

# Standardising Initial Emergency Nursing Care: A Multicentre Implementation Evaluation

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A thesis submitted to fulfil the requirements  
of the degree of Doctor of Philosophy

Susan Wakil School of Nursing and Midwifery  
Faculty of Medicine and Health  
The University of Sydney

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## **Statement of Originality**

I certify that the work in this thesis has not previously been submitted for any other degree or purpose.

I also certify that I have written the thesis, and it is the result of work I have undertaken as part of my Doctor of Philosophy candidature. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

Signature:

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Date: 29/6/2025

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## Authorship Attribution Statement

Professor Kate Curtis, Dr Sarah Kourouche and Associate Professor Andrea McCloughen supervised this PhD thesis. Professor Margaret Fry was a member of the supervisory team until the end of 2023. This thesis includes five manuscripts that have been either published or submitted for review. These publications are listed below, along with my authorship attribution statements.

### Publication 1

**Kennedy, B.**, Kourouche, S., McCloughen, A., Munroe, B., Melville, G., & Curtis, K. (2025).

*Strategies that contribute to sustained practice change in the emergency department: A scoping review* [Manuscript submitted for review on 30 June 2025].

This manuscript is reproduced in full in Chapter 2. I designed this scoping review with KC and SK. I conducted the literature search, data extraction and analysis and interpretation of findings, wrote the draft manuscripts and led the preparation and submission of the final manuscript for publication. GM provided advice and assistance with analysis and visualisation of the data. Duplicate screening of papers for inclusion was completed by SK, and data extraction was crosschecked for accuracy by BM and SK.

### Publication 2

**Kennedy, B.**, Curtis, K., Kourouche, S., Casey, L., Hughes, D., Chapman, V., Fry, M. (2024).

Establishing enablers and barriers to implementing the HIRAID® emergency nursing framework in rural emergency departments. *Australasian Emergency Care*, 27(4), 290–298. <https://doi.org/10.1016/j.auec.2024.08.002>

This publication is reproduced in Chapter 5 (Section 5.1.1). Along with three of my co-authors (KC, MF and SK), I contributed to the design of this study, assisted with the instrument refinement, developed the data collection instrument, analysed and interpreted the data and led the preparation and submission of the manuscript. LC, DH and VC assisted with the recruitment of study participants.

### **Publication 3**

**Kennedy, B.,** Curtis, K., Kourouche, S., Casey, L., Hughes, D., & McCloughen, A. (2024).

Development of an evidence-based strategy to implement the HIRAID® emergency nursing framework in rural emergency departments using behaviour change theory. *International Emergency Nursing*, 77, Article 101538.

<https://doi.org/10.1016/j.ienj.2024.101538>

This publication is reproduced in Chapter 5 (Section 5.1.2). It was informed by the data collected and analysed for Publication 2. The mapping was guided by the behaviour change wheel, with guidance from the second author (KC) to select the strategies for implementation. I led the preparation of the manuscript and submission for publication.

### **Publication 4**

**Kennedy, B.,** Lam, M., Kourouche, S., McCloughen, A., Casey, L., & Curtis, K. (2025). The

impact of HIRAID implementation on the accuracy of emergency nurse documentation in Australian rural emergency departments: A multicenter quasi-experimental study. *Journal of Emergency Nursing*, 51(3), 433–444.

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Publication 4 is reproduced in Chapter 5 (Section 5.2.1). I created the data collection instruments and tested and refined the instrument in consultation with one of my co-authors (KC). Records were identified for review with the assistance of LC. I completed the data collection, analysis and interpretation with the assistance of ML, a biostatistician. I led the preparation of the manuscript and submission for publication.

### **Publication 5**

**Kennedy, B.,** Curtis, K., Kourouche, S., Fry, M., & McCloughen, A. (2025). *Australian rural nurses' experiences of the implementation and impact of HIRAID® emergency nursing framework on nursing practice. A qualitative study* [Manuscript submitted for review on 8 April 2025].

This manuscript is reproduced in Chapter 5 (Section 5.2.4). I co-designed this qualitative study with three of my co-authors (MF, KC and SK) and completed data collection and analysis and interpretation of findings with the guidance of AM and SK. I led the preparation of the manuscript and its submission for publication.

## **Supervisor Confirmation**

As supervisor for the candidature upon which this thesis is based, I can confirm that the authorship attribution statements above are correct.

