lasted on average 34 minutes (SD 6 minutes, range 21-44) and generated 158 pages of transcribed notes.

Three main themes and eight subthemes emerged from analysis of the observation and interview data. The three main themes were: 1) *being in the resuscitation area*, 2) *prioritising pain*, and 3) *between being and doing.* Each theme is introduced, described and supported by examples from the verbatim data to support the findings (quotes, observations, field notes).

Theme 1: Being in the resuscitation area

The first theme, *being in the resuscitation area*, explores the preparation and training of emergency nurses transitioning into the resuscitation area. This theme encompassed three subthemes: 1) *being a nurse in the resuscitation area, 2) learning to assess pain*, and, 3) *confidence to manage pain in the critically ill patient*. For context, the theme opens with a brief review on the layout of the resuscitation environment in the study sites.

The resuscitation area was observed to be a dedicated space designed to manage a wide range of critically ill patients, deal with the unexpected and to respond to rapidly changing circumstances. There were clear similarities between each site's resuscitation area; each divided into five bays by floor to ceiling walls or curtains, with two points of access: via the waiting room for walk-in patients or the ambulance bay for those transported by ambulance. Each bay was equipped to manage a single patient and included resuscitation equipment, mobile trolleys, storage space for clinical sundries (e.g. oxygen tubing, cervical collars) and monitoring equipment. Incorporated within the resuscitation area was a medication preparation zone. At study site 2, two of the five bed areas were designed to isolate potentially infectious patients; separated by solid walls and closed off by aluminum framed glass panels and doors.

Being a nurse in the resuscitation area

On entering the resuscitation area, critically ill adult patients were observed to be assessed using a structured approach, called the primary survey, to obtain an initial assessment of the patient, their haemodynamic status and immediate care needs. Emergency nurses working in the resuscitation area were observed to conduct detailed patient assessments. Based on patient assessment findings, nurses provided symptom management such as pain relief, optimised respiratory therapies including mechanical ventilation, communicated complex information to patients, family members, colleagues and visiting inpatient teams, and responded to patient deterioration while simultaneously alerting other ED team members. Findings from this initial assessment prioritised the delivery of emergency care. It also marked the first point in the patient's journey where pain was assessed in both study sites. The primary survey was observed to be a rapid, systematic approach represented by the first six letters of the alphabet (A to G) – airway (A), breathing (B), circulation (C), disability (D; neurological stability), exposure and environmental control I, fluid status (F) and give comfort measures (G):

"The primary survey is the cornerstone of patient management in the ED…it guides initial assessment and management of a critically ill patients…to detect and treat actual or imminent life-threatening issues. It helps prioritise our interventions and ensures we don't miss anything important. It forms the basis of our training, it is even taught in pre-registration nurse training." (Interview, S1-CNC1)

During observation, when there were multiple simultaneous assessments occurring, the primary survey and subsequent treatment did not always proceed in a linear, sequential fashion. As part of training and orientating of nurses to the resuscitation area, patient assessment skills, including application and use of the primary survey to prioritise interventions and structure critical communication between healthcare providers is a core component. Examples of this were observed:

Ambulance officer provided handover to the participant nurse on a 17-year-old female patient involved in a motor vehicle collision into oncoming car with total estimated speed of 60k/hr. Patient is alert. Paramedic then provided handover of the patient's haemodynamic status, identified injuries and response to interventions: "From a primary survey point of view, airway is intact, no c-spine tenderness, no problems respiratory wise, blood pressure is good, 120 systolic, you have one cannula in the antecubital fossa which we have given a total of morphine 7mg and 4mg ondansetron. Pain on arrival was 8 out of 10, now 4, and they were nauseous post morphine. All limbs normal strength, nil injuries noted." Participant nurse introduces themselves by name to the patient, and then measures patient's blood pressure and heart rate. The nurse then assisted the patient to change, staying, "I'm just going to get you changed into a gown, and then assess you, but first, how's your pain at the moment?" The patient indicates that the pain is minimal. Participant nurse then auscultates the patient's chest, connects the cardiac monitor, assess patient's recollection of time, place and person (disability), and completes a visual inspection of the patient's limbs. (Field note, November 30th 2020, S2-RN18, care episode #13).

A second example:

Participant takes handover from the night resuscitation nurse on a 19-year-old female motorcyclist, 50km collision with on-coming car at 22:00hrs yesterday. "Flipped and slid across road 30 meters. Conscious, airway patent, helmet intact, bruising to left ankle –multiple abrasions to arms and chest. Pelvis stable, limbs neurovascularly intact. Plan is for review this morning by trauma team. CT [computed tomography] *head, neck and chest completed, nil findings, cervical soft collar removed." Assisting participant nurse (S2-RN9) then introduces themselves to the patient, and verifies the patient's ID. Patient states their name, date of birth and home address* [airway, disability]*, then auscultates the patient's chest, observes the patient's respiratory rate and pulse oximetry* [breathing]*, before measuring the patient's blood pressure* [circulation]*. Nurse identifies the patient's intravenous cannula and reviews the patient's fluid balance chart and urine output* [circulation, fluid]*, then takes the patient's temperature and asks if they feel warm enough* [exposure]*. On returning with a warm* *blanket, and assessed if the patient is in pain, "You've scraped a lot of skin off your chest – it must hurt. Do you need more pain relief?"* [give comfort] *Patient sobbing, nods.* (Field note, November 19th 2020, S1-RN7, care episode #6).

During the process of patient management, participants frequently reviewed and compared their assessment findings with previous assessments, to identify any new or changing symptoms, signs of deterioration or interventions not yet completed. This information shaped participant responses, which included initiating or completing therapies, or escalating and sharing critical information:

> *"To make sure we haven't missed anything, I run back through the primary survey – it's important to know what you need to manage or escalate."* (Interview, S2-RN13)
>
> And
>
> *"During nursing handover between shifts or breaks, we handover in front of the patient, going through the A to G assessment, plan of care and discuss anything that has yet to be completed – IV* [intravenous] *med*[ications]*, CT or blood tests for example"* (Interview, S1-RN5)
>
> Also
>
> *"Being able to assess and communicate using the same approach – we're are on the same page…"* (Interview, S1-CNS6)

Patients requiring specialist care were referred by the emergency medical team to inpatient teams, to either assist in managing the patient's condition, or aid in excluding or diagnosing the cause for the patient's illness / injury. To assist in managing patient care and formulating a definitive diagnosis, the inpatient team would re-assess the patient, which included obtaining a detailed history of events leading up to and during their presentation to ED. However, when inpatient teams attended the resuscitation area to assess and review patients, it was frequently observed that the resuscitation nurse was rarely consulted. This limited the nurses' ability to communicate information concerning the patient's progress such as pain control:

> *"Some of the* [inpatient] *doctors know us, and will talk with us about the patient, the patient's progress, and changes to the plan of care - but it's hit or miss. We spend the most time with the patient, monitoring and escalating, but are not always involved or consulted."* (Interview, S1-RN4)
>
> And
>
> *"It's pretty poor. You have to flag the inpatient team down before they leave resus[citation] to see if they've changed anything, such as stopping or prescribing new medications or ordering pathology tests that need collecting. This impacts on how we monitor or manage the patient and their symptoms. But if they sneak out of resus*[citation]*, you have no immediate idea, they may not have told our doctors. You need to catch them before they leave."* (Interview, S2-RN11)

Again

"Nurses assess and monitor the patient, give medications, manage multiple demands, and then the inpatient team – who don't always tell you they've charted med[ications] *or infusions, or ordered imaging meaning that have to escort patients to CT with little notice. You can't be everywhere, and you can't always be as attentive as you would like or offer one-on-one nursing at times.*" (Interview, S2-RN14)

Further, supported during observation,

Inpatient cardiology team arrived in the resuscitation area to review a male patient with undifferentiated chest pain. Cardiology consultant introduced themselves to the patient and begins assessing their symptoms including pain morphology. The cardiology consultant then discussed with their team across the patient, the importance of assessing patient's pain, "It can assist in differentiating the possible causes, and what high-risk issues we should look for." The cardiology consultant then explained to the patient that the pain was not cardiac, but more likely gastritis, and that simple analgesia and acid-regulating medication would help. The team then left the resuscitation area. Twelve minutes later, participant nurse intercepted the junior doctor of the cardiology team as they returned to place a pathology test ordering request on the writing desk next to the patient. When the nurse enquired about the plan, or new medications for the patient, the junior doctor advised that medications would be charted after they had finished seeing other patients in the ED. (Field note, November 19th 2020, S1-RN11, care episode #10).

At site 1, a locally developed communication checklist, the POst Resuscitation Plan and OrganISed Escalation, or *PORPOISE*, was used to ensure patient assessment findings, potential complications to monitor for, pain management and the plan of care were communicated between care team members. As the researcher observed:

56-year-old male, fall from scaffolding approximately 5m landing onto low wall, nil sensation, or movement to bilateral lower limbs. Stabilised and intubated, suspected spinal trauma. The ED medical team leader, trauma surgeon, ICU registrar and participant nurse grouped at the writing desk at the foot end of the patient's bed. The nurse guided the group using the PORPOISE form, the group identified the need for ongoing sedation, analgesia and paralysis plan needed documenting. (Field note, November 18th 2020, S1-RN3, care episode #8)

The PORPOSE poster (A) and checklist (B) were affixed to each writing desk (Figure 7.3)

Figure 7.3: Writing desk layout

In contrast to site 2, site 1 had developed a checklist to improve resuscitation communication, and to ensure attending team members had the opportunity to raise concerns, as the following illustrates:

> *"We use it after the patient has been stabilised to ensure everyone's on the same page, working together, before they all step away from the patient. It was developed to ensure nurses were communicated with prior to the teams leaving the resuscitation area."* (Interview, S1-RN3)
>
> And, the researcher observed
>
> *"It's a quick huddle to go through what we found on assessing the patient, their injuries, plan of care, whether analgesia has been charted, check for any outstanding tests, and to ask questions or escalate concerns. It typically happens after the patient has been initially assessed."* (Field note, November 22nd 2020, S1-RN11, care episode #2)

Emergency nurses were observed to be among the first and continuing point of care for critically ill patients managed in the resuscitation area. The sharing and documentation of assessment findings was regularly taking place during the patient's stay within the resuscitation bay. To detect and prioritise patient care needs, a structured patient assessment using the primary survey was conducted, and formed the cornerstone of patient evaluation and plan management. The rapid assessment and prioritisation of patient stability was vital to the early detection of deterioration and timely administration of treatment when competing needs arise. Embedded within the patient assessment, and a domain of the primary survey was pain assessment.

Learning to assess pain

At each site, education regarding pain assessment was provided during orientation to the ED. From secondary data sources, such as orientation workbooks, participants were taught to assess for pain as part of a structured systematic process using the primary survey framework, in which pain assessment fell under 'G' for 'give comfort'. Within this section of the primary survey, workbooks used to support nurses transitioning into emergency nursing practice emphasised using the PQRST (provocation/palliation, quality/quantity, region/radiation, severity, and timing) pain assessment method to guide assessing, describing and documenting pain. The workbook section examined: provoking and palliating factors, the quality of the pain (e.g., characteristics), region and radiating signs, timing and severity of the pain.

During observation, participants combined information from asking these questions with their physical assessment findings to obtain a detailed picture of the events leading up to injury/illness, its location, nature, associated characteristics and intensity of the pain. Information gained using the PQRST method was used to guide escalation, pain medication selection and treatment evaluation as the following quotes illustrate:

> *"Since moving to ED after my new grad*[uate] *year, I've gone through a steep learning curve over the last two years. From re-learning patient assessment skills… especially pain assessment and using intravenous analgesia, sedation… stronger pain relief medication than we would give on the ward. Obviously, you would assess the patient's pain, we use PQRST to get a good idea about the pain being experienced. If a patient was in severe pain, we would call the doctor to attend. Here in ED, some nurses can give a stat dose of analgesics like morphine, but that's normally to minor injury patients, not those in the resuscitation area."* (Interview, S1-RN5)
>
> And
>
> *"I start with asking 'Do you have any pain?' or 'Where is the pain?' This gives you a good place to start examining, or where to first avoid so that you can assess other areas* [of the body]. *Once I have that locked down, using PQRST, I'll ask questions like, 'What makes the pain worse* [provoking]*, or better* [relieving]?' and, *'Did the pain relief from the* [paramedics] *help? How severe is the pain?'"* (Interview, S1-CNS5)

The researcher also observed the following from workbooks used during orientation of nurses to the emergency department, which provided escalation criteria concerning pain levels:

> *Within resuscitation training workbooks were used at each site, nurses were advised that pain assessment should be attended hourly, and if pain was rated as severe, indicated as 8 out of 10 or higher, senior nursing or physicians were to be notified. For mild to moderate pain, nurses could escalate to a senior nurse who, if trained, could administer analgesia to assist in resolving the pain. In either situation, a full patient assessment including vital signs was to be completed, including pain assessment using PQRST.* (Field note 30th November 2020, site training documents)

As part of the professional development pathway at each study site, following consolidation of practice in all areas of the ED, senior emergency nurses could independently initiate care using local protocols, that included diagnostics and the administration of medication to relieve symptoms such as pain. The (CIN) training program (NSW Health, 2011) attended by nurses at both sites builds on the knowledge and experience gained as emergency nurses progress in their specialty career path.

Of the participants interviewed, over a third (n=12, 42%) had successfully completed the CIN program, and were able to commence care independently using protocols, including administration of analgesia. CIN training enabled nurses to provide a range of analgesics from paracetamol and ibuprofen to nitrous oxide (as a mixture, 50% nitrous oxide with 50% oxygen), morphine and fentanyl. While pain assessment of critically ill patients is not part of the CIN training curriculum, commonly excluded due to haemodynamic compromise and/or impaired level of consciousness, participants found that the training program increased their pharmacological knowledge and confidence towards assessment and management of acute pain in critically ill patients:

> *"Doing the CIN course helped - it gave you a bit more of an insight into pain assessment. While the course didn't go into the needs of critically ill patients, it gave you the confidence to discuss pain relief with the treating team. The CIN manual gave you tools to use to help assess pain, but I don't think they would work with intubated patients."* (Interview, S1-CNS5)
>
> And
>
> *"Our pharmacology learning package went through the types of analgesia, the situations we can administer them, and I feel more confident in assessing pain and advocating for pain relief. Having a structured approach to patient assessment and evaluating pain really helped."* (Interview, S2-RN16)

Participants during observations and interviews described learning to assess pain and being guided in their physical assessments and care of critically ill patients by information obtained when taking a pain history. Nurses were observed exposing the region of reported pain (e.g. limb, abdomen), visually inspecting the area, palpating to assess depth or possible injury to underlying organs, and comparing the site of reported pain with other side of the body/limb. While assessing the site of reported pain, participants reported verbally checked with the patient for any changes in the intensity of pain, observed for flinching or guarding by the patient in response to palpating the area, and noted changes in a patient's facial expression. The following interview quotes illustrate:

> *"You can assess the area they are complaining of having pain in, palpate the skin, move the joint or simply observe and look for signs of bruising or swelling. I continually talk to the patient – often they are lying flat staring at the ceiling in c-spine precautions – so I keep them informed, especially if I am going to explore and palpate an area of their body."* (Interview, S1-CNS1)
>
> And
>
> *"In a resus[-citation] situation, things happen quite fast and we may not have time to ask a lot of questions, but just asking, 'Hey, are you in pain?', and if they are able to respond, you can go from there; exploring where the pain is, when it first started, what makes it worse, and what they would normally take for pain. Most of the questions I ask I've learned from senior nurses working in resus*[-citation]*."* (Interview, S2-RN10)

On clarifying observations made in the resuscitation area during informal questioning with participants, all participants described various methods used to measure pain intensity. However, two main approaches were identified: rate the intensity of pain using a numeric value (n=17, 55%), "*from zero to ten, zero being no pain, ten being the worst pain ever"* (Field note 5th December 2020, S2-RN6, care episode #30) or asking the patient to categorise their level of pain as either "…mild, moderate or severe" (Field note 8th December 2020, S2-RN1, care episode #28) (n=3, 10%). At interview, all participants reflected on the importance of asking patients if they were in pain and obtaining a pain history.

However, during observation in the resuscitation area, less than half (48%) of the patients had some aspect of pain assessment completed. When participants were observed assessing for pain in critically ill patients in the resuscitation area, assessment predominantly focused on identifying the site of pain (n=25, 54%) and clarifying the events that led up to the incident (n=14, 30%). Yet very few (n=7, 15%) critically ill patients were re-assessed for the presence or changes in pain within a one-hour period. The researcher observed the following patient assessments in the resuscitation area:

> *Participant nurse assessed a male patient, visible wincing, complaining of chest pain on breathing. Patient was attacked with an axe handle to arms, face and chest during a road-rage incident. Nurse examined the patient's right forearm: removed shirt, visually inspected skin and movement at the shoulder, elbow, wrist and fingers, and asked patient to indicate area of maximum pain. Patient points to raised red area over forearm. Nurse moves forearm through a range of movements (pronation, supernation) - patient winces. "It's likely that you have fractured your forearm, we'll need to x-ray it to be certain.' The nurse asks the patient to rate the level of pain on rest and on movement: 'How bad is the pain out of 10 – 10 being the worst pain, when I moved your forearm?' Patient rates pain as a 10. 'I'll get some strong pain relief charted and support your arm in a sling to reduce movement and pain.'* (Field note November 18th 2020, S1-RN7, care episode #26).
>
> And again,
>
> *Participant nurse received handover from paramedic team on a male patient (care episode #36) from a vehicle accident, "…speed 60k*[/hr]*, airbag deployed, patient self-extricated." Nurse then introduced themselves to the patient and began assessing them using the primary survey framework. Nurse cut off the patient clothes with help from a junior nursing colleague. On assessing breathing, participant nurse palpated the patient chest and swelling over sternum. Speaking to both the patient and the junior nurse, "…sternum fractures are not uncommon due to airbags, but better than a crushed chest." Nurse asked the patient to deep-breathe while they auscultated their chest. The patient held their chest and shook their head – "hurts too much". The nurse asked the patient to rate their pain, "How bad is the pain? Moderate? Severe?"* (Field note, December 3rd 2020, S2-RN2, care episode #36).

During observations, intravenous analgesics in addition to sedatives were common (75%) medications administered intravenously to intubated critically patients to optimise comfort, relieve anxiety and facilitate care. Emergency nurses were frequently observed to be the first clinician to detect the presence of pain in critically ill patients, and vigilant for signs of uncontrolled pain. A variety of approaches to detecting pain in critically ill patients observed ranged from monitoring for behavioural or physiological cues:

> *"I rely more on their vital signs, heart rate, blood pressure, or look to see if they are grimacing, moaning, guarding any area. Even an intubated patient may show you they're in pain."* (Field note, December 9th 2020, S2-RN4, care episode #30)
>
> And
>
> *"Well, I've seen tears coming down or chewing on the tube. Often, I think it is a mixture of the vital signs if they're intubated, they don't often have facial expressions but usually more the vital signs. Just because they're sedated and paralysed, they still need pain relief."* (Field note, November 13th 2020, S1-CNE1, care episode #15)
>
> An example observed by the researcher:
>
> *12:51: Participant nurse caring for a trauma patient and assessing the cause of the high-pressure ventilator alarm. Nurse notices patient biting on the endotracheal tube, grimacing and flexing. "They need something with analgesia, the roc[uranium] is wearing off." Nurse used the public address* [PA] *system to summon the treating physician to attend the resuscitation bay. A ketamine infusion is prescribed, the physician says, "Give a bolus, then increase the rate if you think they* [the patient] *need it."* (Field note, December 4th 2020, S1-RN2, care episode #15).
>
> And some participants spoke of using intuition to assess pain management,
>
> *"…if they're a burn injury patient with a significant percentage of burns and we'd have to intubate and paralyse them, you're not going to expect someone else not to feel pain. I know those burns are going to hurt heaps…I guess I try to imagine the pain the patient would be in, and think would I be in pain, and go from there."* (Interview, S1-RN6)

Emergency nurses assessed pain across a variety of undifferentiated critically ill and injured patients. Nurses built upon their undergraduate pain assessment knowledge during their careers and completed workplace training programs to support becoming the resuscitation nurse. Exposure to further education regarding pain assessment and pharmacology appeared to improve nurse confidence. However, while interview participants expressed the importance of assessing critically ill patients for pain and obtaining a pain history, it was infrequently observed in practice.

Confidence to manage pain in critically ill patients

For many participants (87%, n=26), they reported that their first experience of managing acute pain in critically ill patients occurred while working in the resuscitation area. Managing acute pain in non-verbal or unconscious critically ill patients was reported by all participants as "*intimidating"* (Interview, S1-CNS1). Participants reported feeling "*unconfident"* (Interview, S2-RN19) and "*overwhelmed"* (Field notes, December 9th 2020, S2-RN9, care episode #46). During interview participants reported that access to senior experienced nurses was vital in building participant's confidence in managing acute pain in critically ill patients. As one participant with three years' experience working in the resuscitation area recalled:

> *"I was handed over an intubated trauma patient, my first intubated patient…I just stood there, staring at the patient's chest rising and falling. The nurse handing over realised that I hadn't moved with them to the next patient, and asked "Are you alright?" I remember responding, "What if the* [endotracheal] *tube falls out? How will I know if they're in pain?" I didn't feel I had the confidence to manage this patient on my own yet. You want to ask for help, but the department is already stretched."* (Interview, S2-RN10)

And, from another participant with 13 years' experience working in the resuscitation area:

> *"Moving into resus was intimidating – you never felt like you knew enough at the start. We had no training program back then – you were just thrown in. I remember in my first week in resus, I was caring for an intubated patient…an unrestrained lorry driver with head injuries and blunt chest trauma. I was trying to work out why the ventilator's high-pressure alarm kept triggering and the patient's* [oxygen] *saturations were low – the doctor working with me was struggling as well. The patient looked like he was crying and trying to pull the* [endotracheal] *tube out. It wasn't until a more senior nurse came in to help, and took one look at the patient and quickly bolused morphine that it clicked: the patient was in pain. I felt terrible, I didn't know it was because of pain."* (Interview, S1-CNS1)

Participants commonly gained confidence in assessing and managing acute pain in critically ill patients whilst working alongside senior experienced emergency nurses in the resuscitation area:

> *"Senior nurses guided me to be honest, there wasn't anything specific to pain management in intubated patients above what was taught during orientation to resus. Once you've completed the workbooks and supervised shifts, senior nurses really helped me put it into practice. I just asked, and they helped me. The educators are not always on shift, like the weekends and nights, so the next people who can help are the senior nurses."* (Interview, S2-RN3)
>
> And
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> *"…the senior nurses really help – they provided feedback and showed me how to work with ventilated patients, spot potential causes for pain and how to manage analgesia."* (Interview, S1-CNS5)

During interviews, when participants were asked to rate their confidence on a scale from 0 to 10 (0 least confident, 10 most confident) in managing pain in critically ill patients, all participants acknowledged the importance of adequate pain control. However, significantly lower levels of confidence were reported at interview, when critically ill patients were unconscious or non-verbal, compared to those patients who could self-report (mean 6/10 versus 9/10 respectively, Z=4.46; p<.001) pain intensity. All observed participants reported that they would arrange for or provide analgesia if they thought their patient was in pain. Those participants (n=12, 40%) who reported lower levels of confidence (≤5) in detecting pain in unconscious or non-verbal critically ill patients, found identifying or interpreting signs of pain challenging:

> *"Three [out of 10] if I'm honest. It's quite difficult: knowing when to give more analgesia, or when to ask a doctor, 'Can we increase the dosage?' A lot of the times, nurses shy away from asking the doctor questions and wait to find a more experienced nurse."* (Interview, S1-RN15)
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> And
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> *"Four. I'm less confident when they're asleep. I try to guess from their behaviour or vital signs - but it's hard especially in an intubated patient. If you've got a relative there you could ask them to help identify pain, or if the pain is gone. Mostly, if I think its pain, I give or arrange for analgesia quickly, and watch for the patient to relax."* (Interview, S1-RN6)
>
> Again
>
> *"Five – about halfway. I watch for how the patient responds to the ventilator – are they pushing against it* [ventilator dysynchrony]. *If I'm not sure if the patient is showing me signs of pain, I imagine the type of injury they've suffered and how I would feel and go from there."* (Interview, S2-RN13)

A barrier to effectively managing acute pain in the critically ill patient was raised by most participants (n=14; 46.7%) at interview who undertake other senior roles such as triage and in-charge, concerned maintaining sufficient time working in the resuscitation area. As participants progressed in their career, acquiring increasing levels of knowledge, skill and confidence, they were frequently allocated to other areas of the ED such as triage, or leadership roles overseeing large teams of nurses. During interview two senior nurses with over 10 years' experience explain:

> *"It's difficult the more senior you become, as you spend less time in resus and more time at triage or in coordinating roles. In the last* [six weeks] *roster, I had two shift in resus. I've become acutely aware of losing the ability to do all sorts of resus skills, like caring for ventilated patients…you become less confident."* (Interview, S1-CNS1)
>
> And

"Probably four. It's difficult - the more senior you become, the less time you get in resus. Most times I work in triage or in a coordinating role, so you lose those skills. And, if you work an 8-hour roster like me, you have to push to get in there." (Interview, S2-RN7)

Interview participants that reported previous experience in managing critically ill patients, or who had completed external courses on caring for critically ill patients, reported higher levels of confidence in detecting and assessing pain in unconscious or non-verbal critically ill patients:

"I'd go nine out of ten. Having worked in ICU, I'm quite comfortable working with intubated patients. Although the degree and type of analgesia and sedation used in ICU is different in ED where you want the patient completely still while they're assessing, imaging etcetera to find the cause. In ICU the level of sedation is quite low so they could blink for yes or whatever, then obviously that's your cue to increase analgesia." (Interview, S1-CNS5)

Again

"Nine out of ten, you can never be perfect. While I didn't get taught RASS or CPOT, I used them when I worked in ICU, but you remember how to use them to help keep patients comfortable and sedated." (Interview, S2-CNE2)

For many, transitioning into the resuscitation area to manage often multiple undifferentiated critically ill patients requiring highly complex care and ensuring adequate pain control was challenging. Assessment of pain, when performed by participants, was observed to be multidimensional and included assessing for intensity, location, duration, characteristics, and the impact on function or activity. Variation in experience and confidence in managing acute pain in non-verbal critically ill patients was reported. The following section presents the second theme, *prioritising pain amidst the workload.* This second theme presents the factors reported or observed to influence an emergency nurse's ability to prioritise pain management.