Supervisor name: Professor Kate Curtis

Signature:

Date: 30/6/2025

## **Artificial Intelligence (AI)**

During the preparation of this thesis, I used Grammarly to assist with spelling and grammar. Where text was modified by generative AI, I reviewed it for possible errors, inaccuracies and biases. I take full responsibility for the submitted thesis. The work is my own, and generative AI has been used within the parameters stipulated by The University of Sydney's generative AI guidelines.

## **Editing**

This thesis was edited by Elite Editing, and editorial intervention was restricted to Standards D and E of the *Australian Standards for Editing Practice*.

# Abstract

## Background

Emergency nurses play a vital role in the delivery of safe, high-quality emergency care and are the first clinicians to assess and treat patients who present to the emergency department (ED). Their decisions inform the patient's journey and safety. In rural settings, where 24-hour onsite medical services are not always available, an emergency nurse may be the only clinician a patient will see. In all EDs, appropriate patient-related decisions are contingent upon accurate nurse assessments. Nevertheless, there is no standardised approach to emergency nursing care. The HIRAID (History, Infection risk, Red flags, Assessment, Interventions, Diagnostics, reassessment and communication) emergency nursing framework addresses this gap, providing a standardised approach to post-triage patient assessment and management. HIRAID has been tested in both simulated and real-world settings, specifically four EDs in a regional local health district, showing a positive effect on emergency nursing and patient outcomes. However, it has not yet been evaluated in the rural context. Guided by behaviour change theory, this thesis describes the development and evaluation of a HIRAID implementation strategy in 11 rural EDs.

## Methods

A multimethod implementation evaluation study was conducted in two phases across 11 EDs in the Southern New South Wales Local Health District, a predominantly rural health district in Australia. Five separate studies based on quantitative, qualitative and mixed methods were conducted to design and evaluate the HIRAID implementation.

### *Phase 1: Implementation strategy development*

First, a mixed methods survey of 102 emergency nurses in 11 rural EDs was conducted to identify the enablers and barriers to HIRAID implementation. Quantitative data were analysed using descriptive statistics, while qualitative data were analysed using content analysis. The results were integrated and mapped to the theoretical domains framework to determine the enablers of and barriers to implementation. Second, the identified enablers and barriers were mapped to the corresponding intervention functions on the

behaviour change wheel, which in turn were mapped to behaviour change techniques to inform the development of the implementation strategy.

#### *Phase 2: Implementation evaluation*

Evaluation of HIRAID implementation was guided by the RE-AIM (reach, effectiveness, adoption, implementation quality, maintenance) framework and involved four separate studies using a multimethod approach. The evaluation was informed by nurse surveys and interviews and audits of site implementation records and medical records. Descriptive and inferential statistics were used to report quantitative data, while inductive content analysis was used to analyse qualitative interview data.

## **Results**

#### *Phase 1: Implementation strategy development*

The survey of emergency nurses led to the identification of two enablers and four barriers to the implementation of HIRAID. These enablers and barriers were mapped to ten of the 14 domains in the Theoretical Domains Framework: memory, attention and decision processes, beliefs about consequences, beliefs about capabilities, social/professional role and identity, intentions, environmental context and resources, knowledge, social influences, optimism and reinforcement. Seven corresponding intervention functions were selected and mapped to 20 behaviour change techniques to be operationalised through 12 delivery modes, including education, clinical champions, educational videos and electronic medical record modifications.

#### *Phase 2: Implementation evaluation*

Using the developed implementation strategy, the HIRAID framework was implemented in 11 EDs. The framework achieved a high reach, with over 90% of emergency nurses engaged in components of the education program. It also achieved high dose, with over 30 trained champions (instructors) delivering 48 face-to-face training sessions, capturing over 80% of nursing staff. Training was delivered by a trained HIRAID instructor always or most of the time (92%), indicating high fidelity in terms of delivery. However, the educational resources were used less than 50% of the time, falling into the low-fidelity range. Most nurses (82.5%) reported using the HIRAID documentation templates. This finding was supported by the documentation audit, which showed that the templates

were used 77.8% of the time. Fidelity to a range of strategies used in delivery was within the low-to-moderate range. Challenges reported during implementation were inadequate staff and insufficient time to implement the HIRAID framework as intended.