Theme 2: Prioritising pain

This theme arose primarily from work observations of emergency nurses in the resuscitation area. Observation field notes focused on how emergency nurses managed patient care needs, including the assessment and management of acute pain, while balancing departmental demands. These observations were further explored in participant interviews. The second theme is subdivided into three subthemes: 1) *managing the work of resuscitation;* 2) *minimising delay*; and, 3) *out of sight*.

Managing the work of resuscitation

The subtheme *managing the work of resuscitation* presents the challenges of stabilising critically ill patients. Of the healthcare team members, the emergency nurse was observed to be the first and continuing point of contact for critically ill patients in the resuscitation area. Hence, the process of assessing, resuscitating and stabilising patients generated varying levels of workload for the resuscitation nurse and the different members of the resuscitation team:

> *"Emergency nurses are continually busy assessing, monitoring and treating, collecting* [pathology] *tests, communicating with the patient about their care and the various care team, escalating to various care teams when there are issues, administering medication such as sedation and analgesia, and providing comfort."* (Interview, S1-RN3)

Arriving patients identified with life-threatening conditions were observed to be brought into the resuscitation area from the ambulance bay (56.5%) or escorted from the waiting area by the triage nurse (32.6%) and directed by the resuscitation nurse to a designated treatment bay. For patients being transported by ambulance with life-threatening conditions, nurses working in the resuscitation area received early warning of their impending arrival by way of a dedicated telephone located in the acute area, which the ambulance controller can ring to notify the ED of an incoming ambulance transporting a critically ill or injured patient. Once alerted, paramedics would be contacted by the ED using the ambulance radio to obtain further information about the patient's condition, current treatment provided and estimated time of arrival. This information was then relayed to the resuscitation nurse(s). The nurse was observed to then prepare the resuscitation areas and relevant equipment for the patient's arrival, and alert relevant specialty care teams (e.g. surgeons, neuro-trauma team).

In contrast, for patients brought into the resuscitation area from the waiting room, the resuscitation nurse used the PA system to alert the department and request medical assistance. At times urgency was critical and instead the nurse would activate the emergency buzzer at the back of the bed for assistance by the resuscitation nurse and team. However, there were times when patient volume, acuity and/or complexity exceeded the capability of the nurse/s working in the resuscitation area. The number of nurses allocated to work in the resuscitation area varied across study sites (range 2 to 3 nurses), but at least one nurse was present at all times. However, during observation, participants working in the resuscitation area frequently managed multiple competing care demands for multiple critically ill patients (median 3, range 1-5) with competing complex care needs. When the demand increased, participants either escalated for further nursing or medical assistance, engaged paramedic staff to assist while ED team members assembled, or negotiated as to when they would be able accommodate patient care procedures in the resuscitation area. A typical example of the workload and demand managed in the resuscitation area was observed by the researcher over a 30-minute period involving one senior participant emergency nurse with 18 years' experience:

> *(10:01) ANSW* [Ambulance New South Wales] *control radios ED to prepare for an 84-year-old female, suspected intracranial bleed with sudden drop in GCS from 11 to 6 requiring airway support maneuvers and oxygen. ETA 7 minutes. Participant nurse used PA* [Public Address] *system to request a physician to attend the resuscitation area, then picks up the phone and activates*

neurosurgical team page, while another nurse prepares the resuscitation bay, checks airway intubation and mechanical ventilator set up.

(10:06) Ambulance arrives with suspected intracranial hemorrhage patient. Participant nurse assists paramedics to transfer the patient to resuscitation bed 1 and takes handover and uses the PA system a second time to request a physician to attend the resuscitation area, then starts to inspect the away as snoring heard. Inserts a nasopharyngeal airway and asks the senior paramedic to continue maintaining head-tilt-jaw-thrust, and for the junior paramedic to insert a second intravenous cannula, while they assessed patient's BP, GCS and pupillary light reflex, and limb tone.

(10:18) ED physician arrives at bed 1 and requests handover from paramedics and participant nurse.

(10:20) Triage nurse escorts paramedics into the resuscitation area with a 61-year-old male who fell from a ladder (<1m), unresponsive, GCS 5, and seizure activity observed at scene. Participant nurse uses the PA system to request the clinical nurse educator to assist in the resuscitation area, and transfers the patient into bed 2. ED physician arrives and starts assessing patient.

(10:22) Clinical nurse educator arrives to assist in the resuscitation area and receives handover from paramedics about patient in bed 2.

(10:25) Nurse-in-charge comes into the resuscitation and speaks with participant nurse concerning a patient in the acute area needing cardioversion. Participant nurse outlines current issues being managed in the resuscitation area, including the need to intubate patient in bed 1, and requests that the patient is stabilised in the acute area and transfer delayed until the 11am resuscitation nurse starts. CNUM agrees, and asks, "Do you need more help in resus?" the participant nurse raises their eyebrows and nods.

(10:30) Neurosurgical team arrive to assess patient in bed 1. Patient is now intubated by emergency physician with assistance from participant nurse. A second nurse connects the mechanical ventilator. ED physician asks participant nurse to set up sedation and analgesia. Verbal order provided, "Morphine and midazolam, the mixed single syringe, 5mls per hour". Neurosurgical team ask for an urgent CT to be ordered. Participant nurse intervenes and requests the neurosurgical team order the CT themselves as the ED team are busy.

(10:35) Triage nurse escorts paramedics into the resuscitation area bed 3 with a 36-year-old female complaining of abdominal pain and vaginal bleeding for past two days. Bleeding increased over past 24-hours, now hypotensive with a systolic BP of 55mmHg. Investigated by GP who arranged ultrasound that shows ectopic pregnancy. Clinical nurse educator assists in transferring the patient into bed 3 and receives handover from triage nurse and paramedics. Clinical nurse educator then uses PA system to request for medical assistance in the resuscitation area, and conducts a primary survey.

(10:38) ED consultant arrives and is directed to bed 3 by participant nurse.

(10:47) Medical emergency alarm activated at triage – a loud two-tone alarm blares throughout the ED. An RN from acute area comes into the resuscitation area, "The [CNUM] *has asked me to help out in resus, I'll go see what the emergency buzzer is about."*

(11:00) Emergency physician escorts patient from the acute area requiring cardioversion into the resuscitation area and speaks with the participant nurse about the patient, who requests that the procedure be delayed until another resuscitation nurse arrives, and notices consent has not been documented. Participant nurse requests emergency physician to site an additional cannula and consent the patient. Allocates patient to bed 4.

(11:05) 11am resuscitation nurse arrives and receives handover from the educator. (Field note, December 3rd 2021, S2-RN1, care episodes #22 - #24).

Workload for participants was observed to be variable and unpredictable in the resuscitation areas. On several occasions when the acuity and complexity of critically ill patients exceeded the capacity of nurses working in the resuscitation area, additional emergency nurses were requested to assist. The care needs of patients in the resuscitation area were diverse and variable. Participants used a variety of strategies to balance providing timely, safe care and pain relief to patients in the resuscitation area when workload increased.

Minimising delay

The subtheme *minimising delay,* arose from the observed and reported efforts of nurses working in the resuscitation area to provide timely pain management to critically ill patients. To minimise delay in administering analgesia, nurses used a variety of strategies from negotiation to co-opting nurses or physicians that entered the resuscitation area to either prescribe, sign out or administer medication with them:

"With only two or three nurses working in resus, things can get delayed. We alert the nurse coordinator, but it can take a while to find a spare nurse to come in and assist – to help catch up. I just grab the first person that walks in." (Field note, December 8th 2020, S2-CNS4 care episode 31#)

And

"Every registered nurse can help you sign-out or give morphine or fentanyl. Sometimes I grab the triage nurse before they leave resus. They need to triage patients, but they can stop for a few minutes to help administer pain relief." (Interview, S1-CNS2)

Again

"The doctors often come through resus[-citation] *to check on their patients, so if I feel that my patient needs pain relief, I grab them to chart it. They're pretty happy to help."* (Interview, S2-RN12)

Participants could also arrange analgesia pre-emptively before the patient arrived in the resuscitation area. When the ED received notification from ambulance control of a patient being transferred to them, the senior physician and occasionally the nurse-in-charge attended the resuscitation area to help receive the patient. Some participants took the advantage of this assistance to obtain prescribing analgesia for other patients currently in the resuscitation area, or obtained a verbal order for what analgesia to prepare in readiness for the new patient, for example:

"I discuss what drugs are going to be needed with the team before the patient arrives in resus, especially the post intubation drugs to keep them comfortable. It helps to get things ready, so there is no delay. It's one of the things I get new nurses in resus to practice. The doctors are pretty good really, and actually listen to our opinion - it can get busy in resus, so being prepared saves time, and the patient can get pain relief sooner." (Interview, S1-CNS5)

And

"You get the information from the Bat Phone report, if there's likely to be pain, which most of the cases have some aspect of pain-causing mechanism, you can pre-empt the need for analgesics, discuss it with the doctor and even get it ready before the patient even comes in." (Interview, S1-RN2)

Observations supported interview findings:

Emergency physician attended the resuscitation area and contacted ambulance control using the radio. After obtaining a summary of the expected patient's condition, the physician informed the participant nurse. The participant nurse then asked if any analgesia or sedation could be got ready, as the patient was intubated. Acknowledging this, the physician went with the nurse to drug cupboard to check the medications out. (Field note, November 26th 2020, S1-RN4, care episode #20)

And

Nurse coordinator and physician came into the resuscitation area and informed the participant nurse of a patient being transferred from another hospital who was for stroke admission. Participant nurse asked coordinator to help reposition an intubated patient and asked the physician to chart an increased analgesia infusion rate, as they had needed to bolus several times. "Can you chart a higher dose or range for this patient to control their pain?" Physician agreed and amended the prescription chart. (Field note, December 7th 2020, S2-RN16, care episode #40)

While emergency nurses remained vigilant of their patients for signs or symptoms of pain, they experienced multiple challenges in providing timely relief from pain and discomfort to critically ill patients while balancing the needs of other patients in the resuscitation area. Participants used a variety of strategies to try and meet patient's pain relief requirements. However, operating within some aspects of the resuscitation area layout made this more pain management more difficult. The next subtheme *out of sight*, explores the impact of the resuscitation area layout on communication, visibility and pain management.

Out of sight

In the two study sites, while the resuscitation area was easily accessible from the ambulance bay or triage area, its location and various internal structures limited communication and visibility between clinicians, patients and the rest of the department. The design of the treatment space and the layout of the resuscitation area impacted on how participants interacted with critically ill patients and provided care, including assessing and managing acute pain. Across the study sites, the design of resuscitation area treatment spaces could be grouped into three types: open, partially open and closed.

At site 1, the open treatment spaces were the most common and involved the use of opaque curtains to divide bays at the sides and front of the bed areas. This patient safety design was observed to allow nurses to move quickly between resuscitation bay areas, had limited impact on audibility of communication between and monitoring of adjoining bay areas, as one participant expressed when the researcher was orientated to the resuscitation area:

> *"You can call out and the other nurse can easily hear you. We sometimes pull the middle curtain back if we need to watch one patient whilst working up the patient next to them."* (Field note, November 20th 2020, S1-RN4, care episode #14)

At site 2, partially open resuscitation bays were formed using floor to ceiling solid partition walls with curtains placed at the front of the bed area. This design limited audibility and obscured communication and line of sight between adjoining treatment spaces but allowed better protection from medical ionizing radiation from X-ray machines, and mounting of heavy equipment commonly needed during stabilisation and resuscitation of trauma patients. As the researcher observed during a morning shift:

> *Participant nurse pulled back the curtain, looked up and down the resuscitation area and asked, 'Did someone call me?' 'Are you free for a second check?' a nurse replied. "Where?" the participant nurse clarified, "In four, need the drug keys as well." came the reply. The participant nurse doffed their gown, sanitised their hands and walked into resus 4. "What do you need?" the participant nurse enquired, "Morphine, 5mg thanks. Been meaning to get someone to help but didn't see anyone around."* (Field note, December 9th 2020, S2-RN6, care episode #26)

At site 1, closed resuscitation bays were used, and consisted of solid floor to ceiling partition walls or aluminum framed opaque glass panels and doors to completely enclose the treatment space. This design was used to form negative pressure or negative airflow isolation rooms where critically ill patients with potentially transmissible diseases would be treated. These isolation rooms were built in 2017 prior to COVID-19. The design of this treatment space, while limiting communication and line of sight, also directly impacted on participants' confidence to enter the enclosed space and the continuity of patient care. Participants at site 1 expressed concern at being alone and out of sight as the leading reason for being reluctant to enter an isolation room. This was compounded by participants' common experiences of not being able to summon help to assist with basic patient care when in the isolation room or needing to be accessible to other critically unwell patients in the resuscitation area.

Participants during interview recounted that junior staff found this the hardest as they were often unprepared to work in such an isolated space, where foresight was needed to ensure all necessary equipment and medication was obtained prior to entering the isolation rooms:

> *"I've definitely noticed, and possible with me as well, there's a reluctance to go in unless you really need to. Once you're in there, trying to get help to pass something into the room, or medication, especially* [opiate] *analgesia - you have to double check it with another nurse. Not only just while you're in the room, but, you become very reliant on someone outside the room…if the other nurse already has a patient that is unstable, they can't readily leave them to go inside* [the isolation room], *it delays the care the patient needs."* (Interview, S1-CNS5)

> And

> *"Communication is super difficult. The intercom doesn't work properly. You get stuck in the room - just you and a doctor, but you are gowned up, sweating and you can't get anything from outside. You're just standing there waiting to catch someone's eye - because all the drugs you need are outside in the medication area. So you're like trying to tap on the window, trying to get someone's attention because there might be three other resus patients out there, trying to get someone's attention to drop stuff off for you. Which for anything creates a bit of a challenge because you often need morphine that requires a second nurse to check out – it's a challenge just full stop."* (Interview, S1-RN5)

> Again

> *"If you have to wear full PPE* [personal protective equipment], *everything becomes more challenging. It's hot, it's uncomfortable, the masks are uncomfortable, you don't want to be in there for longer than necessary, and mostly, you're often in there by yourself. If the patient was outside in the other resus bays* [points to open treatment space with curtains] *it's easier to get help and get things. So it's really difficult. I think it would be really difficult for junior nurses to know what they actually need to prioritise, and you've really got to think, "Okay, what are my priorities now? What needs to be done? What order do I have to do them in? Why do I have to do them in that order?" and, "How am I going to do it most efficiently?"* (Interview, S1-CNS2)

Assessing and monitoring of patients cared for in the isolation rooms relied on visual observation and remote monitoring. While the isolation rooms were equipped with intercom systems, the unit inside the room was wall mounted away from the bed area, and had a non-directional microphone, meaning that any noise inside the room was transmitted to the outside unit's speaker greatly reducing audibility. On observing the isolation room, the researcher was orientated on the use of the telecom system:

> *Participant demonstrated how the wall telecom system worked. On operating the panel to activate the microphone inside the isolation room, a heavily distorted sound comprising high range static and a constant low range humming from the negative airflow system was produced. The sound of the participant nurse and the patient was inaudible. The nurse operating the telecom system commented that turning the speaker volume up would further worsen the sound quality.* (Field note, November 18th 2020, S2-CNE1, care episode #12)

Without direct means of communication with the patient, participants would observe the patient via the window in the isolation door, and watch vital signs displayed on monitors inside the room to assess the patient's stability, including distress. If there were signs of deterioration, or distress, participants would enter the isolation room to assess the patient at the bedside. Patients did have access to a call bell, which could be operated to signal to nurses working in the resuscitation area that assistance was needed. Similarly, when an emergency nurse was inside the isolation room, communication occurred by hand gestures, speaking loudly by the door seal. In some instances, opening the isolation door fractionally to speak directly with healthcare staff or calling out as observed by the researcher:

> *Participant nurse was assessing an older patient brought to ED from a nursing home who was restless and trying to climb out of the bed. The participant nurse, after making eye contact with the other emergency nurse working in the resuscitation area, beckoned them over by waving at them. The other nurse put their eye against the door seal while turning on the intercom system. A loud hissing noise followed by acoustic feedback came through the intercom's speaker. The nurse outside the isolation room shook their head, "I can't hear you, speak up". The participant nurse dashed to the door, opened it fractionally and said, "Can you get [the doctor], we're going to need IV pain relief" and then went back to the patient to stop them getting out of the bed again.* (Field note, November 23rd 2020, S1-RN17, care episode #7)
>
> And from interview
>
> *"It is really hard to get help if you are the one inside the isolation room. If it's not life-threatening, you don't use the emergency buzzer for every little thing. If there's another nurse with you, knocking on the door can work to get their attention. But sometimes, when resus is full, you have to catch someone's eye, or call out through the door if you can't see anyone."* (Interview, S1-RN1)

The third theme describes the interpersonal relationships and interactions between nurses working in the resuscitation area, with critically ill patients and their family, and the ED team. Specifically, how participants sought to reduce patient discomfort and improve the patient care experience in the resuscitation area to ameliorate pain.

Theme 3: Between being and doing

The final theme, '*between being and doing'*, emerged from observed and reported nurse-patient interactions and behaviours in responding and managing pain and discomfort of critically ill patients. Two sub themes are presented in this section: 1) '*being present for the patient*' reveals the intentional acts of participants to be with and connect with the patient and the patient's personal experience of the situation; the 2) '*art of doing*' emerged from accounts and observations of participants' actions when performing interventions or clinical tasks to humanise the process of care and the patient's experience of the resuscitation environment.

Being present for the patient

This subtheme was more than the act of completing care tasks, as important as they may have been, but rather being purposefully present for the patient and attentive to the patient's experience of the situation. Participants in interviews acknowledged the importance of building a genuine connection with the patient to increase trust in the care being delivered, and to reduce discomfort and distress, which were recognised as affecting a patient's pain. The following illustrates the voices of all participants:

> *"For many patients, it's the first time they have been to the ED let alone in resus. It can be a highly stressful time, lots of questions, poking and prodding – you can see the stress and embarrassment on their face. As an emergency nurse, you have to be a master of conversation and all-round interpreter of body language. Getting to know the patient, what they are experiencing, helps guide how you might help, and build trust."* (Interview, S1-CNS6)
>
> And
>
> *"It's what it means to be a nurse, even in emergency…to be there and weather whatever comes, in that moment, with the patient. We may be highly skilled, know all the buttons and problem-solving steps, but connecting with the patient, being able to work with a patient at all extremes. It impacts on patient trust and confidence."* (Interview, S1-CNC1)

As emergency nurses moved around the resuscitation area, they would pause to observe the patient. There were several incidences observed where participants frequently looked towards the patient to observe their behaviour, that often led to participants initiating a conversation, or small talk, to further explore how patients were coping. A typical observation highlights this, which was expanded upon at interview:

> *Within minutes of meeting a new patient the participant nurse noticed how quiet the patient was being, and how the patient made little eye contact - the patient was glancing at the wall, the ceiling, and monitors around the bed area. The nurse approached the foot of the bed,*

smiled, and introduced themselves. The patient briefly made eye contact with the nurse and was biting their lower lip. "You look worried. I need to quickly check your blood pressure, but can I help with anything, or contact a relative or neighbour?" The patient responded that they were concerned for their wife who gets confused easily when left alone in the house. The nurse shared that they also have an elderly relative they worry about, and that a welfare check could be arranged by the police. The patient agreed, and the nurse contacted the social worker who arranged a welfare check with the police. Police brought the patient's wife to the ED. Throughout, the nurse remained in the resuscitation bay and kept the patient informed. (Field note, November 25th 2020, S1-RN3, care episode #10)

As two experienced participants with over 7 years' experience working in the resuscitation area highlighted, while technical skills are important, connecting with the patients was also important; nurses sought to be present with the patient, not only seek to identify discomfort or distress:

"Patients are often scared or anxious. They can be worried about a lot of things from pets at home to what to expect, whilst coping with their injuries. Intubated patients can become agitated – pull lines out or even the [endotracheal] *tube. There are many priorities…things that need doing, but if you can spend time with them, listen to their concerns, we can make the patient more comfortable, they feel safer in the* [resuscitation area]. *If the patient isn't making eye contact, I'll pop in and take their vital signs as an excuse to be next to the bed to start up a conversation."* (Interview, S2-RN11)

And

"I think it's very important to try to make sure you are having those conversations with your patients, to make sure that they are actually okay. Introduce yourself, smile and listen to them. A couple of times that I think it really made a big difference by being with the patient and having a conversation and just letting know what's happening, asking how they're going." (Interview, S1-CNS2)

As observed multiple times across the study sites, how participants positioned themselves relative to the patient, and the degree of line of sight afforded varied, from either sitting next to the patient, around the edges of the resuscitation bay, or just outside the curtain area:

"Participant nurse moved mobile workstation and chair to the end of the patient's bed and angled the computer screen to the side to be able to see the patient. "Can you see me from here?" The nurse said. The patient gave a thumbs-up sign." (Field note, December 2nd 2020, S2-RN15, care episode #35)

And

"You need to be able to see your patients to continually monitor them, to show them that you are there if they need you, especially if there are acutely unwell. Sometimes, if you have multiple patients, you can draw the curtains back a bit so that you can pop your head in quickly if the patient calls out, or something alarms. You can stand in front of the resus[citation] *area so that you can see both, if the patients don't need you within arm's reach."* (Interview, S1-RN10)

Conversely, participants used distance and reduced lines of sight to disconnect with patients in certain situations; for example, where patients were aggressive, or perceived to be aggressive. Participants would position themselves outside the resuscitation bay to enable a view of the vital signs monitor, but not be in direct line of sight of the patient:

"You need to be safe, but also able to respond to the patient in an emergency. I angle myself around the corner or behind the pillar, but I always make sure I can see the vital signs monitor." (Interview, S1-RN3)

Further, supported during observation, participants altered their proximity in response to patients' behaviour out of concern for their safety:

Participant nurse giving handover to oncoming nursing staff. Nurse call bell activated by patient in adjacent bay with the curtains pulled around. Participant nurse looks towards the bay, <rolls eyes>, and speaks in a low voice, "They've been shouting and swearing at us all night." Oncoming nurses nod and all move away [2 meters]. Participant nurse shouts, "Just handing over, someone will be [there]in a minute." Following handover, the oncoming nurse stands behind the pillar, and places the mobile workstation to ensure visibility of the patient's vital signs monitor, but not to have a direct line of sight to the patient. Patient continues to yell abusive comments. (Field note, November 18th, 2020, S1-RN8, care episode #21).

For critically ill patients who were unstable or intubated, participants remained in close proximity to the bedside, positioning the mobile computer workstations to be always within arm's reach of the patient. All participants were observed to frequently look at the patient's face, constantly monitoring for and reacting to limb movements and signs of deterioration. To maintain connection with patients who were unconscious or intubated, participants were observed to talk to the patient:

Participant moves the computer on wheels and chair next to the patient's bedside, and lowers the computer monitor to be able to see the patient. "I'm just here if you need anything" the participant says to the patient who nods. (Field note, November 14th, 2020, S1-RN9, care episode #8)

And

The participant continues to talk to the intubated patient – describing what they are doing (wiping blood off the patient's face). The participant then pulls over the computer on wheels and narrates to the patient what they are documenting. (Field note, December 8th, 2020, S2-15, care episode #29)

At interview, participants also described their approach to providing nursing care while still remaining close to the patient:

"It's important that the patient knows whose around them, what's happening to them – even if they are sedated, I still talk to them, make sure things are tidy around them, clean them up." (Interview, S1-RN10)

And

"I make sure I'm close to the patient, just in case they become distressed, pull at the ET tube, but more importantly, that they know someone is with them. Since COVID, it has been difficult to be in contact with the patient, but we have been using gloves filled with warm water linked around their (the patient's) *hand to provide a sense of someone being there…for comfort."* (Interview, S1-CNS1)

When able to spend time with critically ill patients, participants felt it strengthened the nurse-patient relationship, rapport, communication, trust and ability to detect and respond to pain or discomfort. However, workload, work environment and staffing limited the ability of participants to spend time with patients in the resuscitation area:

"I try to spend time with my patients, but when the workload hits, it's hard to be with everyone, or think of every patient their individual situation, you just switch to automatic and get as many tasks done as possible; often before you realise it, you're pushing the patient out of resus, to the CT scanner and then onto the ward." (Interview, S1-CNS3)

And

"Things can change fast in resus. You might have the one patient, and have the time to get know them, and then bat calls come rolling in, or the emergency buzzer gets pushed, or you're a nurse down on the shift and doing twice as much – you spend your time only completing care tasks." (Interview, S2-RN2)

Observations supported this sense of being present for the patient. During one observation period in the resuscitation area, the following was observed between a nurse and a mechanically ventilated critically ill patient:

Participant nurse filled an examination glove with warm water. Ensuring the glove was tied off at the cuff securely, they placed the patient's hand on top, and threaded the fingers of the glove between the fingers of the patient. On probing the nurse behaviour, they explained the importance of patients "knowing someone was there…that someone was with them." (Field note, December 2nd 2020, S2-CNE1, care episode #29)

For patients being cared for in insolation areas (site 1 closed rooms), participants were observed to bundle care activities so as to spend as much time with the patient, collecting equipment, medications and other necessary items before entering the care space, to reduce time away from the patient, or waiting for assistance from a colleague. As observed in the resuscitation area:

"… everything together, sheets, medications, cannulation equipment, even phone chargers, and then jump in. Once you're in there, you can focus on the patient." (Field note, November 19th, 2020, S1-CNS6, care episode #12)

As observed during a busy shift:

A nurse filled a large plastic bag with linen, boxed medications, intravenous fluids, intravenous giving sets and personal hygiene items such as wipes, toothbrush and toothpaste. They then placed a mobile phone charger in their uniform pocket. In their left hand was a shallow tray containing intravenous medications that had been checked with their colleague, and tablets. In their right hand was a drip stand, with the plastic bag hooked onto the top of it. Before they entered the isolation room, the nurse called to the other patients to use their nurse call buzzer if they needed anything, as they were going to be inside a closed room. The nurse then said to the researcher, "You have to get everything, even double of everything before you go in [to the isolation resuscitation bay]*." The researcher then assisted by opening the door to the isolation room to allow the nurse to entre without dropping anything.* (Field note, November 19th 2020, S1-RN7, care episode #7)

Further, supported during interviewed,

"It is frustrating, but you have to continually prioritise care. But once you can be with the patient, you collect everything, meds[ications] *and any tests you might need to do. Once you are in there, you can spend time with the patient."* (Interview, S2-RN7)

The resuscitation area was observed to serve a diverse patient population who experience varying degrees and types of pain and distress. Participants believed they were caring for the whole patient, not just the chief complaint. Participants therefore actively sought out ways to support an inter-relational experience, that is, a nurse-patient relationship that fostered mutual openness and trust to create caring and space for effective moments in an environment that is foreign and often chaotic. All observed participants positioned themselves in ways to spend time in proximity with the critically ill patients in their care.

The art of doing

The *art of doing* emerged from participants' accounts of caring for critically ill patients and observed actions and interactions in the resuscitation area to ameliorate pain using a person-centred approach. While participants identified and managed potential physical sources of a patient's pain arising from their injuries or as consequence of necessary life-saving procedures, all further sought to ameliorate pain through addressing patient anxiety. Participants reported that the resuscitation area is a highly stimulating, chaotic and emotionally charged environment, leading to patients' feeling anxious and stressed; further increasing a patient's sensitivity of acute pain and vice versa:

> *"If a patient is anxious, their sense of pain increases. Similarly, if the patient's pain isn't well controlled, it will make them more anxious – they'll start to worry and stress out. We're very good at getting the analgesia in but working out if the patient is anxious or worried takes time and trust. Once larger issues have been handled and the technical aspects are completed, I'll often talk or inquire about their support systems, and say, "Do you have a partner or friends who you want to know that you're here or you want us to contact?" obviously if they're conscious, and if they're not, we just look online for their next of kin."* (Interview, S1-RN10)

> And

> *"Patients can be anxious about a whole range of things. Finding out what is causing the anxiety takes rapport and trust. Sometimes the patient can point the issue out, it might even be that they need to be cared for by a female nurse. Our ED sees many Indigenous, Muslims, Greek and Jewish people. It can make a lot of difference to know the person you are caring for – EDs can feel like a very hostile place."* (Interview, S1-CNS5)

> Again

> *"Once they are settled, you can do little things to help make the patient more comfortable. You can dim the lights, pull the curtains round, or volume level of non-essential alarms…if they are cold, you can give them a warm blanket."* (Interview, S2-RN8)

Nurses voiced that unacknowledged pain increases patient anxiety and reduced trust towards nursing and medical care. Similarly, undetected anxiety and distress could exacerbate the pain experienced by critically ill patients and build distrust between the patient and the care team.

During study observations, while participants used pharmacological measures to reduce pain, also evident were the non-pharmacological means used to reduce discomfort and distress to further ameliorating patient's pain. Participants aimed to provide person-centred care, by exploring for and adapting care to include potential cultural, emotional and/or social needs of patients, to reduce anxiety and thereby ameliorate pain. This was particularly noted during one observational visit, where a participant nurse was assisting in the assessment of a young Muslim woman with suspected head and neck injuries whilst ensuring dignity:

> *ED physician finishes assessing the patient for overt head and neck trauma and requests a CT head and neck. Participant nurse re-applies the soft collar to stabilise the patient's neck for transport to CT. "I need my head covered" the patient stresses to the nurse. The patient looks distressed. The nurse and the patient discuss how best to cover their head given the constraints of the soft collar and the need to remain still. The patient agrees for the hijab to be placed loosely over the top of the head and down the sides of her face, in order to cover as much hair as possible.* (Field note, November 26th 2020, S1-RN1, care episode #2)

Patients often arrived in the resuscitation area in some degree of pain, partially clothed, and covered in blood, mud and/or street litter. At interview, participants shared their approaches to reducing patient anxiety by addressing the emotional and social needs of critically ill patients, while providing emergency nursing care:

> *"It can feel like you leave your dignity at the front door of ED, you're a mess, and sometimes life-saving care doesn't allow for much modesty. The whole situation is enough to make anyone anxious – a group of random people prodding you, undressing you. You do everything with care and try to be as understanding and calming as possible…holding their hand throughout it all. But once patients are medically stabilised, we can really get in and start caring for them - cleaning them up, make them warm, cover them up with sheets and blankets to provide some degree of dignity. We can help them make phone calls or Zoom calls to relatives. I always make sure the patient has at least one clean hand that relatives can hold."* (Interview, S1-CNS3)
>
> And
>
> *"Even when caring for intubated patients, it even goes right back to your basic nursing: tidy the IV lines so they don't get trapped, position their limbs to avoid pressure injuries and spasms but keep a hand on top of the sheets so relatives can hold it, use warm blankets, and most of all, talk to your patient – tell them what's going on and who is visiting them. Where and when you can, involve the family…that has been hard during COVID, but we've been able to make exceptions in ED."* (Interview, S2-RN12)

During observations the use of touch was an essential nursing attribute used to provide a reassuring presence. While observing participants the use of touch was applied when communicating with the patient and when pain was becoming unbearable. Below is an example of a frequent observation:

Participant holds patient's hand undergoing conscious sedation to relocate fracture bones in left ankle. "I'm going to be here with you throughout this. If it gets too much, squeeze my hand." The patient starts to lift their head and grimaces as the orthopaedic physician manipulates fractured bones into alignment. The nurse continues to hold the patient's hand and talks reassuringly to patient whilst monitoring vital sign monitor. The second time, when patient lifts head and grimaces, the patient squeezes the nurse's hand. The nurse tells the physician to pause, whilst they bolus analgesia to the patient. The physician agrees. Patient relaxes. Nurse continues to hold patient's hand and talk to patient – "We're giving you more pain killers. We'll wait a few minutes before we plaster the leg." (Field note, December 9th 2020, S2-RN17*,* care episode #36).

All participants spoke of the important role family members and partners play as significant sources of social support for critically ill patients in reducing their anxiety, stress and worry. Conversely, the absence of family members or concern for a partner's wellbeing could become a source of patient worry and stress. All participants sought to ensure that patients could connect with family members or their partners. Participants reported using a variety of strategies to ensure connections with family or partners, especially important during the COVID restrictions imposed in NSW which limited visitors in hospitals. Interview participants shared examples of how they used various mobile devices with teleconferencing applications to assist patients connect with their relatives:

"We showed patients how to connect with the hospital's free WIFI network and how to start a Skype chat on their phone. If their mobile phone was flat, we had charging leads, or we could use the computer on wheels [mobile workstation computer]. *You had to get tech-savvy. Patients can worry a lot – being able to see or hear their relative really de-stressed them."* (Interview, S2-CNS3)

Similarly, observed on several occasions were participants working with patients to assist in connecting with relatives or resolve patient's concerns for their relatives. The *art of doing* aimed to allay a patient's worry and fear:

Participants used a range of closed and open questions when working with patients in the resuscitation area, including in the isolation rooms, to connect patients to with family members: "Do you want us to contact your daughter to be here with you?" (S1-RN1) *or , "If you have a mobile phone, I can show you how to Skype or Zoom – they can then see you"* (S1-RN6)*, and alternatively "We have an iPad we can use to Skype call your wife - it doesn't cost anything."* (S1-RN10). (Field note, November 14th 2020, care episodes #8, #12 and #14)

And, observed by the researcher

When the nurse felt that the patient's response didn't align with what they were observing, they asked the patient's family member/relative – "She is being very brave, but do you think [they] are in pain?" (Field note, December 12th 2020, S2-CNS2, care episode #26).

Again

Participant nurse documenting patient observations on the computer inside the patient's resuscitation bay, notices a discussion between patient and their wife. The nurse steps in and asks the patient's wife, "Your husband [patient] looks worried. Have you had breakfast or need a cup of tea or morning medications?" The patient's wife explains they rushed out the house when the ambulance came. Nurse arranges for the patient's wife to book into ED, and for a doctor to chart their medications. Patient's shoulders visible relax, and the patient thanked the nurse, "She's all I have." (Field note, 3rd December 2020, S2-CNS4, care episode #28)

However, observed participants found it progressively more difficult to provide a person-centered care approach. During times of high demand and increased workload in the resuscitation area. While participants' behaviours remained professional and respectful towards the patient, their ability to spend time with a patient, and deliver care that included the preferences and values of the patient were constrained. As one participant expressed explained during interview:

"Resus[citation] *can become so busy that there isn't any time to spend with the patient. Sometimes all you can do is get as many jobs done, as many tasks completed as possible, and apologies to the patient. Things they might need have to go on a list for later."* (Interview, S1-RN1)

The last theme *and the art of doing* detailed how nurses demonstrated a range of expertise and person-centred caring behaviours being present and art of doing just detail the subthemes- summary points. The various resuscitation area designs impacted on nurse-patient communication, providing timely patient-centred care, including pain relief and comfort. Participants actively sought ways to develop an inter-relational experience in an environment that often chaotic. The participants ability to be with patients and shape care to include patient preferences and values were often challenged by unpredictable workloads, availability of staff and the urgency to complete assessment and clinical and care tasks. However, the rapidly changing environment of the resuscitation area at times constrained the capability of emergency nurses to pursue behaviours that they perceived to optimise the well-being of the patient and sustain a therapeutic relationship to better manage pain.

Summary

This Chapter presented the findings of non-participant observations and semi-structured interviews conducted across two emergency departments. Emergency nurses working in the resuscitation area needed to be highly experienced and skilled to manage acute pain for a wide range of life-threatening conditions. For emergency nurses, transitioning into the resuscitation area marked the first time that they were responsible for managing acute pain and comfort in critically ill patients. Preparing nurses to independently manage undifferentiated critically ill patients was facilitated by locally designed workbooks and clinical supervision. Participants, however still faced a variety of challenges in assessing and responding to pain in critically ill patients. These findings illustrate that the detection and continuity of pain management relied upon the confidence, knowledge and experience of the emergency nurse allocated to the resuscitation area. Workload and communication factors, along with variations in assessment methods and levels of knowledge in managing acute pain in non-verbal critically ill patients may contribute to inadequate pain and discomfort control.

The following Chapter presents an overall discussion of this sequential explanatory mixed-methods study, and specifically the interpretation of results, presented as meta-inference findings, methodological strengths and limitations, implications for emergency nursing policy, practice and education, and recommendations for future research.

CHAPTER 8: DISCUSSION AND CONCLUSIONS

Introduction

This Chapter presents a discussion of the overall integrated findings of this explanatory sequential mixed method study, and the positioning of the findings within existing literature. The overall study aim was to examine emergency nurses' perceptions and practices in managing acute pain in critically ill adult patients. Specifically, the study sought to explore emergency nurses' actions and behaviours in assessing, monitoring and pain management practices, within the resuscitation area.

This Chapter initially opens with a statement of key findings. This is then followed by a critical discussion of the interpretation and meta-inferences of the study findings and conclusions. Following this, the methodological strengths and limitations of the study are described. The Chapter then presents the implications for emergency nursing policy, practice and education, and recommendations for future research. Finally, the conclusion of the thesis is then presented.

Statement of key findings

Assessment and management of acute pain in critically ill patients cared for in the resuscitation area is the responsibility of emergency nurses. Emergency nurses managed multiple critically ill patients with a wide array of life-threatening conditions in an often challenging and chaotic environment. To identify and prioritise care needs, nurses systematically assessed patients for life-threatening signs and symptoms, including the presence of pain. The literature review (Chapter 3) presented in this thesis synthesised a substantial amount of published research that explored pain management in ED, including the barriers, myths and the role of the emergency nurse. However, no evidence was found that addressed the perspectives and experiences of emergency nurses managing acute pain in critically ill patients.

In phase 1 of this study, emergency nurses' knowledge and attitude towards pain scores were found to be variable. However, while emergency nurses strongly agreed that pain relief in critically ill patients, including opioid pain management was important, in clinical practice, the frequency of pain assessment was observed to be low. Survey findings highlighted that pain management knowledge and skills were largely scaffolded from workplace learning programs and guidance from senior nursing colleagues on transitioning into the resuscitation area. Further, while nurses who received ongoing workplace education in pain management had higher pain management test scores, nurses voiced at interview having low confidence in assessing and managing pain in non-verbal or unconscious critically ill patients.

The use of observational pain assessment instruments was infrequently reported upon and observed in practice to be absent. Observation findings identified that nurses detected pain in non-verbal or unconscious critically ill patients by observing patient behaviour, monitoring for changes in vital signs or through experience and intuition.

Nurses were vigilant for signs of patient or family member discomfort or distress and would use interpersonal skills, positioning within the resuscitation bay and adapt their practice, to reduce the impact of the clinical situation and the foreignness of the resuscitation area. To avoid delay in providing pain relief to critically ill patients, nurses were observed to prompt physicians to discuss pain management options prior to patients arriving in the resuscitation area by ambulance or at the patient's bedside once the patient was stabilised. While nurses had some degree of influence regarding pain management within the resuscitation area, this was dependent upon the nurse-physician relationship and clinician experience.

This study demonstrated that emergency nurses' practices in managing acute pain in undifferentiated critically ill patients are complex and rarely linear (Ebright et al., 2003; Franklin et al., 2011; Mahmoudi et al., 2013). Through the Donabedian analytical lens adopted in this study, several inter-related factors were identified as impacting and shaping nursing practice and the quality of acute pain management in the resuscitation area.

The Donabedian model (antecedent, structure, process, outcome) provided a means to conceptualise underlying mechanisms impacting on pain management outcomes for critically ill patients; identifying implications for future research, education, practice and policy development. In this study, the *antecedent* domain referred to the socio-cultural values/practices, previous pain experiences and support network. *Structure* related to the facility, workforce, nurse expertise and resuscitation environment. The *Process* domain related to how care was delivered or actioned in managing acute pain in critically ill patients. *Outcome(s)* included changes in patient's health status such as improved pain control, calmness, and empowerment (Figure 8.1).

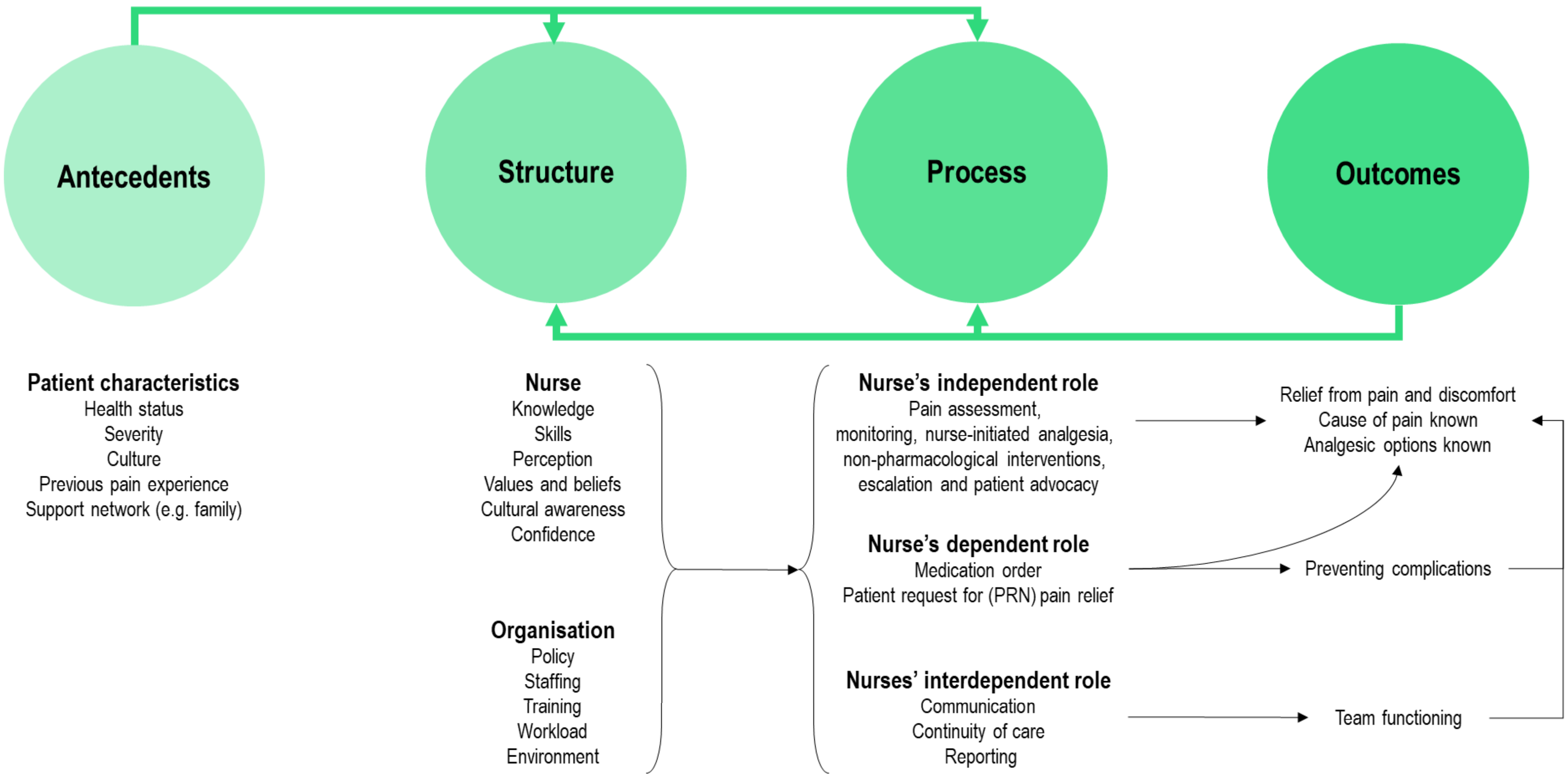

Figure 8.1: Factors impacting on acute pain management in the resuscitation area

Meta-inferences

Emerging from the meta-inferences of the data integration are key factors impacting emergency nursing practice in monitoring, assessing and managing acute pain in critically ill patients in the emergency department. The following section details the meta-inferences and conclusions of the study findings.