A review of 222 medical records (110 pre and 112 post implementation) at ten of the 11 EDs demonstrated significant improvements in the accuracy of post-triage nursing documentation, as measured by a modified D-Catch instrument. The mean score for the quantity of relevant information increased from 1.8 ( $\pm 0.6$ ) to 2.6 ( $\pm 0.7$ ),  $t(219) = 9.99$ ,  $p < .001$ , while the mean score for the quality of information increased from 1.6 ( $\pm 0.5$ ) to 2.2 ( $\pm 0.6$ ),  $t(219) = 8.45$ ,  $p < .001$ .

## **Conclusion**

The findings show that a tailored, evidence-based implementation strategy designed to address context-specific barriers and enablers was effective for the sustained uptake of HIRAID in rural EDs. HIRAID was delivered with high reach, dose and quality. The intervention demonstrated individual and clinical effectiveness, supporting clinical practice and improving the quality of documentation. Fidelity to the strategies delivered by HIRAID champions varied from low to high. The use of HIRAID was sustained for more than 6 months post implementation. The results of this evaluation highlight areas for improvement to inform future implementation activities in the rural context and in EDs more broadly.

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## Publications Related to This Thesis

- Kennedy, B.**, Kourouche, S., McCloughen, A., Munroe, B., Melville, G & Curtis, K. (2025). *Strategies that contribute to sustained practice change in the emergency department: A scoping review* [Manuscript submitted to the *Annals of Emergency Medicine* for review on 30 June 2025].
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- Kennedy B.**, Curtis K., Kourouche S., Fry M., Casey L., & Hughes D. (2023, 4–6 October). *Development of an evidence-based implementation plan for HIRAID™ emergency nursing framework in rural emergency departments* [Paper presentation]. 20th International Conference of Emergency Nurses, Perth, Western Australia, Australia.
- Kennedy, B.**, Curtis, K., Lam, M., Kourouche, S., & McCloughen, A. (2024, 16–18 October). *The impact of HIRAID® implementation on the quality of emergency nurse documentation in rural emergency departments: A multi-centre quasi-experimental study* [Paper presentation]. 21st International Conference of Emergency Nurses, Sydney, New South Wales, Australia.

## List of Abbreviations

|            |  |
|------------|--|
| ACEM       | Australasian College for Emergency Medicine  |
| AIHW       | Australian Institute of Health and Welfare   |
| APEASE     | affordability, practicality, effectiveness/cost-effectiveness, acceptability, side-effects/safety and equity |
| CNC        | clinical nurse consultant  |
| COM-B      | capability, opportunity, motivation—behaviour  |
| BCT        | behaviour change technique   |
| BCW        | Behaviour Change Wheel   |
| EBI        | evidence-based intervention  |
| ED         | emergency department   |
| ERIC       | Expert Recommendations for Implementing Change   |
| HIRAID     | history, infection risk, red flags, assessment, interventions, diagnostics                                   |
| LHD        | local health district  |
| NHMRC      | National Health and Medical Research Council   |
| NSW        | New South Wales  |
| PRISMA     | Preferred Reporting Items for Systematic reviews and Meta-Analyses   |
| PRISMA-ScR | PRISMA Extension for Scoping Reviews   |
| RDS        | Research Data Store  |
| RE-AIM     | reach, effectiveness, adoption, implementation quality, maintenance  |
| REDCap     | Research Electronic Data Capture   |
| TDF        | Theoretical Domains Framework  |

# Chapter 1: Introduction

In this thesis, along with the embedded peer-reviewed publications, the implementation of the HIRAID (History, Infection risk, Red flags, Assessment, Interventions, Diagnostics, reassessment and communication) emergency nursing framework across a large rural local health district (LHD) in the state of New South Wales (NSW), Australia, is reported. This study was undertaken as part of a larger research program. Southern NSW LHD was the first rural LHD to implement of the HIRAID framework, led by the thesis author. This involved developing data collection instruments and other resources that have been subsequently used at other sites as part of the larger research program. Based on an implementation science approach and behaviour change theory, this thesis details the development of the implementation strategy and the evaluation of the implementation and its outcomes (Curtis et al., 2023).