Emergency nurses' knowledge and attitudes towards pain management

This study revealed deficits in knowledge and attitude regarding pain management, which impact on issues of patient advocacy, safety and quality of care, decision-making, and professional values (Rubio-Navarro et al., 2019). Theoretical knowledge and attitude regarding pain were highly variable across survey participants. Similar to other studies involving emergency nurses conducted in the Middle-East (Al-Rawee et al., 2022; Al-Sayaghi et al., 2022), East Africa (Kahsay & Pitkäjärvi, 2019a), North America (Moceri & Drevdahl, 2014), and East Asia (Tsai et al., 2007), the least correctly answered items in this study were questions related to the case studies. While surveyed nurses agreed that pain is subjective and is best evaluated by the patient, this was not borne out in responses to the case scenarios. One possible explanation for deviating from patient's self-report of severe pain and providing sufficient analgesia, is nurses' reliance on behavioural cues. This was confirmed by participant's responses to the survey case vignettes that showed an increase in overall mean pain score, and percentage of participants selecting adequate analgesia; all of which improved as the behavioural manifestations increased across the three scenarios. These results reflect implications from other studies; that whilst patient pain scores were collected, they may not form the basis for decision-making about pain management (Chatchumni et al., 2016); nurses may underrate patient's pain (Klopper et al., 2006) and administer analgesia based on their rating of the patient's pain rather than the patient's self-report (Ene et al., 2008). Another possible reason for nurses devaluing the patient's self-report of pain may relate to insufficient pain management knowledge.

Respondents in this study initially developed knowledge and expertise in managing acute pain during their pre-registration nursing degree, and then built upon this through workplace training. Interview participants found that while undergraduate pain management education aided in building basic pain management knowledge, it focused on differentiated patients, who were able to self-report, with more chronic pain, and did not provide knowledge concerning assessment of acute pain in non-verbal patients or in the critically ill patients. While pain is a key public health priority with the goal that all healthcare providers are trained in pain management (Department of Health, 2021; International Association for the Study of Pain, 2015), there remains considerable variation in undergraduate nurse training content (Abdalrahim et al., 2011; Chow & Chan, 2015; Mackintosh-Franklin, 2017; Thompson et al., 2018). Importantly, nurses in this study first developed knowledge and expertise to assess and manage acute pain in critically ill patients through workplace learning and clinical supervision on transitioning into the resuscitation area.

Clinical education is one of the signature pedagogies in the discipline of nursing that provides exposure to practice in action (Esterhazy et al., 2021). Historically, EDs have locally developed workplace learning resources, typically combining self-directed learning and supervised clinical practice, to assist nurses to acquire the necessary knowledge and skills to undertake various clinical functions and roles (Jantzen, 2019; Miller, 1989; Nevalainen et al., 2018). Analgesics, particularly opioids, are the primary treatment for acute pain in critically ill or injured patients. Studies implementing nurse-initiated analgesia have used a variety of workplace training methods (e.g. in-service education, training package, competency assessments) to improve timely access to pain relief on arrival to ED (Barksdale et al., 2016; Chang et al., 2018; Kelly et al., 2005; Muntlin et al., 2011; Pierik et al., 2016; Ridderikhof et al., 2017; Santos et al., 2021; Sepahvand et al., 2019) in a range of moderate to severe painful conditions (Finn et al., 2012; Fry et al., 2011; Fry & Holdgate, 2002; Fry et al., 2004) using a range of opioid medications.

During clinical observations and interviews, while all nurses reported feeling less confident in assessing and managing acute pain in non-verbal or unconscious critically ill patients, many who had completed training to independently initiate analgesia at triage or as part of the CIN role, reported greater confidence in advocating for and administering opioids. That is, when nurses have the necessary knowledge and skills, they are more confident in their assessment and management of patients' pain (Alzghoul & Abdullah, 2020; Germossa et al., 2019; James & Mill, 2018; Liu et al., 2021; Peterson et al., 2017). Further, while regular pain education programs can improve nurses' knowledge and attitudes towards pain, as noted here and other recent studies (Germossa et al., 2018; Innab et al., 2022; Santos et al., 2021), developing confidence is a process that requires time and the ability to apply the knowledge and decision-making skills in an applicable setting with access to clinical supervision (Decker et al., 2008).

Emergency nurses' pain management practices in the resuscitation area

Across Australian EDs, management of pain and discomfort in critically ill patients occurs daily. Critically ill patients continue to remain in the ED for extended periods of time due the escalating demand for intensive care beds (Chalfin et al., 2007; Mohr et al., 2020; Richardson, 2002). Emergency nurses are now therefore, required to manage critically ill patients for longer periods of time, including managing pain. Pain management practices encompass a set of activities: assessing patients' pain (Smith et al., 2022), providing appropriate nurse interventions to relieve patients' pain (Ayenew et al., 2021) and reassessing patients' pain after intervention (Hatherley et al., 2016). As observed in phase 2, emergency nurses were responsible for conducting a comprehensive assessment of the patient when they arrive in the resuscitation area to prioritise and structure nursing care. Critically ill patients by their very nature are unstable, with one or more undifferentiated life-threatening conditions requiring urgent intervention (Kayambankadzanja et al., 2022). These findings highlighted that pain was assessed in less than half of critically ill patients, with fewer still re-evaluated after administering analgesia. Also noted was that the majority of patients who were re-assessed required further opioid analgesia.

Importantly, voiceless, mechanically ventilated critically ill patients were rarely re-assessed for pain. One explanation for this is the lack of evidence-based pain assessment instruments to help guide nursing practice in the assessment and management of pain in critically ill patients, especially those requiring mechanical ventilation (Rababa et al., 2021; Seo et al., 2022).

Critically ill patients unable to verbalise the presence of pain require continuous monitoring using validated behavioural pain tools (Smith et al., 2022). While the majority of survey respondents indicated behavioural cues such as grimacing were reliable indicators of pain, very few participants indicated the use of validated behavioural pain assessment instruments. Yet, behavioural pain assessment instruments are being used in Australian EDs, such as the CPOT or BPS (Varndell et al., 2016a), to assess pain in critically ill or injured patients unable to self-report. Concerningly, eight out of ten survey respondents also viewed changes in vital signs (blood pressure, heart rate) as reliable indicators of pain being present. Within the literature however, studies have consistently demonstrated that vital signs are not specific enough to detect or distinguish acute pain from other types of distress arising from anxiety, illness or injury (Arbour et al., 2014; Daoust et al., 2016; Erden et al., 2018). For example, one large multisite study examining patients (n=153,567) presenting to EDs in moderate to severe pain, demonstrated no significant changes in vital signs (Daoust et al., 2016). While medication administration should not occur in absence of knowing broadly the patient's condition, which can include vital signs, emergency nurses' reliance on observing changes in vital signs may delay pain assessment, recognition and/or administration of analgesia.

The use of structured approaches to manage pain in critically mechanically ventilated ill patients, such as algorithms incorporating evidence-based pain and sedation assessment tools, can reduce variation in clinical practice, reduce patient mortality and morbidity, and systematically reduce the likelihood of insufficient or excessive administration of analgesia (Devabhakthuni et al., 2012; Modanloo et al., 2019; Sessler & Pedram, 2009; Zalieckas & Weldon, 2015). Two recent studies evaluating analgesia algorithms incorporating the behavioural pain scale in ICU (total n=530) patients (de Souza et al., 2022; Hamrick et al., 2019) demonstrated increased frequency of pain assessment, communication between clinicians, decreased patient mortality and morbidity, judicious use of opioids and significant reduction in pain. To date, no studies have investigated introducing similar algorithms into ED, to guide nurses' practice in managing pain in mechanically ventilated critically ill patients.

Nurses' influence on pain management in the resuscitation area

Nurses' ability to influence practice and processes were noted during observations, including provision of peer support to junior peers, advice and assistance in the assessment and management of pain emerging in critically ill patients. Importantly, how nurses perceived and interpreted patient's verbal and/or non-verbal cues regarding pain, may have influenced how pain is managed in the resuscitation area.

As emergency nurses progress to work independently through various clinical areas in the ED, learning plays a key role in their professional development, bridging skill gaps and continuously improving patient care (Friberg, 2019).

Managing pain in undifferentiated critically ill patients in the resuscitation area clearly requires mastery of a broad range of knowledge and skills. To assist nurses in consolidating this essential knowledge and capacity to safely provide high-quality care, clinical support from senior experienced emergency nurses is needed to ensure nurses feel confident to perform as well as expected. Survey respondents reported that the knowledge and attitudes of other nurses influenced their own pain management practices. Similarly, during observations and follow-up interviews, nurses regularly sought guidance and support from other nurses regarding care of the critically ill patient. As evidence suggests, nurses prefer to source information and practice guidance through interpersonal contact and communication with colleagues, including pain management, rather than the Internet or journal articles (Denness et al., 2017; Estabrooks et al., 2005; Yin et al., 2015). For example, Pravikoff et al. (2005) found that nearly two-thirds (67%) of nurses always or frequently sought information about clinical questions from colleagues rather than from a reference text or journal article. This finding highlights the pivotal role peer support plays in influencing nurses in their development and consolidation of knowledge and skills within the clinical area, and potentially in narrowing the evidence-practice gap in the management of pain in critically ill patients.

The introduction of the CIN role into emergency care was to initiate early focused assessment, diagnostic tests and improve early symptom management, such as pain at the point of entry to ED (Fry & Jones, 2005; Hodge et al., 2011). While the CIN role is not specifically targeted towards managing acute pain in critically ill patient, one strategy to improve evidence-based pain management practice and nurse confidence could include expanding CIN training; to develop local clinical champions or resource nurses to complement and sustain best pain management at the bedside in the ED. In the context of nursing, 'pain resource nurses' function as an accessible experienced resource for pain management, and assist in improving the quality of care from within the practice environment (Gunnarsdottir et al., 2017). Pain resource nurse programs, primarily implemented in the USA (Allen et al., 2018; Gunnarsdottir et al., 2017) across a variety of clinical settings and demonstrated a range of targeted nurse and patient outcomes, including increased patient comfort (Du Pen et al., 2000; Elliott et al., 1997; Grant et al., 2011; Ravaud et al., 2004), nurse-physician communication (Grant et al., 2011), increased frequency of pain assessment and documentation (Paice et al., 2006), use of validated pain assessment instruments (Ravaud et al., 2004), and provided a supportive culture and awareness of pain management (Stevenson et al., 2006). Emergency nurses manage a wide variety of undifferentiated patients who have differing pain management needs and frequently seek assistance from senior peers. Pain resource nurses could assist in disseminating best practice and enable nurses to develop confidence in and a consistent and methodical approach to pain exploration in critically ill patients.

How pain is experienced is different for everyone. Similarly, as this study demonstrated, how pain is perceived by nurses can also differ. Considerable variability was noted from the survey findings between emergency nurses' estimation of pain intensity associated with critical care tasks and procedures. In this study, the majority of procedures commonly performed when caring for critically ill patients in the ED were judged by nurses to cause on average only mild pain; potential delaying or minimising the amount of analgesia administered. Differences in the actual pain felt by the patient and a nurse's perception of the patient's pain can be attributed, to some extent, to the subjective nature of pain. Nurses' perception of pain may therefore clearly result in underrating a patient's pain which can influence the treatment and care given to the patient (Tetteh et al., 2021a). Previous studies have consistently demonstrated that nurses significantly underestimate patient's pain, even when the patient is able to self-report (Kahsay & Pitkäjärvi, 2019a; Puntillo et al., 2003; Roche et al., 2017). Respondents in this study perceived endotracheal suctioning and repositioning as causing mild to moderate pain; activities that are frequently performed - many times per day - to maintain adequate ventilation and reduce pressure injury risk.

However, in studies examining care-related pain using behavioural pain tools in ICU repositioning (mean BPS score 9.25, SD 1.29) and suctioning of endotracheal tubes in mechanically ventilated patients (mean BPS score 9.13, SD 1.12) were rated as causing moderate to severe pain (Ayasrah, 2016; Gomarverdi et al., 2019). One possible explanation is that nurses and other clinicians may assume that they would instinctively know when the critically ill patient is experiencing pain, and how intense the pain is likely to be. As supported by the findings of this study this may be compounded by a lack of experience in the resuscitation area managing critically ill patients. As demonstrated in this study and others (bring ref to here), the degree of nursing experience and perceived level of pain intensity showed a moderate statistically positive relationship (AbuBaker et al., 2019; Al-Kalaldeh & Al-Zaidaneen, 2022; Giusti et al., 2018), Further, nurses with less experience may be unaware of the degree of care-related pain being experienced by critically ill patients (Varndell et al., 2020). The incongruency between nurses' perceptions concerning the pain level of critically ill patients are exposed to, may therefore delay analgesia and lead to suboptimal pain management.

The critical art of comfort

Emergency nurses in this study were vigilant for patients' comfort care needs, which varied between individuals and could change at any stage of care in the resuscitation area. A nurse's ability to be compassionate, caring, and communicative evolves over time, and reflects the art of nursing (Palos, 2014). Comfort is an expression of nursing art consisting of intentional activities (process) by which discomfort is reduced (outcome). Unrelieved anxiety and discomfort negatively impacts on patient pain experiences (Cimpean & David, 2019; Mei et al., 2021). Common triggers in this study included uncertainty of outcome, being isolated in a foreign environment, concern for a loved one left at home, and separation from family. As confirmed by previous research, being admitted to the ED is stressful and anxiety provoking (Patel, Biros, Moore, & Miner, 2014; Sturesson et al., 2016). The link between anxiety and pain is bi-directional, with both acting as risk factors for each other (Kolcaba, 2003; Kolcaba et al., 2006; Kolcaba, 1995). As the amygdala is stimulated (Ressler, 2010), patients with lower levels of anxiety demonstrate a higher pain tolerance compared to those with higher levels of anxiety (James & Hardardottir, 2002).

Critically ill patients in ED often experience co-occurring symptoms of pain and anxiety (McCahill et al., 2022). The impact of anxiety on pain experiences is well documented in other patient contexts such as burns (Byers et al., 2001), surgical procedures (Tola et al., 2021) and gerontology (Hellwig & Domschke, 2019). Under recognition of anxiety in the adult ED is a risk factor for oligoanalgesia and poor patient satisfaction (Craven et al., 2013). While clinical assessment tools have been developed to separately evaluate pain and anxiety (Sahin & Sahin, 2022; Taal & Faber, 1997), presently the revised American Pain Societies Patient Outcome Questionnaire is the only validated instrument combining both pain and anxiety assessment. Importantly, the questionnaire has been psychometrically tested in the ED environment (Hughes et al., 2021). While the study found the ED modified questionnaire was feasible to use to assess patient-reported outcomes of pain care, broader testing is required that should include critically ill patients. In the absence of specific assessment tools, emergency nurses relied upon detecting behavioural cues.

Emergency nurses are the most present of clinicians in the resuscitation area and thus best able to read the emotional cues of patients, establish human connections and provide comfort whilst delivering a range of time-critical and personal care. The concepts of comfort and discomfort are used in nursing practice and in other disciplines. Definitions for each have, however changed over time and can vary between contexts. Comfort is an important concept and core value of nursing, which has always been a central concern in the definition of the nature of nursing knowledge, the discipline and the profession (McEwan & Willis, 2018). In this study, like others, comfort came from interactions with other individuals, and objects (Freitas et al., 2012; Lichen et al., 2021), and from having physical, psychospiritual, sociocultural and environmental needs addressed (Kolcaba, 2003; Kolcaba et al., 2006; Kolcaba, 1995; Lichen et al., 2021). Participants in this study actively sought ways to be present with the patient, to create and maintain a therapeutic nurse-patient connection and to optimise patient cultural dignity and privacy. Since the days of Florence Nightingale, nurses have been judged by their ability to make patients comfortable, both physically and mentally (Howett et al., 2010; Karimi & Masoudi Alavi, 2015). Championing critically ill patients' need for comfort is central to person-centred care. Findings from this study reflected that patient's needs for comfort varied between individuals and can occur at any time. Emergency nurses, in the complex context of the undifferentiated critically ill or injured patient, frequently need to make decisions about pain and other types of discomfort based on factors other than self-reported variables. To date, there has been limited research pertaining to the concept of comfort within the context of emergency care. However, one study conducted by Wensley (2020), examined the concept of comfort from the perspective of acute ill patients, and developed the Comformt ALways Matters (CALM) multidimensional framework. To conceptualise the findings of observed nursing behaviour and actions to providing comfort to patients to ameliorate pain and reduce distress, the CALM framework was adapted to encompass findings from this study (Figure 8.2).

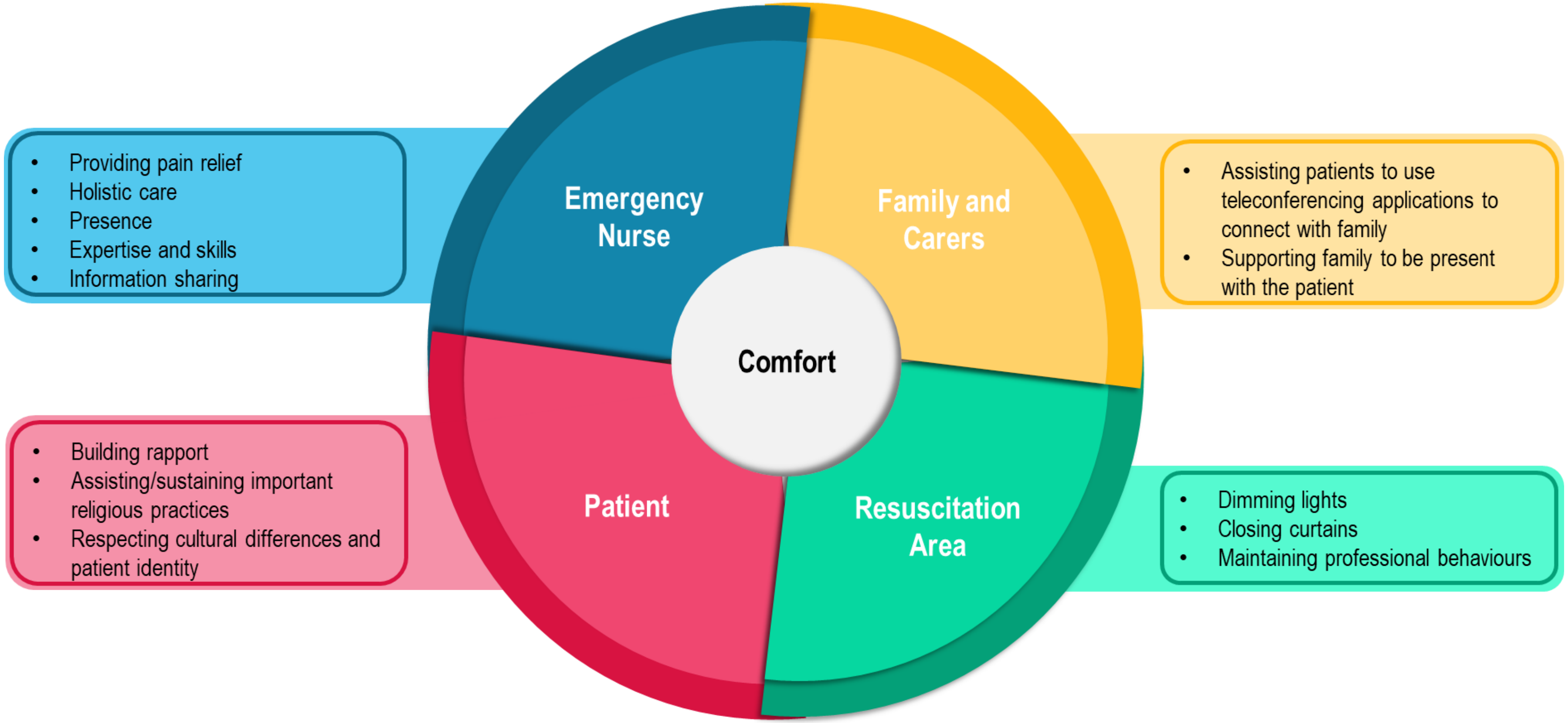

Figure 8.2: Observed nurse behaviours initiated to improve patient comfort in the resuscitation area

The *patient* domain concerns patient's preferences in finding comfort and reducing distress, such as seeking cultural and spiritual connectedness (Carr et al., 2005; Kapoor et al., 2015; Michaelides & Zis, 2019). Providing care that is congruent with the cultural, spiritual beliefs and values of patients promotes identity, health and wellbeing (Padela & Punekar, 2009; Salinda et al., 2021). Participants in this study modified care activities to incorporate patient's beliefs and values. As Brooks et al. (2019) noted, when cultural differences are acknowledged, communicated and engaged with respectfully, patients are more likely to experience a positive and beneficial nurse-patient relationship and better health outcomes (Al Shamsi et al., 2020). Early research on the relationship of culture and pain conducted found that reactions to pain varied by cultural group and reflected the beliefs of the group (Zborowski, 1969; Zola, 1966). Misunderstanding the values and beliefs of patients, and patients expressing discomfort may lead to increased anxiety and distress; negatively impacting on pain. While professional standards advocate for culturally sensitive communication and engagement with patients and their family (Australasia College for Emergency Medicine, 2010; College of Emergency Nursing Australasia, 2020b), cultural diversity training remains largely absent (Kula et al., 2021).

The *family and carers domain* relates to the unique connection and ability of family to provide and enhance comfort (Wensley et al., 2020). Family members are the main source of social support for critically ill patients throughout their illness, and play an important role in assisting recovery (Botes & Langley, 2016). During the COVID-19 pandemic, patients struggled to stay connected with their family due to physical distancing requirements. In this study, emergency nurses recognised the important role family plays as a buffer against the unfamiliarity and uncertainty of the resuscitation area, by providing reassurance, sustaining spiritual and cultural norms and a sense of the familiar. Amid the pandemic restrictions, emergency nurses became skilled in using a range of electronic devices (e.g. smartphones, mobile computers) and applications to enable patients to speak and connect with their family. Participants reported at interview their perceived positive impact this had on patient anxiety; allowing family to connect and bring comfort to the patient. The ubiquity of smart devices, previously seen as being distracting and anti-social, became essential to connect and express comfort and humanity in hospitals and EDs (Billingsley, 2020; Monaghesh & Hajizadeh, 2020; Moolla et al., 2020). While the impact of using video conferencing applications on patient discomfort within the context of critically illness is unclear, there is emerging evidence that it can reduce worry (Bryant et al., 2022), and is a compassionate solution to enhance family presence and reduce patient distress (Billingsley, 2020; Cunningham & Aubusson, 2020).

In this study, when family members were present in the resuscitation bay, emergency nurses proactively enquired about their wellbeing, such as needing a drink, reassurance or assistance, which was observed to reduce patient anxiety and improving nurse-patient rapport and trust. When family members were not able to be present, emergency nurses were creative in their approach to simulate human contact by using water filled gloves to mimic hand holding. Therapeutic or caring touch has been used in critical care nursing practice to indicate presence, safety, reassurance and as a gesture of giving strength and comfort (Sandnes & Uhrenfeldt, 2022). During the peak of the COVID pandemic, nurses recognised the negative impact that loneliness had on intubated patients who were isolated or unable to be visited by family, and developed the technique to reduce patient distress and provide comfort (Benassatto, 2021). Previous studies have shown that critically ill patients are able to recall a range of memories during admission. Factual memories are amongst the most commonly recalled events, such as ventilator support and care procedures are reported to be 20% to 83% (Magarey & McCutcheon, 2005; Ringdal et al., 2006; Roberts et al., 2007) including recalling pain and anxiety as well as feelings of being safe (Egerod et al., 2015; Stein-Parbury & McKinley, 2000). Critically ill patients were also able to recall nurses who evoked emotions of safety and security, by their warm touch, and reassuring words spoken (Olsen et al., 2017).

The *emergency nurse* domain relates to several patient comfort needs that relate to the ability of nurses to engage, communicate, and provide holistic care in a competent manner that addresses their needs (Wensley et al., 2020). Unlike nurses in other departments, emergency nurses provide care to a wide range of patients experiencing life-threatening conditions, discomfort and loss of control. While studies examining patients' level of satisfaction regarding nursing practice have shown greater ratings associated with technical aspects of nursing care (Godkin et al. 2002, Merkouris et al. 2004, Eichhorn et al. 2015, Desborough et al. 2016, Mollaoglu & Celik 2016), there is the need for an holistic approach in ED; one that places greater emphasis on the individual patient, families, and sociocultural context, which is the foundation for humanising care (Kvande et al., 2022). Participants sought ways to determine what is most important to them by listening and by noting non-verbal feedback such as facial expressions, gestures, and silences. Communication skills were vital in this process, particularly when dealing with patients and families affected by sudden deterioration in health in an often-busy clinical area of the ED.

The final domain, *resuscitation area*, reflects factors occurring in the physical care space and ambience (Wensley et al., 2020). A hospital campus is a convoluted mosaic that continues to evolve to meet community needs (Brambilla et al., 2020). EDs have complex zones that are subdivided into unique clinical care areas, and is positioned to be the most available point of access to immediate health care (Woolard et al., 2016). The resuscitation area is arranged to provide highly complex and technical care, and is maintained in an immediate state of readiness, compartmentalised bays, brightly lit with a low to moderate level of ambient noise, to receive the most critically unstable patients requiring rapid stabilisation; (Ortiga et al., 2013). Eriksson (Eriksson, 1990), in her seminal work, introduced the term 'carative', meaning kindness and equanimity (in contrast to technical curative factors) which can generate a healing environment. Successive studies have demonstrated that the physical environment can impact on patient health, comfort and pain management; factors including noise and overcrowding (Evans, 2003; Ortiga et al., 2013), privacy (Barlas et al., 2001; Price et al., 2022) environmental lighting (Timmermann et al., 2015) air temperature (Verheyen et al., 2011) and spatial layout (Maben et al., 2016). Conversely, the ability to communicate essential information between resuscitation bays such as calling for assistance, having adequate lighting to read medication labelling (Grissinger, 2018), sufficient air ventilation to reduce heat exhaustion whilst wearing personal protective equipment (Luze et al., 2021), and sufficient space to safely conduct procedures (e.g. lumbar puncture), is essential for clinician safety, focus and patient safety (Borradale et al., 2020).

In this study, once patients were stabilised, all participants adjusted subtle aspects in and around the resuscitation area to make patients feel more comfortable by talking softly, dimming ceiling lights, reducing non-critical alarm volumes, providing blankets for warmth and pulling curtains closed. For patients requiring continuous monitoring, such as intubated critically ill patients, nurses were observed to remain close to the patient and focus on reducing background noise.

Perceived barriers to pain management

Achieving adequate pain management in undifferentiated critically ill patients required emergency nurses to make complex decisions, communicate and collaborate with other clinicians and advocate for patients (Shannon & Bucknall, 2003), yet as findings from this study demonstrate, barriers impacting pain management were evident in the resuscitation area. Nurses cannot function effectively in the multidisciplinary healthcare team unless they are knowledgeable (Nguyen et al., 2021). Low levels of nursing theoretical knowledge results in poor pain assessment and management (nurse independent role), especially for patients who are unable to self-report (Sweity et al., 2022; Zuazua-Rico et al., 2020). Of note in this study, of the 16 critically ill mechanically ventilated patients, only two were re-evaluated for pain. Evidence has consistently shown that pain assessment does not occur as frequently as it should (Eriksson et al., 2014; Mahar et al., 2012; Melile Mengesha et al., 2022; Varndell et al., 2015b; Wikström et al., 2014) and that critically ill patients continue to receive sub-optimal pain management as a consequence of clinicians not knowing that a pain assessment is needed (Cetin et al., 2021; Marks & Sachar, 1973; Sampson et al., 2020; Varndell et al., 2013).

Optimal pain assessment must lead to changes in patient management, including frequency of re-assessment of pain, to better meet patients evolving needs (Gordon et al., 2005). Contrary to this, observations of nurses' clinical practice in the resuscitation area showed that assessment and re-assessment of pain in critically ill patients rarely occurred. Several studies to date have shown that over half of emergency nurses lack knowledge in key aspects related to pain assessment (Al-Sayaghi et al., 2022; Moceri & Drevdahl, 2014; Tsai et al., 2007; Varndell et al., 2020). Pre-registration nurse training programs are not designed to prepare nurses to meet all aspects of specialty patient care, such as acute pain management in the emergency nursing context. While current evidence suggests that education can improve some aspects of pain management knowledge and clinical practice (Deldar et al., 2020; Innab et al., 2022; Issa et al., 2021), it is unclear what education approach such as short lecture-based interventions (Grommi et al., 2021; Liu et al., 2021), simulation-based training (Singh et al., 2018) or interactive artificial intelligence driven virtual reality programs (Harmon et al., 2021), best improves nursing knowledge, skills and perceptions, and ultimately pain care outcomes.

Emergency nurses' practice within the resuscitation area is highly complex and pain management does not follow one standard set of practices, that can be dependent upon by nurse-physician relationship (Chatchumni et al., 2019). In this study, the ability of nurses to influence pain management in the resuscitation area centred on nurses' negotiating with physicians. From the phase 1 survey findings, the ability of emergency nurses to advocate and negotiate with the prescriber to permit titration of analgesia to more effectively target and control acute pain in critically ill patients (nurse dependent role) was reported as poor; especially if either party was junior in their experience of caring for critically ill patients. Critically ill patients are clearly a vulnerable group, more so if unable to self-report pain. Adequate and timely analgesia to manage acute pain in critically ill patients is strongly. However, how this was enacted in the resuscitation area was observed to be impacted by a lack of nurse-physician communication (nurse inter-dependent role).

From observations of nursing practice, a further perceived barrier to optimal pain management concerned the frequent failure to routinely communicate pain assessment findings or pain management plans during clinical handover. Clinical handover enables the transfer of information, accountability and responsibility for a patient or group of patients (Australian Commission on Safety and Quality in Health Care, 2021). Nearly every aspect of pain management relies on communication: assessing pain and functional status, deciding on pain management goals, implementing treatment plans, and assessing the effectiveness of those plans; ultimately impacting on continuity of care (Australian Commission on Safety and Quality in Health Care, 2022; Henry & Matthias, 2018). Poor and disjointed communication between care providers may increase the risk of delay in administering analgesia or titration of analgesia to achieve pain control goals, thereby potentially exposing the patient to further suffering (Jorm et al., 2009). In the resuscitation area, communication failures can occur in clinical handover due to the urgent, changing and unpredictable nature of care provision (Calder et al., 2017; Tiwary et al., 2019; Vermeir et al., 2015).

However, during observations, nurse-physician communication was still infrequent and disjointed even in stabilised critically ill patients. Studies exploring communication between care providers and acute pain management are few, especially within the context of critically ill patients. Studies by Kim et al. (2011), Nagpal et al. (2010) and Catchpole et al. (2007) examined omissions in information, including pain management plans, at critical junctures of patient care: pre-procedure, post-procedure and at handover to other treating teams. In these studies, based on incident analysis, checklists were developed to trigger key information and to limit adverse events resulting from omissions in information. Across all three studies there was a significant reduction in missing information, with one study (Kim et al., 2011) purporting zero adverse events over an 11-month period since the implementation of a communication checklists.

At one study site, a local communication checklist (PORPOISE) had been developed to guide information exchange at handover, including a plan for pain management plans. During observation and reported by nurses at interview, the checklist was found to assist in ensuring necessary information was shared and discussed prior to medical staff leaving the resuscitation area. All study participants across both study sites perceived the design of the resuscitation area as a barrier. The design of the resuscitation area at both study sites reduced or obstructed the ease by which clinicians and patients could see or hear anything from within or from outside the area. Current recommendations advocate for maximum auditory and visual privacy for occupants of the individual resuscitation bays and those around them (Australasian College for Emergency Medicine, 2021). However, this design approach impacted on participants' ability to practice and limited the degree of visibility between nurses. In site one, which had isolation rooms equipped with negative airflow systems, nurses felt totally isolated from within the resuscitation area and from the rest of the department. While intercom systems had been integrated into the isolation rooms, the audio quality was so poor that nurses were observed shouting through the door or using hand gestures to communicate. In times of high pressure, clinicians preferentially turn to each other for information and decision-making support, rather than searching for information electronically such as hospital policies and guidelines (Lafferty et al., 2021; Martin et al., 2019). Other studies found that with increasing separation between clinicians, both physically and visually, it severely limits opportunities to share information, co-ordinate, collaborate and model behaviour (Coiera, 2006; McGhee et al., 2022). This research supports these findings, with experienced resuscitation nurses reporting difficulties in coordinating care, communicating and implementing timely interventions to critically ill patients because of the design of the resuscitation bay. Considerations around accessing support and communication strategies should be incorporated into the design of resuscitation areas, to ensure staff feel supported, and that care can be provided in a more consistent manner.

In agreement with findings from Taiwan (Cheng et al., 2013), the USA (Arendts et al., 2013; Hao et al., 2014; Mills et al., 2009) and New Zealand (Pretorius et al., 2015), participants in this study perceived increased workload due to overcrowding as a major barrier that can impact on any part of the pain management process. In this study during peak periods, nurses were observed to be continually re-prioritising between multiple patient care needs, and the operational needs of the department. High workload environments with low nurse-patient ratios have long been associated with poor patient safety and quality of nursing care (Banda et al., 2022; Duffield et al., 2009; Irvine et al., 1998; Needleman et al., 2002; Varndell et al., 2016b). While nurses used workarounds such as preemptively obtaining analgesia prior to the patient's arrival, delays in administration and evaluation of outcome were also observed. Of significant concern was the lack of evaluating patient's pain following administration of analgesia, which was less frequent in patients who were intubated and mechanically ventilated, compared to those who could self-report. A previous study conducted by Mitchell and colleagues (2009) investigating the impact of workload on the administration of analgesia across 232 ED patients, demonstrated that as workload increased so did time to pain assessment.

Emergency nurses face many barriers working in this time-sensitive environment and specifically for the resuscitation area, where care requirements can differ from one moment to the next, whether working as part of a team or independently to evaluate and stabilise critically ill patients. In the findings of this study, emergency nurses bore the substantial workload for managing critically ill patients requiring minute-to-minute assessment and complex decision making.

Methodological strengths and limitations

A number of methodological strengths and limitations are noted as context for the interpretation and evaluation of study findings. This mixed-methods study highlights the value of combining qualitative and quantitative studies. First, use of a well-established sequential explanatory mixed-methods design underpinned by pragmatism, provided new understandings of acute pain management practices for a critically ill patient and the role of the emergency nurse. Importantly, the mixed-methods approach enabled comparison of multiple data sources thereby broadening our understanding of clinical practice, and resulting in a richer and more detailed description of the context of practice; and more specifically the everyday work of caring for critically ill patients by emergency nurses. This approach and the research processes undertaken, as presented in this thesis and subsequent publications (Varndell et al., 2017; Varndell et al., 2018a, 2020, 2021a; Varndell et al., 2021b) enhanced the overall rigour and validity of the work. Second, the use of an expert panel in the development of instrument for phase 1 survey (content validity) and subsequent piloting (face validity), data analysis, theme generation and findings were strengthened. It is acknowledged however, that further psychometric testing is required comprising item reduction analysis to decrease the number of questions that are not related to the domain under study to reduce potential participant burden, and to establish reliability of the survey instrument (Boateng et al., 2018). Third, undertaking observations and interviews at two trauma designated metropolitan tertiary referral EDs with frequent exposure to managing critically ill patients in the resuscitation bay increased the quality and depth of data collection, analysis, integration and generation of meta-inferences (Onwuegbuzie & Collins, 2007). As Donabedian (1988) cautions, measuring quality of clinical care is neither precise nor complete. Whilst a larger sample of all participants may have revealed additional information about the perception and practices in assessing, monitoring and managing acute pain in critically ill adult patients in the study sites, the Donabedian framework proved to be an appropriate audit methodology to investigate this phenomena. These findings adequately validated the Donabedian framework and provided important baseline information for future research and emergency nursing science. Fourth, integrity and rigour of the transcription process enhanced phase 2 findings. Finally, the range of clinical experience of participants in phase 2, strengthened the study and ensured that the findings would resonate with emergency nurses.

The focus of this study was the role of the emergency nurse. Although it could have been beneficial to also look more closely at the practices, behaviours, opinions and perspectives of other healthcare providers, the study design included the purposeful selection of the emergency nurse as they form the majority of individuals in the ED, and are in close proximity to critically ill patients and their family members; assessing and responding to patients' needs. By only focusing on observations from the perspective of emergency nurses, the study was limited in its scope of understanding all of the circumstances surrounding the observed behaviours. To limit this, follow up interviews adopted a semi-structured format to seek clarity on observations made in the resuscitation area, and to identify missing or hidden behaviours and actions related to acute pain management. Due to the fast-paced and complex nature of critical care in the resuscitation area, it was not possible to observe all nurses individually, which may limit the interpretation and generalisation of study findings. The number of emergency nurses working in the resuscitation at any one time set the maximum limit on potential participants. Trying to follow all nurses and interactions would have reduced the quality and consistency of the data. Therefore, the researcher chose to focus on an individual nurse who was caring for a critically ill patient. To limit recall bias, the researcher maintained written contemporaneous field notes and sought clarification in the form of follow-up questions with participants. More than just the number of participants observed in the resuscitation area, the time spent observing the practice and interactions of emergency nurses totaled 156.5 hours. Data collection ended when no new patterns emerged. Although, spending more time observing different participants may have introduced new understanding, data collection was also limited by the impact of COVID-19 and infection prevention and control requirements such as wearing a respiratory protective device (e.g. N95 mask).

Interviews were included to explore participants' experiences, perceptions, thoughts and interpretations of specific observed behaviors relating to managing acute pain in critically ill patients. To minimise the impact of participant recall bias, the researcher invited the participant to be interviewed as close to caring for a critically ill patient. Other methodological limitations are also noted. As the study sites were two trauma designated metropolitan tertiary referral EDs in Sydney, Australia, findings may not translate to emergency nursing practices of critically ill patients in different care settings, such as rural and regional hospitals, aeromedical retrieval, or international ED contexts. Phase 2 participants were all experienced resuscitation nurses, and findings based on their clinical experiences may therefore differ when compared to emergency nurses with less critical care experience in the resuscitation bay.

For context in phase 1, there were no accurate measures of the size of the emergency nursing workforce. In 2002 the Australian Institute of Health and Welfare estimated that 7,532 registered nurses were employed in the specialty of emergency nursing (2002). More recent reports do not unfortunately delineate emergency nursing from critical care nursing (Australian Government, 2022); and nurses may also work across both specialties. To increase the chance of recruiting emergency nurses with recent experience in managing acute pain in critically ill patients, the survey was advertised at a major international conference for emergency nurses, via email to members and across the social media platforms of the College of Emergency Nursing Australasia and the International Conference for Emergency Nurses. Without more detailed recent data on the actual size of the emergency nursing workforce, it may limit generalisability of the survey findings.

Implications for policy, clinical practice and education

This mixed method study highlighted the perceptions and practices of emergency nurses' assessing, monitoring and managing acute pain in critically ill patients, and provided key insights into the knowledge, skills and expertise necessary to optimise patient comfort and pain control. These findings and conclusions, therefore, have important implications for future policy, clinical practice, education, and research.

Implications for policy

Three major policy implications emerged from the study findings. First, additional training and education beyond that of pre-registration nursing education is fundamental for optimal assessment and management of pain in critically ill patients in ED settings across Australia. Second, clear policy regarding best practice recommendations for assessment and management of acute pain in the ED that includes critically ill patients is currently missing. Based on these findings, a state-wide policy is required to outline the expected minimum standards of care incorporating evidence-based assessment tools and protocols for the assessment and management of acute pain in critically ill patients the ED, if consistency in practice is to be enhanced. This need could extend to other jurisdictions in Australia. The policy needs to detail the expected standards of education and credentialing of emergency nurses working in the highly complex role of caring for critically ill patients. More importantly, emergency professional colleges should develop standards of care, tools and a credentialing framework for emergency clinicians for assessment and management of acute pain in critically ill patients in the ED. Study findings highlighted that emergency nurses in practice titrate analgesia to optimise pain control and relieve discomfort in critically ill patients. This needs to be formally recognised within policies, specifically treatment protocols and standing orders. Treatment protocols and standing orders would provide visibility for this important work already performed independently by emergency nurses, but largely hidden in the resuscitation area. Practice, patient outcomes and care activities would be enhanced and improved with the development of protocols and standing orders that enable the resuscitation nurse to independently, safely and in a timely way provide and optimise analgesia for the critically ill patient. Third, policy informing the design of the resuscitation area including communication equipment (e.g. PA and intercom systems) needs to be reviewed to ensure it facilitates staff and patient safety, optimises lines of sight and visibility, and enables communication. Study findings highlighted that the geography of care, impaired lines of sight and communication negatively, which impacted on the nurse's ability to facilitate timely pain management.

Implications for clinical practice

Three major practice implications emerged from the study findings. First, an ED multidisciplinary patient-centred approach to acute pain management is needed. The structure of this approach could be in the form of an evidence-based protocol or flowchart that guides the administration and titration of analgesia, in the context of an intubated mechanically ventilated patient, and in concert with sedation and anxiolytic coverage.

This protocol / flowchart should incorporate the ability for emergency nurses to adjust or bolus analgesia to optimise patient comfort. Development of a formalised structure would provide the opportunity to build familiarity and discussion around approaches to managing the pain control needs of critically ill patients between emergency clinicians, as well as inform the development of clinical competencies. This formalised practice guidance would also provide opportunities to audit and monitor the quality of pain management care and decision-making in critically ill patients within the ED. In addition, emergency nurses should incorporate into their practice the use of evidence-based verbal and non-verbal pain assessment instruments and analgesia protocols, to assist with determining the presence and intensity of pain in critically ill patients and enable the timely administration of pain relief.

Second, a communication checklist should be incorporated into practice that enables clinicians to systematically discuss and handover aspects of the patient's care. In this study, a communication checklist was identified and observed in clinical practice to guide communication between clinicians that included pain and sedation management. The use of a communication checklist to guide communication would provide the opportunity for clinicians to raise concerns about missed patient care or seek clarification around patient management.

Third, the clinical competence of emergency nurses must be maintained to ensure consistency and confidence in managing critically ill patients in the resuscitation area. In this study, as nurses gained clinical experience, they were rotated into other leadership roles (e.g. nurse-in-charge) and therefore, infrequently rostered to work in the resuscitation area; leading to deskilling and increased risk of missed patient care. Ensuring emergency nurses can maintain knowledge, skills and expertise in the resuscitation area, including management of acute pain, would improve confidence and patient safety.

Implications for education

Two major implications emerged concerning nursing education and team communication. First, the findings highlighted that emergency nurses demonstrated low and variable pain management knowledge and confidence, specifically in managing acute pain in critically ill patients unable to self-report pain. Emergency nurses clearly require highly complex knowledge and skills to ensure continuing safety and optimal acute pain management expertise. Importantly, the study highlighted that pain management education and training of emergency nurses is not uniform across Australia. To improve standardisation and transferability of knowledge, skills and expertise, at least a state-wide education framework is required, supported by the findings of this study, to be developed to support emergency nurses managing acute pain in critically ill patients. Further, to embed and sustain best pain management practice, pain management champions should be explored within the ED, which could also provide mentorship to novice emergency nurses across the department.

The second implication pertains to multidisciplinary communication within the resuscitation area, specifically nurse-physician communication regarding pain management goals, plan, and use of pharmacological and non-pharmacological measures to control pain and improve patient comfort. To this end, multidisciplinary education opportunities incorporating simulation need to be developed to promote pain assessment, communication, critical thinking and teamwork around acute pain management across a range of critically ill patient scenarios.

Given the importance of emergency nurses' role in optimising pain management and providing continuity of care, education programs should be expanded to include pain management protocols incorporating evidence-based pain assessment instruments to guide pain evaluation, management and escalation points, and include the ability for nurses to initiate and titrate analgesia to patient's needs and physiological tolerances.

Recommendations for future research

These study findings provide the basis for suggestions for future research examining emergency nursing practices in managing acute pain in critically ill patients. Efforts to increase implementation of the evidence that exists, such as use of validated pain assessment instruments identified in this literature review, are needed to improve pain assessment and decision-making. Further research is therefore, needed to refine and validate appropriate pain assessment instruments within the ED context, which then could inform protocol development to enable emergency nurses to administer and titrate analgesia to the needs of critically ill patients. The impact of using such protocols within the ED context should ideally be examined in a randomised controlled trial. The survey instrument developed as part of phase 1 of this study requires further testing, which could form part of a bi-national or international research study exploring pain management practices of emergency nurses.

Study findings further highlight variation in training and policy concerning acute pain management in critically ill patients. Evidence presented in this thesis highlighted the need to increase nursing knowledge, skills and confidence for managing acute pain in critically ill patients. Further research is required to identify the best method, outcome measures, length of intervention and follow-up in delivering pain management education, including assessing cost and long-term retention of information. The education approach adopted could also be supported by the development of pain resource nurse roles in the ED, that could assist in disseminating best practice and enable nurses to develop confidence in and a consistent and methodical approach to pain assessment in critically ill patients (as well as other patient cohorts that present to ED). To date, pain resource nurse training programs have not been explored in the Australian ED setting and requires further investigation. Future research should also include development and testing of care standards concerning the assessment and management of acute pain in critically ill patients cared for in the ED. If proven effective, these care standards could inform policy and development of a national education and training program tailored to the context of the emergency nurse and the ED multidisciplinary team.

Based on this study's findings, further research is required to examine the concept of comfort and its impact on delivering emergency care from the perceptive, of the critically ill patient and their family members. Validated assessment instruments have been identified in the literature. However, broader testing is required to evaluate reliability and validity in the emergency care environment. In this study, nurses used a variety of actions and behaviours to reduce patient discomfort and anxiety to improve pain relief. Once such action was to mimic hand holding. Further research is required to examine the safety, feasibility and impact of devices mimicking hand holding in intubated critically ill patients in the ED.

Throughout COVID-19, emergency nurses took innovative steps to ensure critically ill patients could communicate with family and carers whilst in they were in the resuscitation area. The ability to communicate with family and support networks is central to patient comfort and confidence in the care provided. However, further research is required to examine the feasibility and utility of video conferencing systems and its impact on nurse-patient-family connection, comfort and wellbeing within the context of emergency care. Additionally, this study's findings suggest the need to examine the impact of the resuscitation area environment on comfort of critically ill patients and their families, which could inform future ED designs and utilisation of clinical space.

Conclusion

This study's aim was to explore the perceptions and practices of emergency nurses managing acute pain in critically ill patients. A sequential explanatory mixed-methods design was used to examine emergency nurses' knowledge, beliefs, and values, as well as observing clinical practice in managing acute pain in critically ill patients. Findings from this study outline factors and mechanisms affecting emergency nursing capacity to manage acute pain in critically ill patients in the resuscitation area. Pain management is the responsibility of every healthcare provider. This study has highlighted the pivotal role of emergency nurses in advocating and influencing pain management in critically ill patients. The findings show that the capability of emergency nurses to initiate analgesia varies across Australia, and that the training, level of knowledge, skills and expertise in managing acute pain in critically ill patients is suboptimal. This study revealed that nurse confidence in assessing and managing acute pain in non-verbal critically ill patients was low and relied in part on access to support from senior experienced nursing staff. Findings further showed that the capacity of emergency nurses to assess and manage acute pain was impacted on by workload, communication challenges and the location and design of the resuscitation area.

In a first, this study has uncovered themes that contributed to a greater understanding of the concept of nursing presence and holistic care in the resuscitation area. Through this analysis, a recognition of presence at the bedside illuminated nursing behaviours that optimise patient comfort and provide holistic care in order to ameliorate pain.

A systematic review of the literature found that training programs, acute pain management algorithms, communication checklists and clinical support resources, can improve pain management in critically ill patients. Further research and quality improvement work is needed to close the gap in detecting and addressing acute pain in this often complex and vulnerable patient population. This study has made several recommendations based upon the findings. In policy, an examination of current pain management standards and guidelines is warranted to support best practice in managing acute pain in critically ill patients. Further, policy governing the design of EDs needs to be examined to improve line of sight and include functional solutions to improve communication between staff working in isolation areas. In practice, use of evidence-based pain assessment instruments and analgesia protocols are needed to improve detection and management of acute pain in verbal and non-verbal critically ill patients by emergency nurses. In education, the development of multidisciplinary education resources, inclusive of theoretical and simulation-based training or interactive artificial intelligence driven virtual reality programs supported by pain management champions, are needed to improve workforce knowledge, skills and ability to manage acute pain in critically ill patients. Ideally, this multidisciplinary education program should be nationally accredited.

This study supports an array of local and international research possibilities. Following appropriate testing, replication of the survey developed for phase 1 of this study, could generate further understanding of emergency nurses' pain management practice outside of Australia. Multidisciplinary guidelines inclusive of nurse-initiated analgesic protocols could be developed through a multiagency consensus process (e.g. Delphi), which could then implemented and examined in a stepped wedge cluster randomised trial to evaluate impact on patient care. Findings from this study could further inform the development of policy and programs of education. Further research is needed to develop continual professional development standards that enable nurses to maintain knowledge, skills and expertise whilst progressing through their career in order to provide safe, effective pain management to critically ill patients. Lastly, further research is needed to deepen the understanding around the art of nursing and holistic care in the ED setting. Findings could inform the development of future pre-registration nurse training and postgraduate specialty education in emergency nursing.

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APPENDICES

Appendix 1: Delphi study - Summary of survey item mean score, consensus and stability

Domain, item	Consensus (%)	Stability (CQV)	Score range		Median	Time to consensus and stability (days)
			Minimum	*Maximum*		
1. Participant demographics						
1.1. What is your self-identified gender?	89.5	0.31	8	9	9	2
1.2. How old are you?	88.6	0.31	8	9	9	5
1.3. How many years of nursing experience do you have?	98.3	0.24	8	9	9	8
1.4. How many years of emergency nursing experience do you have?	88.3	0.32	7	9	9	4
1.5. Which of the following best describes your role?	94.9	0.14	8	9	9	6
1.6. What are your current qualifications in nursing?	99.3	0.04	7	8	7	7
1.7. Are you a member of the College of Emergency Nursing Australasia?	89.4	0.06	8	9	8	5
1.8. In which state or territory is your ED based?	94.8	0.19	8	9	9	8
1.9. Which of the following patient groups constitutes your ED patient population?	95.7	0.15	7	8	8	4

Domain, item	Consensus (%)	Stability (CQV)	Score range *Minimum*	Score range *Maximum*	Median	Time to consensus and stability (days)
1.10. What best describes your type of ED?	94.5	0.36	7	9	8	2
1.11. Please select what best represents your annual ED patient presentation activity	84.3	0.42	7	8	8	1
1.12. Which of the following facilities are available at your hospital?	96.2	0.46	7	9	8	1
1.13. Is your ED a designated trauma facility?	100.0	0.00	9	9	9	1
1.14. How frequently would a critically ill patient be retrieved from your ED to another hospital?	94.3	0.02	8	9	9	1
2. Clinical governance (Domain 1)						
2.1. In your ED, do you have any standing orders that enable nurses to independently administer analgesia? (Skip logic: if no, go to question 2.8)	94.0	0.44	7	9	7	8
2.2. In your ED, on average, how many years of emergency nursing experience is required prior to being able to administer analgesia using a standing order?	84.9	0.05	7	9	8	6
2.3. In your ED, what training is required for a nurse to be able to administer analgesia using a standing order? (Skip logic: if no, go to 2.5)	92.4	0.32	8	9	8	15
2.4. What was the duration of training provided to use analgesia standing orders?	84.6	0.11	8	9	9	8

Domain, item	Consensus (%)	Stability (CQV)	Score range *Minimum*	*Maximum*	Median	Time to consensus and stability (days)
2.5. When did you receive training? (Skip logic: if no, go to 2.8)	93.1	0.11	8	9	9	7
2.6. In assessing your competency to administer analgesia using standing orders, what methods where used?	97.3	0.09	8	9	9	4
2.7. What did the training incorporate (please select all that apply)?	87.1	0.20	7	9	9	18
2.8. Do you receive ongoing education in the use of any nurse standing orders?	92.6	0.06	6	8	8	5
2.9. Which of the following analgesics are you able to nurse-initiate?	98.6	0.49	7	9	8	7
2.10. In your ED, do standing orders allow nurses to independently initiate repeat doses of analgesia if needed?	91.4	0.12	8	9	8	6
2.11. In your ED, are the nurse standing orders adequate to manage patients in acute pain?	88.9	0.45	7	8	7	21
2.12. What is the minimum patient age a nurse can administer analgesia using a standing order?	98.3	0.29	7	8	7	18
2.13. What is the maximum patient age a nurse can administer analgesia using a standing order?	84.9	0.05	8	9	8	6
2.14. Are you aware of any incidents where harm has been caused to a patient directly related to nurse administered analgesia using a standing order?	95.3	0.33	8	9	9	19

Domain, item	Consensus (%)	Stability (CQV)	Score range *Minimum*	Score range *Maximum*	Median	Time to consensus and stability (days)
2.15. Do you receive ongoing education about pain management in your department?	99.1	0.45	8	9	9	2
2.16. Do you commence Patient Controlled Analgesia in your department?	85.1	0.08	7	9	7	4
3. Practice (Domain 2)						
3.1. Have you attended educational session/course/module on pain assessment and management in the last two years?	83.6	0.10	7	9	7	21
3.2. What pain assessment tools do you use when assessing the intensity of pain in adult patients?	88.7	0.09	8	9	8	9
3.3. What tool do you use to measure depth of sedation in a mechanically ventilated adult patient?	97.9	0.46	7	9	8	16
3.4. What pain assessment tools do you use when assessing the intensity of pain in mechanically ventilated adult patients?	97.3	0.48	7	8	8	12
3.5. I use analgesia more readily due to communication difficulties with critically ill patients.	88.4	0.47	8	9	8	19
3.6. When requesting analgesia, physicians consider my assessment of the patient's needs.	88.8	0.11	7	9	8	19
3.7. Analgesia is prescribed with broad parameters that allow me to titrate the amount administered.	88.0	0.35	8	9	9	5

Domain, item	Consensus (%)	Stability (CQV)	Score range *Minimum*	*Maximum*	Median	Time to consensus and stability (days)
3.8. Goals of patient pain management are clearly communicated between physicians and nurses.	96.4	0.38	8	9	9	14
3.9. Availability of nursing staff has influenced my administration of analgesia to critically ill patients.	98.4	0.41	8	9	8	19
3.10. I have administered analgesia in order to complete other essential nursing functions.	94.7	0.36	7	9	7	21
3.11. Nurses in my department influence my pain management of critically ill patients.	95.9	0.39	7	9	7	18
3.12. Patient's families often communicate to me their desire for pain relief for their relative (the patient).	91.8	0.43	8	9	8	10
3.13. Comments from a patient's family regarding patient's pain influence my administration of analgesia.	100.0	0.00	9	9	9	13
3.14. I often disagree with physicians regarding appropriate analgesia for my critically ill patient.	88.7	0.37	8	9	8	6
3.15. A mechanically ventilated critically ill patient is over-analgised with opiates if:	92.5	0.00	9	9	9	15
3.16. A mechanically ventilated critically ill patient is under-analgised if…	86.7	0.17	8	9	9	15
3.17. Increased heart rate or blood pressure indicate a critically ill patient is experiencing pain.	86.8	0.41	7	9	8	11

Domain, item	Consensus (%)	Stability (CQV)	Score range *Minimum*	*Maximum*	Median	Time to consensus and stability (days)
3.18. I intend to administer analgesia to critically ill patients if not contraindicated.	96.5	0.49	8	9	8	13
3.19. I often request analgesia be prescribed to managed potential pain.	98.0	0.01	7	8	7	14
3.20. The physician always ensures analgesia is prescribed for potential pain.	98.1	0.14	7	9	7	10
3.21. In your ED, how frequently do you use Patient Controlled Analgesia to control acute pain in patients?	91.9	0.29	8	9	9	19
4. Knowledge (Domain 3)						
4.1. Providing analgesia impairs accurate assessment of the critically ill patient.	90.1	0.09	7	9	9	14
4.2. A diagnosis is required prior to administering analgesia to the critically ill patient.	96.2	0.16				10
4.3. Due to the ageing process, elderly patients feel less pain.	87.8	0.30	7	8	8	4
4.4. Vital signs are always reliable indicators of the intensity of a patient's pain.	84.8	0.32	7	9	8	10
4.5. Patients who can be distracted from pain usually do not have severe pain.	98.3	0.22	8	9	9	16
4.6. Patients may sleep in spite of severe pain.	94.0	0.32	9	9	9	13

Domain, item	Consensus (%)	Stability (CQV)	Score range *Minimum*	*Maximum*	Median	Time to consensus and stability (days)
4.7. Aspirin and other non-steroidal anti-inflammatory agents are not effective analgesics for painful bone metastases.	90.7	0.44	8	9	9	5
4.8. Respiratory depression rarely occurs in patients who have been receiving stable doses of opioids over a period of months.	92.4	0.47	8	9	9	11
4.9. Combining analgesics that work by different mechanisms (e.g., combining an NSAID with an opioid) may result in better pain control with fewer side effects than using a single analgesic agent.	100.0	0.10	8	9	9	12
4.10. The usual duration of analgesia of 3.5-5mg intravenous morphine is 4-5 hours.	96.3	0.28	8	9	8	21
4.11. Opioids should not be used in patients with a history of substance abuse.	87.6	0.37	7	8	7	18
4.12. Elderly patients cannot tolerate opioids for pain relief.	95.7	0.42	6	8	7	17
4.13. Patient's spiritual beliefs may lead them to think pain and suffering are necessary.	100	0.39	7	9	7	9
4.14. After an initial dose of opioid analgesic is given, subsequent doses should be adjusted in accordance with the individual patient's response.	94.6	0.25	8	9	8	11
4.15. Giving patients a saline injection (placebo) is a useful test to determine if the pain is real.	99.8	0.38	8	9	8	13

Domain, item	Consensus (%)	Stability (CQV)	Score range *Minimum*	*Maximum*	Median	Time to consensus and stability (days)
4.16. If the source of the patient's pain is unknown, opioids should not be used during the pain evaluation period, as this could mask the ability to correctly diagnose the cause of pain.	97.5	0.49	7	8	7	6
4.17. Benzodiazepines are not effective in relieving acute.	93.2	0.42	8	9	9	21
4.18. Opioid addiction is defined as a chronic neurobiological disease, characterized behaviours that include one or more of the following…	92.8	0.05	6	8	8	18
4.19. The term 'equianalgesia' means approximately equal analgesia and is used when referring to the doses of various analgesics that provide approximately the same amount of pain relief.	86.7	0.45	6	9	8	15
4.20. Sedation assessment is recommended during opioid pain management because excessive sedation precedes opioid-induced respiratory depression.	100.0	0.00	9	9	9	9
4.21. The approximate time to peak effect for morphine given IV is?	91.5	0.03	8	9	9	6
4.22. Which statement is true regarding opioid induced respiratory depression?	85.6	0.48	8	9	9	9
4.23. Regular scheduled analgesia is more effective in controlling acute pain compared to PRN (i.e. when needed) analgesia.	93.4	0.40	8	9	9	12

Domain, item	Consensus (%)	Stability (CQV)	Score range *Minimum*	*Maximum*	Median	Time to consensus and stability (days)
5. Beliefs and values (Domain 4)						
5.1. Administration of analgesia to patients is necessary for patient comfort.	86.7	0.15	8	9	9	13
5.2. It is easier to care for a pain-free patient than one that is in pain.	88.6	0.47	7	8	7	14
5.3. If I were a critically ill patient, I would want to be pain-free.	91.0	0.40	8	9	8	18
5.4. Limiting a critically ill patient's suffering is a desired outcome of pain management.	100.0	0	9	9	9	5
5.5. Critically ill patients should receive analgesia because? (Please rate the following)	91.0	0.07	7	8	8	18
5.6. All mechanically ventilated patients should receive analgesia.	100.0	0.00	9	9	9	4
5.7. Patient's rating of their pain is most accurate.	97.8	0.15	7	8	8	19
5.8. It is important to assess pain.	100.0	0.00	9	9	9	12
5.9. It is important to assess pain among trauma patients.	85.6	0.36	8	9	9	6
5.10. It is important to assess pain among burns patients.	84.0	0.38	8	9	9	4
5.11. It is important to assess pain for patients at end-of-life.	90.8	0.48	7	9	7	11

Domain, item	Consensus (%)	Stability (CQV)	Score range *Minimum*	*Maximum*	Median	Time to consensus and stability (days)
5.12. It is important to assess pain among patients receiving sedatives.	96.6	0.01	7	9	7	14
5.13. The most likely reason a patient would request additional analgesia is? (Please rate the following)	91.6	0.06	7	9	8	18
5.14. The most accurate judge of the intensity of the patient's pain is?	85.1	0.45	8	9	8	17
5.15. Which of the following describes the best approach for cultural considerations in caring for patients in pain?	96.3	0.10	8	9	9	8
5.16. Patients should be encouraged to endure as much pain as possible before using an opioid.	100.0	0.00	9	9	9	12
5.17a. Patient A: Andrew, 40 years old, presents to ED complaining of acute abdominal pain which began less than one hour ago. As he enters the triage office, he smiles at you and continues talking and joking with his boyfriend. Your assessment reveals the following information: BP = 120/80; HR = 80/min^{-1}; RR = 14/min^{-1}; on a scale of 0 to 10 (0 = no pain/discomfort, 10 = worst pain/discomfort) he rates his pain as 8. Using the scale below, indicate the level of pain that best represents your assessment of Andrew's pain.	96.3	0.10	8	9	9	8

Domain, item	Consensus (%)	Stability (CQV)	Score range: *Minimum*	Score range: *Maximum*	Median	Time to consensus and stability (days)
5.17b. It has been two hours after he first received morphine 2.5mg IV. During your nursing assessment, you reassess Andrew's pain and he reports that his pain is ranging between 6 and 8 out of 10. There are no clinically significant changes in his condition, his observations are normal. The physician prescribes PRN Morphine IV 2.5-5mg hourly, to a maximum of 10mg in 24hrs. Select the action you will take at this time. a) Administer no morphine at this time b) Administer morphine 2.5 mg IV now c) Administer morphine 3 mg IV now d) Administer morphine 5 mg IV now	91.0	0.07	7	8	8	18
5.18a. Robert, 40 years old, presented last night with right flank pain radiating through to groin, was diagnosed as possible renal colic. Robert is awaiting a CT-KUB. He is lying quietly and grimaces as he turns in bed. Your assessment reveals the following information: BP = 120/80, HR = 80/min, RR = 14/min on a scale of 0 to 10 (0 = no pain/discomfort, 10 = worst pain/discomfort) he rates his pain as 8. Using the scale below, indicate the level of pain that best represents your assessment of Robert's pain.	93.8	0.21	7	9	7	11

Domain, item	Consensus (%)	Stability (CQV)	Score range: *Minimum*	Score range: *Maximum*	Median	Time to consensus and stability (days)
5.18b. Your assessment, above, is made two hours after receiving morphine 2.5mg IV. During your nursing assessment, you reassess Robert's pain and he reports that his pain is ranging between 6 and 8 out of 10. There are no clinically significant changes in his condition, his observations are normal. The physician prescribes PRN Morphine IV 2.5-5mg hourly, to a maximum of 10mg in 24hrs. Select the action you will take at this time: a) Administer no morphine at this time b) Administer morphine 2.5 mg IV now c) Administer morphine 3 mg IV now d) Administer morphine 5 mg IV now	90.8	0.48	7	9	7	11
5.19a. Harry, 40 years old, brought in by ambulance unconscious and unable to maintain own airway. He was intubated successfully 45 minutes ago, mechanically ventilated without issue, and being sedated with morphine 2mg/hr IV and midazolam 2mg/hr IV. At handover, you notice that Harry is grimacing, wincing and scrunching his eyes closed. Your assessment reveals the following information: BP = 120/80, HR = 80/min, RR = 14/min and mechanically ventilating without issue. Using the scale below, indicate the level of pain that best represents your assessment of Harry's pain.	93.1	0.38	7	9	7	11

Domain, item	Consensus (%)	Stability (CQV)	Score range *Minimum*	*Maximum*	Median	Time to consensus and stability (days)
5.19b. On the prescription chart, the physician has charted Morphine sulphate 50mg/50ml with a rate of 1-5mL/hr, and Midazolam 50mg/50ml with a rate of 1-5mL/hr. Select the action you will take at this time: a) Adjust no medications at this time b) Increase morphine to 3 mg/hr c) Increase midazolam to 4mg/hr d) Increase both morphine and midazolam to 3mg/hr	96.2	0.7	8	9	8	11
6. Perception (Domain 5)						
6.1. Rate how painful (0 = no pain, 100 = maximum pain) you think the following care tasks are for critically ill patients?	100	0.07	7	9	9	21

Appendix 2: Phase 1 - Emergency nurses' practices and experiences in managing acute pain in critically ill adult patients survey

A few questions about you

Q1.1 What is your self-identified gender?

- ○ Male (1)
- ○ Female (2)
- ○ Transgender (3)
- ○ Prefer not to say (4)

Q1.2 What is your age?

____

Q1.3 How many years of nursing experience do you have?

____

Q1.4 How many years of emergency nursing experience do you have?

Q1.5 Which of the following best describes your role?

- ○ Registered Nurse (1)
- ○ Nurse Educator (2)
- ○ Nurse Researcher (3)
- ○ Nurse Consultant (4)
- ○ Nurse Manager (5)
- ○ Nurse Practitioner (6)

Q1.6 What are your current qualifications in nursing? (Please select all that apply)

- ☐ Hospital certificate (1)
- ☐ Diploma of Nursing (2)
- ☐ Baccalaureate in Nursing (3)
- ☐ Bachelor of Nursing (4)
- ☐ Postgraduate certificate (5)
- ☐ Postgraduate diploma (6)
- ☐ Master of Nursing (7)
- ☐ PhD (8)
- ☐ Other (Please describe): (9) ____

Q1.7 Are you a member of the College of Emergency Nursing Australasia?

- ○ Yes (5)
- ○ No (6)

A few questions about your ED

Q1.8 In which state or territory is your ED based?

- ○ Australian Capital Territory (1)
- ○ New South Wales (2)
- ○ Northern Territory (3)
- ○ Queensland (4)
- ○ South Australia (5)
- ○ Tasmania (6)
- ○ Victoria (7)
- ○ Western Australia (8)

Q1.9 Which of the following patient groups constitutes your ED patient population?

- ○ Adults (16 years and older) (1)
- ○ Paediatric (under 16 years old) (2)
- ○ Both (3)

Q1.10 What best describes your type of ED?

○ Level 6 - Provides 24-hour service including triage by qualified emergency staff and advanced care for all presentations, including complex emergencies; delivering full spectrum of trauma care for all critically ill and injured patients. Specialty services on-site such as neurosurgery, cardiothoracic surgery. (1)

○ Level 5 - Provides 24-hour service including triage by qualified emergency staff and advanced care for all presentations. Ability to provide comprehensive trauma care and stabilisation of all trauma patients until transfer. Provides short-stay unit / area to define patient diagnosis and determine continued hospitalisation or discharge plan and destination for acutely ill patients. Specialty services on site for consultation. (2)

○ Level 4 - Provides 24-hour service including triage by qualified emergency staff and advanced care for all presentations. Ability to provide high-quality trauma care to medium and minor level trauma patients including invasive monitoring, and capable of stabilising trauma patients until transfer. May provide short-stay unit or equivalent functional area. Access to specialty services. (3)

○ Level 3 - Provides primary care assessment within designated area of health facility with Registered Nurse(s) onsite 24-hours, triage of all presentations, capable of providing treatment for minor injuries and acute illness. Advanced resuscitation including short-term mechanical ventilation pending transfer to definitive care. Capable of responding to local major incidents. May have a dedicated short-stay unit to define patient diagnosis. (4)

○ Level 2 - Provides primary care assessment within designated area of health facility with Registered Nurse(s) onsite 24-hours, triage of all presentations, capable of providing treatment for minor injuries and acute illness, basic resuscitation stabilisation of critically ill paediatric, adult and trauma patients prior to arrival of the retrieval service. (5)

○ Level 1 - Primarily nurse-led clinic with Registered Nurse accessible 24-hours for emergency presentations and 24-hour access to registered medical practitioner. (6)

Q1.11 Please select what best represents your annual ED patient presentation activity

- ○ Less than 25,000 patients (1)
- ○ 25,000 to 54,000 patients (2)
- ○ 55,000 to 75,000 patients (3)
- ○ More than 75,000 patients (4)

Q1.12 Which of the following facilities are available at your hospital? (Please select all that apply)

- ☐ Intensive Care Unit (1)
- ☐ High Dependency Unit (2)
- ☐ Coronary Care Unit (3)
- ☐ Operating Theatre (4)

Q1.13 Is your ED a designated trauma facility?

- ○ Yes (1)
- ○ No (2)

Q1.14 How frequently would a critically ill patient be retrieved from your ED to another hospital?

- ○ Very frequently (1)
- ○ Frequently (2)
- ○ Occasionally (3)
- ○ Rarely (4)
- ○ Very rarely (5)
- ○ Never (6)

Domain 1: Clinical governance

Q2.1 In your ED, do you have any standing orders that enable emergency nurses to independently administer analgesia to presenting patients?

A Standing order is defined as authorisation to administer specific medication for the purpose of treatment of a defined condition, without a patient-specific written prescription by an authorised prescriber (e.g. physician), often in the form of a policy or guideline.

- ○ Yes (1)
- ○ No (2)

Q2.2 In your ED, on average, how many years of emergency nursing experience is required prior to being able to administer analgesia using a standing order?

- ○ Less than 1 year (1)
- ○ 1 to 3 years (2)
- ○ 3 to 5 years (3)
- ○ 6 or more years (4)

Q2.3 In your ED, what training is required for a nurse to be able to administer analgesia using a standing order? (Please select all that apply)

- ☐ Completion of a face-face course (1)
- ☐ Completion of a learning package / workbook (2)
- ☐ Completion of an online module (3)
- ☐ None (4)
- ☐ Other (please describe): (5) ____

Q2.4 What was the duration of training provided to use analgesia standing orders?

- ○ Less than 4 hours (1)
- ○ 4 - 8 hours (2)
- ○ 9 - 15 hours (3)
- ○ 16 or more hours (4)

Q2.5 When did you receive training?

- ○ Less than 1 year ago (1)
- ○ 2 - 4 years ago (2)
- ○ 5 or more years ago (3)
- ○ Never (4)

Skip To: Q2.14 If When did you receive training? = Never

Q2.6 In assessing your competency to administer analgesia using standing orders, what methods were used (please select all that apply)?

- ☐ Exam / quiz (1)
- ☐ Case scenarios (7)
- ☐ Simulated practice (2)
- ☐ Supervised practice (3)
- ☐ Audit (4)
- ☐ None (5)
- ☐ Other (please describe): (6) ____

Q2.7 What did the training include (please select all that apply)?

- ☐ Pharmacology (1)
- ☐ Pain theories (2)
- ☐ Application of standing orders / local policy (3)
- ☐ Pain assessment (4)
- ☐ Assessing pain in elderly patients (14)
- ☐ Assessing pain in cognitively impaired patients (16)
- ☐ Assessing pain in mechanically ventilated patients (15)
- ☐ Alternative pain management strategies (e.g. ice-packs, elevation) (6)
- ☐ Interventional pain management therapies (e.g. nerve blocks, infusions) (12)
- ☐ Use of Patient Controlled Analgesia (13)
- ☐ Patient education (7)
- ☐ Judicious use of opioids (8)
- ☐ Managing potential side-effects of analgesia (9)
- ☐ Identifying potential opioid dependency (11)
- ☐ Case scenarios (10)
- ☐ Other (please describe): (5) ____

Q2.8 Do you receive ongoing education in the use of any nurse standing orders?

- ○ 1 - 2 times per year (6)
- ○ 3 - 4 times per year (7)
- ○ 5 or more times per year (8)
- ○ Never (10)

Q2.9 Which of the following analgesics can you administer using standing orders? (Please select all that apply)

- ☐ Paracetamol (1)
- ☐ Paracetamol with codeine (2)
- ☐ Ibuprofen (3)
- ☐ Diclofenac (4)
- ☐ Indomethacin (5)
- ☐ Nitrous oxide and oxygen mixture (e.g. Entonox) (6)
- ☐ Methoxyflurane (7)
- ☐ Oxycodone (8)
- ☐ Morphine (9)
- ☐ Fentanyl (10)
- ☐ Other (Please describe): (11) ____

Q2.10 In your ED, do standing orders allow nurses to independently initiate repeat doses of analgesia if needed?

- ○ Yes (1)
- ○ No (2)

Q2.11 In your ED, are the nurse standing orders adequate to manage patients in acute pain?

- ○ Extremely adequate (1)
- ○ Somewhat adequate (2)
- ○ Neither adequate nor inadequate (3)
- ○ Somewhat inadequate (4)
- ○ Extremely inadequate (5)

Q2.11 In your ED, what is the minimum patient age a nurse can administer an analgesic using a standing order? (Enter 'No limit', if no minimum age)

- ○ Months (4) ____
- ○ Years (5) ____

Q2.12 In your ED, what is the maximum patient age a nurse can administer an analgesic using a standing order? (Enter 'No limit', if no maximum age)

- ○ Months (4) ____
- ○ Years (5) ____

Q2.13 Are you aware of any incidents where harm has been caused to a patient directly related to nurse administered analgesia using a standing order?

- ○ Yes (1)
- ○ No (2)

Q2.14 Do you receive ongoing education about pain management in your department?

- ○ Always (1)
- ○ Most of the time (2)
- ○ About half the time (3)
- ○ Sometimes (4)
- ○ Never (5)

Q2.15 Do you commence Patient Controlled Analgesia in your department?

- ○ Yes (1)
- ○ No (2)

Domain 2: Practice

Q3.1 Have you attended any educational sessions/ courses/ modules on pain management in the last two years?

- ○ Yes (1)
- ○ No (2)

Q3.2 What pain assessment tools do you use when assessing the intensity of pain in adult patients? (Please select all that apply)

- ☐ Numerical Rating Scale (e.g. 0 to 10) (1)
- ☐ Verbal Rating Scale (e.g. none, mild, moderate or severe) (2)
- ☐ Visual Analogue Scale (e.g. 10cm ruler) (3)
- ☐ Abbey Pain Scale (4)
- ☐ Behaviour Pain Scale (5)
- ☐ Faces Pain Scale (6)
- ☐ Critical Care Pain Observation Tool (7)
- ☐ Pain Assessment in Advanced Dementia Scale (8)
- ☐ None (9)
- ☐ Other (Please describe): (10) ____

Q3.3 What pain assessment tools do you use when assessing the intensity of pain in mechanically ventilated adult patients? (Please select all that apply)

- ☐ Numerical Rating Scale (e.g. 0 to 10) (1)
- ☐ Verbal Rating Scale (e.g. none, mild, moderate or severe) (2)
- ☐ Visual Analogue Scale (e.g. 10cm ruler) (3)
- ☐ Abbey Pain Scale (4)
- ☐ Behaviour Pain Scale (5)
- ☐ Faces Pain Scale (6)
- ☐ Critical Care Pain Observation Tool (7)
- ☐ Pain Assessment in Advanced Dementia Scale (8)
- ☐ None (9)
- ☐ Other (Please describe): (10) ____

Q3.4 What tool do you use to measure depth of sedation in mechanically ventilated adult patients? (Please select all that apply)

- ☐ Glasgow Coma Scale (1)
- ☐ Ramsay Sedation Scale (2)
- ☐ Sedation Agitation Scale (3)
- ☐ Richmond Agitation and Sedation Scale (4)
- ☐ None (5)
- ☐ Other (Please describe): (6) ____

Please rate your level of agreement to the following statements

Q3.5 I use analgesia more readily due to communication difficulties with critically ill patients.

- ○ Strongly agree (1)
- ○ Somewhat agree (2)
- ○ Neither agree nor disagree (3)
- ○ Somewhat disagree (4)
- ○ Strongly disagree (5)

Q3.6 When requesting analgesia, physicians consider my assessment of the patient's needs

- ○ Strongly agree (1)
- ○ Somewhat agree (2)
- ○ Neither agree nor disagree (3)
- ○ Somewhat disagree (4)
- ○ Strongly disagree (5)

Q3.7 Analgesia is prescribed with broad parameters that allow me to titrate the amount administered

- ○ Strongly agree (1)
- ○ Somewhat agree (2)
- ○ Neither agree nor disagree (3)
- ○ Somewhat disagree (4)
- ○ Strongly disagree (5)

Q3.8 Goals of patient pain management are clearly communicated between physicians and nurses

- ○ Strongly agree (1)
- ○ Somewhat agree (2)
- ○ Neither agree nor disagree (3)
- ○ Somewhat disagree (4)
- ○ Strongly disagree (5)

Q3.9 Availability of nursing staff has influenced my administration of analgesia to critically ill patients

- ○ Strongly agree (1)
- ○ Somewhat agree (2)
- ○ Neither agree nor disagree (3)
- ○ Somewhat disagree (4)
- ○ Strongly disagree (5)

Q3.10 I have administered analgesia in order to complete other essential nursing functions

- ○ Strongly agree (1)
- ○ Somewhat agree (2)
- ○ Neither agree nor disagree (3)
- ○ Somewhat disagree (4)
- ○ Strongly disagree (5)

Q3.11 Nurses in my department influence my pain management of critically ill patients by:

	Strongly agree (1)	Somewhat agree (2)	Neither agree nor disagree (3)	Somewhat disagree (4)	Strongly disagree (5)
a. By sharing their knowledge of analgesic medications (1)	○	○	○	○	○
b. Through their attitudes about appropriate pain management for critically ill patients (2)	○	○	○	○	○

Q3.12 Patient's families often communicate to me their desire for pain relief for their relative (the patient).

○ Strongly agree (1)

○ Somewhat agree (2)

○ Neither agree nor disagree (3)

○ Somewhat disagree (4)

○ Strongly disagree (5)

Q3.13 Comments from a patient's family regarding patient's pain influence my administration of analgesia

- Strongly agree (1)
- Somewhat agree (2)
- Neither agree nor disagree (3)
- Somewhat disagree (4)
- Strongly disagree (5)

Q3.14 I often disagree with physicians regarding appropriate analgesia for my critically ill patient

- Strongly agree (1)
- Somewhat agree (2)
- Neither agree nor disagree (3)
- Somewhat disagree (4)
- Strongly disagree (5)

Q3.15 A mechanically ventilated critically ill patient is over-analgesed with opiates if:

	Strongly agree (1)	Somewhat agree (2)	Neither agree nor disagree (3)	Somewhat disagree (4)	Strongly disagree (5)
a. They have a depressed respiratory rate (1)	○	○	○	○	○
b. They do not have a cough reflex with suctioning (2)	○	○	○	○	○
c. They respond only to noxious stimuli such as suctioning or nail be pressure (3)	○	○	○	○	○
d. They do not follow simple commands (4)	○	○	○	○	○

Q3.16 A mechanically ventilated critically ill patient is under-analgesed if:

	Strongly agree (1)	Somewhat agree (2)	Neither agree nor disagree (3)	Somewhat disagree (4)	Strongly disagree (5)
a. They are spontaneously moving such as their hands and/or feet (1)	○	○	○	○	○
b. They are moving their trunk or lifting their legs (2)	○	○	○	○	○
c. They are reaching for their lines or endotracheal tube (3)	○	○	○	○	○
d. They are tachypneic (4)	○	○	○	○	○
e. They are grimacing (5)	○	○	○	○	○

Q3.17 Increased heart rate or blood pressure indicate that a critically ill patient is experiencing pain

- ○ Strongly agree (1)
- ○ Somewhat agree (2)
- ○ Neither agree nor disagree (3)
- ○ Somewhat disagree (4)
- ○ Strongly disagree (5)

Q3.18 I intend to administer analgesia to critically ill patients if not contraindicated

- Strongly agree (1)
- Somewhat agree (2)
- Neither agree nor disagree (3)
- Somewhat disagree (4)
- Strongly disagree (5)

Q3.19 I often request analgesia be prescribed to manage potential pain in a critically ill patient

- Strongly agree (1)
- Somewhat agree (2)
- Neither agree nor disagree (3)
- Somewhat disagree (4)
- Strongly disagree (5)

Q3.20 The treating physician always ensures analgesia is prescribed for potential pain in a critically ill patient

- Strongly agree (1)
- Somewhat agree (2)
- Neither agree nor disagree (3)
- Somewhat disagree (4)
- Strongly disagree (5)

Domain 3: Knowledge

Please answer true or false, or select the correct answer to the following questions

Q4.1 Providing analgesia impairs accurate assessment of a critically ill patient.

- True (1)
- False (2)

Q4.2 A diagnosis is required prior to administering analgesia to a critically ill patient.

- True (1)
- False (2)

Q4.3 Due to the ageing process, elderly patients feel less pain.

- True (1)
- False (2)

Q4.4 Vital signs are always reliable indicators of the intensity of a patient's pain.

- True (1)
- False (2)

Q4.5 Patients who can be distracted from pain usually do not have severe pain.

- True (1)
- False (2)

Q4.6 Patients may sleep in spite of severe pain.

- ○ True (1)
- ○ False (2)

Q4.7 Aspirin and other non-steroidal anti-inflammatory agents are not effective analgesics for painful bone metastases.

- ○ True (1)
- ○ False (2)

Q4.8 Respiratory depression rarely occurs in patients who have been receiving stable doses of opioids over a period of months.

- ○ True (1)
- ○ False (2)

Q4.9 Combining analgesics that work by different mechanisms (e.g. a non-steroidal anti-inflammatory with an opioid) may result in better pain control with fewer side effects than using a single analgesic agent.

- ○ True (1)
- ○ False (2)

Q4.10 Regular scheduled analgesia is more effective in controlling acute pain compared to PRN (i.e. when needed) analgesia.

- ○ Yes (1)
- ○ No (2)

Q4.11 The usual duration of analgesia of 2.5-5mg intravenous morphine is 4-5 hours.

- True (1)
- False (2)

Q4.12 Opioids should not be used in patients with a history of substance abuse.

- True (1)
- False (2)

Q4.13 Elderly patients cannot tolerate opioids for pain relief.

- True (1)
- False (2)

Q4.14 Patients' spiritual beliefs may lead them to think pain and suffering are necessary.

- True (1)
- False (2)

Q4.15 After an initial dose of opioid analgesic is given, subsequent doses should be adjusted in accordance with the individual patient's response.

- True (1)
- False (2)

Q4.16 Giving patients a saline injection (placebo) is a useful test to determine if the pain is real.

- Yes (1)
- No (2)

Q4.17 If the source of the patient's pain is unknown, opioids should not be used during the pain evaluation period, as this could mask the ability to correctly diagnose the cause of pain.

- Yes (1)
- No (2)

Q4.18 Benzodiazepines are not effective in relieving acute pain.

- True (1)
- False (2)

Q4.19 Opioid addiction is defined as a chronic neurobiological disease, characterized by behaviours that include one or more of the following: impaired control over drug use, compulsive use, continued use despite harm, and craving.

- True (1)
- False (2)

Q4.20 The term 'equianalgesia' means approximately equal analgesia and is used when referring to the doses of various analgesics that provide approximately the same amount of pain relief.

- True (1)
- False (2)

Q4.21 Sedation assessment is recommended during opioid pain management because excessive sedation precedes opioid-induced respiratory depression.

- True (1)
- False (2)

Q4.22 The approximate time to peak effect for morphine given IV is?

- 20 minutes (1)
- 45 minutes (2)
- 1 - 2 hours (3)
- 3 hours (4)

Q4.23 Which statement is true regarding opioid induced respiratory depression?

	True (1)	False (2)
a. More common several nights after surgery due to accumulation of opioid (1)	○	○
b. Obstructive sleep apnoea is an important risk factor. (2)	○	○
c. Occurs more frequently in those already on higher doses of opioids before surgery. (3)	○	○
d. Can be easily assessed using intermittent pulse oximetry (4)	○	○

Domain 4: Beliefs and values

Please rate your level of agreement to the following statements

Q5.1 Administration of analgesia to patients is necessary for patient comfort.

- Strongly agree (1)
- Somewhat agree (2)
- Neither agree nor disagree (3)
- Somewhat disagree (4)
- Strongly disagree (5)

Q5.2 It is easier to care for a pain-free patient than one that is in pain.

- Strongly agree (1)
- Somewhat agree (2)
- Neither agree nor disagree (3)
- Somewhat disagree (4)
- Strongly disagree (5)

Q5.3 If I were a critically ill patient, I would want to be pain-free.

- Strongly agree (1)
- Somewhat agree (2)
- Neither agree nor disagree (3)
- Somewhat disagree (4)
- Strongly disagree (5)

Q5.4 Limiting a critically ill patient's suffering is a desired outcome of pain management.

- Strongly agree (1)
- Somewhat agree (2)
- Neither agree nor disagree (3)
- Somewhat disagree (4)
- Strongly disagree (5)

Q5.5 Critically ill patients should receive analgesia because:

	Strongly agree (1)	Somewhat agree (2)	Neither agree nor disagree (3)	Somewhat disagree (4)	Strongly disagree (5)
a. It is an uncomfortable experience (1)	○	○	○	○	○
b. A stressful experience (2)	○	○	○	○	○

Q5.6 All mechanically ventilated patients should receive analgesia.

- Strongly agree (1)
- Somewhat agree (2)
- Neither agree nor disagree (3)
- Somewhat disagree (4)
- Strongly disagree (5)

Q5.7 Patient's rating of their pain is most accurate.

- Strongly agree (1)
- Somewhat agree (2)
- Neither agree nor disagree (3)
- Somewhat disagree (4)
- Strongly disagree (5)

Q5.8 It is important to assess pain.

- Strongly agree (1)
- Somewhat agree (2)
- Neither agree nor disagree (3)
- Somewhat disagree (4)
- Strongly disagree (5)

Q5.9 It is important to assess pain among trauma patients.

- Strongly agree (1)
- Somewhat agree (2)
- Neither agree nor disagree (3)
- Somewhat disagree (4)
- Strongly disagree (5)

Q5.10 It is important to assess pain among burns patients.

- Strongly agree (1)
- Somewhat agree (2)
- Neither agree nor disagree (3)
- Somewhat disagree (4)
- Strongly disagree (5)

Q5.11 It is important to assess pain for patients at end-of-life.

- Strongly agree (1)
- Somewhat agree (2)
- Neither agree nor disagree (3)
- Somewhat disagree (4)
- Strongly disagree (5)

Q5.12 It is important to assess pain among patients receiving sedatives.

- Strongly agree (1)
- Somewhat agree (2)
- Neither agree nor disagree (3)
- Somewhat disagree (4)
- Strongly disagree (5)

Q5.13 Which of the following describes the best approach for cultural considerations in caring for patients in pain?

	Strongly agree (1)	Agree (2)	Somewhat agree (3)	Neither agree nor disagree (4)	Somewhat disagree (5)
a. There are no longer cultural influences in Australia, due to the diversity of the population (1)	○	○	○	○	○
b. Cultural influences can be determined by an individual's ethnicity (e.g., Asians are stoic, Italians are expressive, etc.) (2)	○	○	○	○	○
c. Patients should be individually assessed to determine cultural influences (3)	○	○	○	○	○
d. Cultural influences can be determined by an individual's socioeconomic status (4)	○	○	○	○	○

Q5.14 Patients should be encouraged to endure as much pain as possible before using an opioid.

- True (1)
- False (2)

For the following questions, please select the correct answer.

Q5.14 The most likely reason a patient would request additional analgesia is:

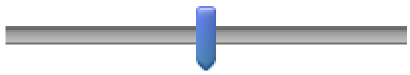
	True (1)	False (2)
a. The patient is experiencing increased pain (1)	○	○
b. The patient is experiencing increased anxiety or depression (2)	○	○
c. The patient is requesting more staff attention (3)	○	○
d. The patient's requests are related to addiction (4)	○	○

Q5.15 The most accurate judge of the intensity of the patient's pain is?

	True (1)	False (2)
a. The physician treating the patient (1)	○	○
b. The emergency nurse managing the patient (2)	○	○
c. The patient (3)	○	○
d. The patient's spouse or family (4)	○	○

Q5.16 Andrew, 40 years old, presents to ED complaining of acute abdominal pain which began less than one hour ago. As he enters the triage office, he smiles at you and continues talking and joking with his boyfriend. Your assessment reveals the following information: BP = 120/80, HR = 80/min-1, RR = 14/min, on a scale of 0 to 10 (0 = no pain/discomfort, 10 = worst pain/discomfort) he rates his pain as 8. Using the scale below, indicate the level of pain that best represents your assessment of Andrew's pain.

0 ------------------------------------10

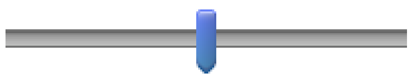


Q5.17 It has been two hours after he first received morphine 2.5mg IV. During your nursing assessment, you reassess Andrew's pain and he reports that his pain is ranging between 6 and 8 out of 10. There are no clinically significant changes in his condition, his observations are normal. The physician prescribes PRN Morphine IV 2.5-5mg hourly, to a maximum of 10mg in 24hrs. Select the action you will take at this time.

- Administer no morphine at this time (1)
- Administer morphine 2.5 mg IV now (2)
- Administer morphine 3 mg IV now (3)
- Administer morphine 5 mg IV now (4)

Q5.18 Robert, 40 years old, presented last night with right flank pain radiating through to groin, was diagnosed as possible renal colic. Robert is awaiting a CT-KUB. He is lying quietly and grimaces as he turns in bed. Your assessment reveals the following information: BP = 120/80, HR = 80/min, RR = 14/min on a scale of 0 to 10 (0 = no pain/discomfort, 10 = worst pain/discomfort) he rates his pain as 8. Using the scale below, indicate the level of pain that best represents your assessment of Robert's pain.

0 ------------------------------------10



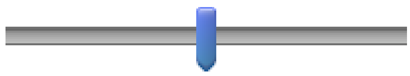
Q5.19 Your assessment, above, is made two hours after receiving morphine 2.5mg IV. During your nursing assessment, you reassess Robert's pain and he reports that his pain is ranging between 6 and 8 out of 10.

There are no clinically significant changes in his condition, his observations are normal. The physician prescribes PRN Morphine IV 2.5-5mg hourly, to a maximum of 10mg in 24hrs. Select the action you will take at this time:

- ○ Administer no morphine at this time (1)
- ○ Administer morphine 2.5 mg IV now (2)
- ○ Administer morphine 3 mg IV now (3)
- ○ Administer morphine 5 mg IV now (4)

Q5.20 Harry, 40 years old, brought in by ambulance unconscious and unable to maintain own airway. He was intubated successfully two hours ago, mechanically ventilated without issue, and is currently being managed with morphine 4mg/hr IV and midazolam 4mg/hr IV. At handover, you notice that Harry is grimacing, wincing and scrunching his eyes closed. Your assessment reveals the following information: BP = 120/80, HR = 80/min, RR = 14/min and mechanically ventilating without issue. Using the scale below, indicate the level of pain that best represents your assessment of Harry's pain.

0 ------------------------------------10



Q5.21 On the prescription chart, the physician has charted Morphine sulphate 50mg/50ml with a titratable rate of 1-5mL/hr, and Midazolam 50mg/50ml with a titratable rate of 1-5mL/hr. Select the action you will take at this time:

- ○ Adjust no medications at this time (1)
- ○ Increase morphine to 5 mg/hr (2)
- ○ Increase midazolam to 5 mg/hr (3)
- ○ Increase both morphine and midazolam to 5 mg/hr (4)

Domain 5: Perception

Please rate your level of agreement to the following statements

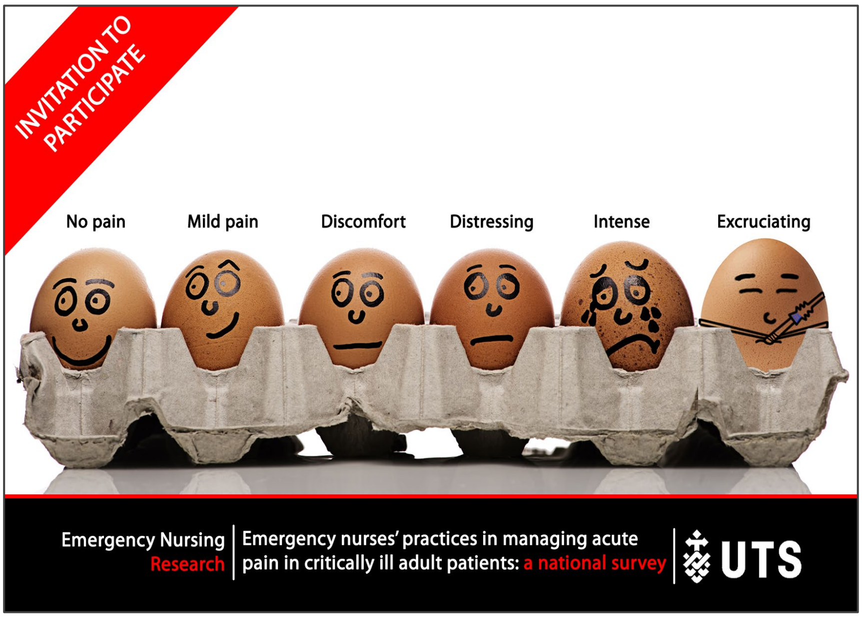
Q6.1 Rate how painful (0 = no pain, 100 = maximum pain) you think the following care tasks are for critically ill patients.

Care task	**0 ----------------------------------100**
Endotracheal suctioning	
Non-invasive ventilation (e.g. CPAP)	
Mechanical ventilation	
Venipuncture	
Arterial cannulation	
Intravenous cannulation	
Central catheter insertion	
Adhesive removal	
Chest tube insertion	
Insertion of a urinary catheter	
Lumbar puncture	
Turning the patient	
Applying anti-thrombolytic stockings	
Non-invasive blood pressure measurement	
Brushing teeth	

Care task	0 ----------------------------------100
Transferring from bed to CT/MRI table	
Washing the patient	
Taking an ECG	
Taking a capillary blood glucose sample	
Limb relocation	
Cardioversion	
Intramuscular injection	
Wound debridement	
Wound dressing	
Eye care	

Appendix 3: Phase 1 - Postcard invitation

Front



Back

For more information, and to see if you qualify...

Go to http://bit.ly/EDPAIN

OR

Scan the QRS code below with your smartphone

Postage

Please share this invitation with your colleagues

Study approved by the South Eastern Sydney Local Health District Human Research Ethics Committee (HREC 17-162). Administration Officer can be contacted on (02) 9382 6361.

Appendix 4: COVIDSafe Research Activity Risk Assessment Checklist and Plan

FACULTY/UNIT:	**School of Nursing and Midwifery**		
PREPARED BY:	**Wayne Varndell**	**DATE:**	**03/08/2020**
PROJECT TITLE:	**Emergency nurse's practices in assessment and managing acute pain in critically ill adult patients: observation study**	**HREC APRPOVAL NUMBER:**	2020/ETH01114

1. PLANNING AND RECORD-KEEPING	**Yes, already in place**	**Not yet, further action required***	**N/A**
I have considered alternates to physical face-to-face contact with participants and believe that face-to-face contact is necessary to achieve the required research outputs.	☒	☐	☐
I have put in place a process to ask participants *before* each face-to-face encounter: a. To the best of their knowledge, whether have they been in contact with a confirmed COVID-19 case in the last 14 days b. Confirm whether they have any symptoms suggestive of COVID-19[1] c. Confirm whether they have been to recent COVID-19 case locations in NSW or VIC.	☐	☐	☒
I have put in place a process to record the details[2] of all participants, which are to be kept securely for 28 days	☒	☐	☐
I am following the direction from NSW Health	☒	☐	☐
I have a continuity plan in place in case I need to stop my research or revert to non-physical face-to-face methods of data collection	☒	☐	☐

*where further action is required, researchers must complete the Action Plan at the end of this checklist and re-submit for review

2. PHYSICAL DISTANCING There is general guidance to maintain a 4 square metres per person capacity limitation based on the room size[3]. This means in a room of 40m² you can have a maximum of 10 people, noting that you still need to exercise social distancing of 1.5m in this scenario.	**Yes, already in place**	**Not yet, further action required***	**N/A**
I have plans in place to ensure physical distancing: • 1.5 m/4m² rule is able to be observed at all times OR	☒	☐	☐

[1] Symptoms include: fever (≥37.5°C) or history of fever (e.g. night sweats, chills) or acute respiratory infection (e.g. cough, shortness of breath, sore throat) or a combination of other non-specific symptoms (headache, tiredness, muscle pain, runny nose, loss of sense of taste or smell, diarrhoea, nausea/vomiting or loss of appetite)

[2] At a minimum, a record should be kept of: 1) Arrival time to location/facility, 2) Rooms used for research activity and other rooms used, 3) Persons you have interacted with including name, mobile number or email address, and length of time for interaction, 5) Exit time from location/facility. Records must be kept for a period of at least 28 days. Records are only to be used for tracing COVID-19 infections and must be stored confidentially and securely.

[3] You can do a walk-through of the workspace with a tape measure and write down the dimensions of all enclosed spaces, calculate the area of each enclosed space by multiplying the length of the space in metres by its width in metres and divide this number by 4. The result is the number of people you can have in a space to allow for at least 4m² of space per person. E.g. Length = 5 metres, Width = 10 metres, Area in square metres: 5 x 10 = 50, Maximum number of people: 50 ÷ 4 = 12.5. Round it down to 12.

• I have an action plan to ensure physical barriers are in place[4]			
I have developed a plan for the flow of people for the full cycle of the research activity, from entry to exit, in consideration of other activities and people in the area or facility to avoid participants queuing or congregating	☒	☐	☐
I will ensure only one person will use a piece of equipment at a time unless the equipment or facility layout allows 1.5m separation between users.	☒	☐	☐

*where further action is required, researchers must complete the Action Plan at the end of this checklist and re-submit for review

3. HYGIENE	Yes, already in place	Not yet, further action required*	N/A
I have put in place appropriate ways to minimise the personal risk to me, in light of my own unique health circumstances (e.g. wearing a face mask, gloves, downloading the COVIDSafe app)	☒	☐	☐
I will have hand sanitiser available and will ensure frequently used areas are cleaned between each participant (e.g. tables, chairs, keyboards, equipment)[5]	☒	☐	☐
I will have detergent/disinfectant and/or surface wipes available to clean workstations and equipment such as monitor, phone, keyboard and mouse, VR equipment, physiological monitors (e.g. heart rate, EEG), etc.	☒	☐	☐
Appropriate PPE is available for use (e.g. face masks)[6]	☒	☐	☐
Opportunities to optimise air flow have been implemented in naturally ventilated facilities (e.g. opening windows or doors). *Not applicable to mechanically ventilated or air-conditioned spaces.*	☒	☐	☐

*where further action is required, researchers must complete the Action Plan at the end of this checklist and re-submit for review

4. SIGNAGE	Yes, already in place	Not yet, further action required*	N/A
In areas or activities where queuing or congestion is expected, I will ensure that physical barriers or floor markings will be used to indicate circulation and movement of people, and to facilitate distancing requirements, e.g. move or walk this way signs or arrows, 'Let's stay 1.5m away' reminders.	☐	☐	☒
Physical distancing and hygiene posters[7] and/or electronic signage will be displayed in prominent locations inside and outside of facilities used during	☐	☐	☒

[4] If a 1.5m separate cannot be maintained for specific activities, physical barriers (e.g. Perspex shields/sneeze screens) or other risk controls have been considered e.g. P2 face masks, time reduced to below 15 minutes.
[5] Researchers and participants are reminded to wash hands or use hand sanitiser including on arrival (and regularly during the day for extended periods) via signage and/or procedures.
[6] Appropriate PPE is available to use where social distancing is not possible, and in high-risk situations (e.g. hospitals) and for "at-risk" participants. For all other scenarios, PPE use should be encouraged where feasible and appropriate.
[7] The following posters are available for download: Simple steps to help stop the spread, How to hand wash, How to hand rub

research processes (not required for one-on-one meetings)			

*where further action is required, researchers must complete the Action Plan at the end of this checklist and re-submit for review

5. **EXTERNAL LOCATIONS / THIRD PARTY FACILITIES (including participants' homes, hospitals clinics, laboratories and other facilities)**	**Yes, already in place**	**Not yet, further action required***	**N/A**
I am following the direction from NSW Health (clinical/visitor guidelines)/ other agency and will comply with their conditions of entry	☒	☐	☐
I have confirmed that my research activities in third party facilities are in line with those organisation's safety controls and protocols and have been endorsed by the relevant authority in the third-party organisation.	☒	☐	☐
I have considered how to access the external facility/site safely including determining what form of transport is appropriate and parking availability.	☒	☐	☐
If visiting a research participant's home OR community sites, maximum visitors will not exceed public health requirements	☐	☐	☒
Travel to and from research site enables 1.5 m distance between persons or 50% capacity of the vehicle	☒	☐	☐

*where further action is required, researchers must complete the Action Plan at the end of this checklist and re-submit for review

6. **LAB-BASED WORK**	**Yes, already in place**	**Not yet, further action required***	**N/A**
Attendance of research staff has been rostered to ensure that the facility does not exceed the adjusted maximum occupancy at any time. Staggered start and finish times have also been considered to assist with travel via public transport.	☐	☐	☒
On-site staffing levels allow for adequate support and supervision of research students and junior researchers	☐	☐	☒
Procedures have been established for the decontamination of shared equipment and PPE between users (e.g. wipe down of control touch panels with disinfectant wipes, shared PPE is laundered between use), lab coats not stored close together.	☐	☐	☒
Safety and wellbeing staff/representatives have been involved in the review of the planned work arrangements/ procedures and their feedback has been considered in the development of the plan to control risks associated with COVID-19.	☐	☐	☒

*where further action is required, researchers must complete the Action Plan at the end of this checklist and re-submit for review

7. ETHICS **The implementation of COVID-19 safe research practices as outlined in the above checklist and action plan does not require submission of an amendment application unless changes are being made to research methods or procedures due to COVID-19 restrictions (e.g. changing from face-to-face workshops to Zoom or online survey). Amendments must be submitted to the Ethics Secretariat for review and approval following instructions here.**	**Yes, already in place**	**Not yet, further action required***	**N/A**
I confirm I have received approval for any changes to my previously approved procedures/protocols via an amendment to the Ethics Secretariat in relation to this checklist and accompanying action plan.	☐	☐	☒

*where further action is required, researchers must complete the Action Plan at the end of this checklist and re-submit for review

RESEARCHER COMMENTS (Insert comments if required)
Ethics approval has been obtained to conduct this study, which incorporates work observations and face-to-face interviews. We are applying for ratification. I am a clinical nurse consultant who is familiar with PPE use, and have been leading safe patient care of suspected/confirmed COVID19 in an emergency department setting. As part of my clinical role I have completed NSW Health mandated PPE training. This study incorporates workplace observations conducted in NSW Health Public hospital emergency departments, and interviews with emergency nurses. I will travel to each study site using my own transport. I will follow NSW Health facility entry requirements (e.g. door screening). I will wear a surgical mask when observing and interviewing emergency nurses. I will clean and wipe down surfaces (e.g. interview room) with facility approved wipes. If required, interviews can be conducted via telephone or using online videoconferencing. Explanation of N/A Section 1 • I have put in place a process to ask participants *before* each face-to-face encounter… *This study is taking place in a NSW Health facility observing nurses working in the resuscitation area, which have completed NSW Health mandated entry screening processes, and will be wearing a surgical mask at a minimum during their interactions with patients and staff. I will also be wearing a surgical mask as part of meeting NSW Health COVID19 mandated work practices, and will ask about any recent history of possible exposure (even though it may be assumed to have already been completed upon entry screening).* Section 4 • *This study is taking place in an NSW Health facility that has appropriate mandated signage in place relating to social distancing. Hand hygiene and social distancing within confined spaces (interview room) have been planned for.* Section 5 • *This study is taking place in an NSW Health facility.* Section 6 • *This study is taking place in an NSW Health facility, no lab-base work is being undertaken.* Section 7

• *Alternative strategies to reduce face-to-face interaction have been considered. Ethics and site approval have been received to conduct face-to-face interviews within appropriately spaced/ventilated areas within each site. Interviews can be conducted via videoconferencing if community COVID 19 risk levels increase.*

APPROVAL BY DEAN/ADR/DIRECTOR	**Yes**	**Not yet, action required**	**Not approved**
I confirm the completed checklist (and below action plan, if applicable) are appropriate and endorse this research activity to commence as outlined below.	☒	☐	☐

[redacted]

Appendix 5: Phase 2 - Summary and characteristics of patients managed by observed emergency nurses

Patient No.	Age, gender	ATS	Mode of arrival	Summary of presenting problem
1	45, male	2	Ambulance	Cyclist versus car, approximate speed 50k/hr. Right wrist deformed, asynchronous chest rise with increasing difficulty in breathing. C-spine immobilisation in-situ. 15mg of IV morphine in total given by ANSW.
2	49, female	2	Ambulance	Passenger in head on collision with lorry. Approximate speed of collision 70km/h. Trapped for 30 minutes requiring FRNSW extrication. Injuries include sternum, abdomen and pelvis. C-spine immobilisation in-situ. Unconscious.
3	43, male	1	Walk-in	Corrosive chemical inhalation, feeling dizzy, palpitations, diaphoretic, and worsening shortness of breath, hyper-salivating. Denies chest pain. BP un-recordable at triage, weak radial pulse, SVT 202/bpm.
4	26, male	2	Ambulance	Right leg and abdomen crush injury from large metal bin – pinned patient to the ground for 20 minutes. Patient unable to straighten or weight bear, clutching abdomen when released.
5	24, female	2	Walk-in	Overdose and foreign body ingestion consisting of 96 x 300mg aspirin tablets and 2 x Stanley blades. Vomited twice, ongoing nausea. Feels as though blades stuck in throat.
6	48, female	2	Ambulance	Cyclist versus car, approximate speed 60km/h. Head injury (helmet cracked) with full thickness laceration across forehead, short loss of consciousness (<5min), bilateral deformed wrists. Required 15mg morphine IV on scene by ANSW.

Patient No.	Age, gender	ATS	Mode of arrival	Summary of presenting problem
7	93, female	2	Ambulance	Fell from top of concrete staircase >3m. Denies loss of consciousness. Right leg shortened and rotated, pain across pelvis, bruising to around right eye. Difficulty extraction from stairwell. Pre-hospital ANSW medications: 7.5mg morphine IV.
8	56, male	2	Ambulance	Fall from ladder approximately 1.5m, landed on low wall. Pain across mid-thoracic back, nil sensation or movement to bilateral lower limbs. Pre-hospital ANSW medications: 20mg morphine IV, 3ml methoxyflurane inhaler, 250ml crystalloid IV.
9	38, male	1	Ambulance	Full thickness laceration (bone visible) across left bicep from glass. Arterial spurt, hand dusky coloured. Loss of consciousness (5-10 minutes). Tourniquet x 2 applied. Approximately 2 -3ltrs of blood loss at scene. Pt alert and pale.
10	61, male	2	Walk-in	3-day history of chest pain, sent in by GP on finding raised troponin (>1200). Intermittent non-radiating chest pain. No diaphoresis or nausea reported.
11	62, female	2	Air ambulance	Cyclist, fell off bike at high speed, struck head, 4cm depression over left frontal-temporal region. Seizing on arrival of ANSW. Escalated to HEMS who intubated and paralysed prior to retrieval. Pre-hospital HEMS medications: 5mg morphine and 5mg/hr midazolam IV infusion commenced, 500mg levetiracetam IV given to abate seizure.

Patient No.	Age, gender	ATS	Mode of arrival	Summary of presenting problem
12	79, female	2	Walk-in	3-day history of right flank pain, fever, and rigors. Vomiting in triage, distressed and pale. Temperature 40°C, SBP 77mmHg.
13	28, male	2	Ambulance	Restrained driver, travelling approximately 80km/hr, front end collision into stationary car. No airbag deployed. Self-extricated. Presents 2 hours later with chest pain and SOB.
14	60, male	2	Ambulance	Attended own GP with 4-hour history of chest pain while at rest onset. Recent MI and CABG. Not diaphoretic or SOB. GP ECG shows large ST elevation.
15	55, female	1	Air ambulance	Pedestrian versus motorbike. Sustained head injury, right pneumothorax, and possible intra-abdominal injuries. Intubated at scene.
16	34, female	1	Walk-in	Abnormal heartbeat. SVT 240bpm, pale and diaphoretic. SBP 67mmHg.
17	32, female	1	Ambulance	Overdose, 30 x 25mg promethazine tablets. Retrieved off flight by ANSW unconscious. Lying in left lateral position to support airway clearance of secretions, tolerating nasopharyngeal. GCS 5.
18	52, male	2	Walk-in	4-6hr history of left testicular pain. GP sent patient to ED to exclude testicular torsion.
19	21, male	2	Walk-in	Sudden onset of speech difficulties, headache, nausea, and blurred vision 20 minutes ago. Good equal upper/lower limb strength.
20	51, female	1	Air ambulance	Unrestrained front passenger in high-speed collision (80-100km/h), ejected from vehicle approximately 25m. Unresponsive, GCS 3, naso-tracheal intubation by HEMS on scene. Partial scalp de-gloving injury, deformed to left side of face. Deformed pelvis – binder in-situ.

Patient No.	Age, gender	ATS	Mode of arrival	Summary of presenting problem
21	30, female	2	Ambulance	Found with reduced consciousness by bystanders. Responded to deep pain stimulation but became agitated and aggressive. States taken GHB. Increasingly yelling and threatening staff. ANSW administered 10mg droperidol IM, and requested assistance by police.
22	61, male	2	Ambulance	Fall from ladder 1-2m, right arm became trapped between rungs of ladder. Suspected mid-shaft humeral fracture. Struck head on ground with short loss of consciousness (<5 minutes) and seizure-like activity witness by wife. Amnesic to events. Complaining of left hip pain – left leg rotated. 10mg morphine IV and fentanyl 50mcg IV given by ASNW. C-spine immobilisation in-situ.
23	36, male	2	Walk-in	Abdominal pain, vaginal bleeding for past two days. Investigated by GP who arranged ultrasound. Confirmed ectopic pregnancy. Increased vaginal bleeding over 24hrs, 10 pads changed since morning, now passing large clots.
24	40, male	2	Ambulance	Pt was gardening, slipped and fell onto gardening sheers. Puncture wound above umbilicus. Estimated 10 deep. Estimate blood loss 1ltr at scene.
25	46, male	2	Ambulance	Pedestrian versus car, alleged assault. Patient was driver in collision (t-boned) at approximately 80km/h. Self-extracted. Patient states then assaulted by driver of other car – punched in head and chest, then ran over. Multiple contusions to right side of arms, legs, chest and abdomen. Denies neck pain or loss of consciousness.

Patient No.	Age, gender	ATS	Mode of arrival	Summary of presenting problem
26	87, female	2	Ambulance	4-day history of feeling unwell since unwitnessed fall in nursing home. Decline in mobility and cognition. Today febrile, diarrhoea, hypotensive (SBP 77mmHg) and Tachypnoeic (RR 41/min).
27	89, male	2	Ambulance	Central chest pain since early morning, and productive cough. Tachypnoeic, right expiratory wheeze, speaking in short sentences. Pre-hospital ANSW medications: 300mg aspirin and GTN 600mcg with effect.
28	44, female	2	Ambulance	Alleged assault, multiple punches to left side of face and back of head. Short loss of consciousness (<5 minutes). Alert, but confused, vomiting. Amnesic to events. C-spine immobilisation in-situ. Pre-hospital ANSW medications: 300mcg fentanyl IN and 4mg ondansetron IV.
29	61, female	2	Ambulance	Overdose, unconscious. Partner states took regular methadone dose (57mLs) at midday, and then took two alprazolam tablets. Unable to rouse, noisy breathing, vomit over face. GCS 5 on ANSW arrival, saturating 86% on RA, pupil sluggish, 3mm.
30	57, female	2	Ambulance	Fell approximately 3m down tiled stairs, struck head with short (<5 minutes) loss of consciousness. Bruising over right orbital region, right eye unable to abduct, pupils equal and reactive to light. C-spine immobilisation in-situ. Bilateral deformed wrists, impaired NV. Patient alert but confused, amnesic to events.

Patient No.	Age, gender	ATS	Mode of arrival	Summary of presenting problem
31	54, male	2	Ambulance	Found in middle of road by bystanders with head injury, confused with unsteady gait. Unclear mechanism, haematoma to left occipital region, no other injuries evident. Alert, confused and amnesic to events.
32	42, male	2	Ambulance	3-day history of chest pain, increasing dyspnoea, bilateral lower limb oedema. Chest now central and crushing.
33	40, female	2	Ambulance	Fell whilst roller skating. Deformed lower right leg, bone protruding. Pre-hospital ANSW medications: 5mg oxycodone PO, 3ml methoxyflurane inhaler.
34	53, male	2	Ambulance	Slipped whilst gardening, full thickness laceration to left shin 25-30cm, bone visible. On anticoagulant, estimated 1ltr blood loss at scene. Pre-hospital ANSW medications: 3ml methoxyflurane inhaler, 420mcg fentanyl IN and 7.5mg morphine IV.
35	75, male	2	Walk-in	Front passenger of car travelling approximately 50km/hr, struck stationary car and rolled. Nil air bags deployed, query loss of consciousness. Trapped for 10-15min. Left chest wall and thoracic pain. Alert.
36	53, male	2	Walk-in	Fall from roof approximately 3m this morning. Landed on left side onto concrete. Struck head with brief (<5 minute) loss of consciousness. Complaining of pain to the lower back and left lateral chest wall. Abrasion to the top of head, right knee, right elbow. Alert and orientated.

Patient No.	Age, gender	ATS	Mode of arrival	Summary of presenting problem
37	41, male	2	Ambulance	Attempted suicide. Unrestrained driver, unknown speed into tree. Front of care deformed, windscreen shattered, airbags deployed. Denies loss of consciousness. Struck head on windscreen. Ambulant on ANSW arrival. Seatbelt sign – bruising to chest and abdomen, deep laceration to chin. Alert and orientated. C-spine immobilisation in-situ.
38	39, female	2	Ambulance	Retained rectal foreign body. States inserted glass bottle of methamphetamine into rectum 1 hour ago, called ASNW due to PR bleed and difficulty in passing stool and flatulence. Hypertensive (230mmHg) and tachycardia (111/bpm). Rectal pain and bleeding noted.
39	27, female	2	Ambulance	Presents post motor vehicle collision with bilateral wrist, neck and left arm pain. Travelling 80km/h, rear-ended stationary car. Nil airbags deployed. No head strike or loss of consciousness reported. Alert with c-spine tenderness.
40	82, male	2	Walk-in	Patient woke up confused, slurred speech, drooling. CALD, daughter translating. States not speaking clearly, very repetitive speech, and disorientated. Noticed left arm weakness.
41	87, female	2	Air ambulance	Fall from 17 stairs, multiple abrasions, laceration to back of head. Degloved left lower leg with uncontrolled bleeding. On Pradaxa. C-spine immobilisation. ANSW 40mg ketamine IV, 4mg ondansetron and 7.5mg morphine IV. Alert but confused.

Patient No.	Age, gender	ATS	Mode of arrival	Summary of presenting problem
42	57, male	2	Ambulance	Fall >2m at building site. Cutting concrete slab when slab collapsed. Found on floor by co-workers. Amnesic to event, safety helmet worn, undamaged. Laceration to right temporal region. Complaining of right shoulder and hip pain. C-spine immobilisation and pelvic binder applied. Pre-hospital ANSW medications given: 3mL methoxyflurane inhaler, 10mg morphine IV, 5mg ketamine IV and 4mg ondansetron IV.
43	41, female	1	Walk-in	Patient retrieved from car outside ED – unwell. Patient reports palpitations for past 30 minutes. Patient pale and diaphoretic. SVT 211/bpm.
44	78, male	1	Ambulance	Generalised seizure, non-resolving. Seizing for past 90 minutes despite 5mg buccal midazolam (administered by carer).
45	61, male	2	Ambulance	Motorcyclist clipped car side mirror travelling at 50km/h, slid 10-20 meters with bike. Helmet and protective clothing worn nil loss of consciousness. Ambulant at scene, complaining of upper thoracic back pain radiating to left shoulder, worse on inspiration. Diminished right side air entry. Patient alert and pale.
46	16, male	2	Walk-in	Cycling at high speed, hit pothole, lost control of bike and fell over handlebars striking head on kerb. No helmet worn. Tender over C6-7, abrasions over both eyebrows and nose, deformed left wrist.