In this chapter a brief overview of the diversity of emergency care settings required to address the health needs of populations in large geographic areas is discussed. Then the integral role of emergency nurses in delivering timely, high-quality emergency care and the gaps in emergency nursing practice in rural health districts are described. The evidence for the HIRAID framework and the demonstrated effectiveness in supporting emergency nursing practice is detailed. Finally, the challenges in translating evidence into practice, with a specific focus on the emergency context, and the recent evolution of implementation science to support the translation of evidence into practice is described. The chapter concludes with the aim and objectives of this thesis outlined.

## 1.1 Background

Australia is the world's seventh-largest country, but its population density is significantly lower than that of countries with a similar land mass (Central Intelligence Agency, 2024). Most Australians reside in major cities (Australian Institute of Health and Welfare [AIHW], 2023b). Those who live outside of the major cities are spread across large, diverse geographic areas. The geographic distribution of Australians living in rural areas creates unique challenges in terms of providing equitable health care that meets the needs of the population (AIHW, 2022). The United States and Canada face similar challenges given their similar large, underpopulated rural areas (Cyr et al., 2019; Wilson et al., 2020). Compared with their metropolitan counterparts, rural Australians have poorer health

outcomes and a greater incidence of chronic disease, partly because of the challenges related to accessing health care (AIHW, 2022).

### **1.1.1 Emergency Department Care**

In Australia, emergency departments (EDs) are the point of access for patients requiring emergency health care. In 2020–2021, over 8.8 million people were treated in Australian EDs, with more than a third of these presentations being outside of the major cities (AIHW, 2021a). The rate of ED presentations has increased steadily to over 9 million in 2023–2024 (AIHW, 2025). Chui et al. (2025) explored the effect of geographic remoteness on ED presentations in NSW, finding significant variations across regions with rates increasing with geographic remoteness. Comparing ED presentations from 2015 and 2021, there was a 10.2% increase in inner regional areas and 87.0% increase in remote or very remote areas while remaining relatively stable in metropolitan areas (Chui et al., 2025)

In 2020–2021, Australia had 291 public hospital EDs providing 24-hour care, with onsite medical and nursing staff and designated resuscitation areas and amenities (AIHW, 2021a). However, more than 400 rural health facilities provide emergency health care (Baker et al., 2022), but many do not meet the staffing or service delivery criteria to be considered an ED (AIHW, 2021b). In rural areas, hospital-based emergency facilities vary in terms of their structure and resources (Australasian College for Emergency Medicine [ACEM], 2023). Many smaller facilities without a 24-hour medical service offer on-call services through local general practitioners, virtual care or, in some instances, the ambulance service, with paramedics assisting as required (Baker et al., 2022; S. Smith et al., 2021). Irrespective of the model of care delivery, all facilities employ nurses, many of whom have extended emergency care skills (ACEM, 2023).

### **1.1.2 Emergency Department Practice Environment**

EDs are challenging clinical environments, with clinicians facing diverse patient presentations of varying complexity and acuity, a fast-paced, time-pressured environment, an unpredictable workload and an ever-increasing number of presentations (Fry et al., 2024; Göransson et al., 2025). Across Australia's healthcare system, care delivery and outcomes vary (Australian Commission on Safety and Quality in Health Care, 2021), and the application of evidence-based practice in emergency settings is inconsistent (Bosch et al., 2019; Braithwaite, Hibbert, et al., 2018; Ferreira et al., 2022; E.

Tavender et al., 2019). Clinical variation refers to a deviation in healthcare services from usual care. However, this variation is unwarranted if care does not align with the clinical presentation or the informed choice of the health consumer (Sutherland & Levesque, 2020). The consistent delivery of evidence-based care promotes equitable care across diverse settings (Buchan et al., 2016). Unwarranted variations in care can result in potential or actual adverse outcomes (Duggan et al., 2016).

Adverse events can have significant functional, psychological and financial effects for patients and their families (Ottosen et al., 2021). In many cases, these events are preventable, with management and diagnostic errors being key contributors (Stang et al., 2013; Tsilimingras et al., 2023). An example of a preventable event in the ED is the failure to escalate clinical deterioration. In Australian EDs, clinical deterioration, which is based on clinical observation parameters, is frequently unreported (Connell et al., 2021; Scott et al., 2015). Abnormal clinical observations during a patients' ED stay can lead to clinical deterioration within 3 days of admission (Considine et al., 2017). In most cases, emergency nurses are responsible for escalation because they are responsible for the ongoing assessment and monitoring of patients during their ED stay.

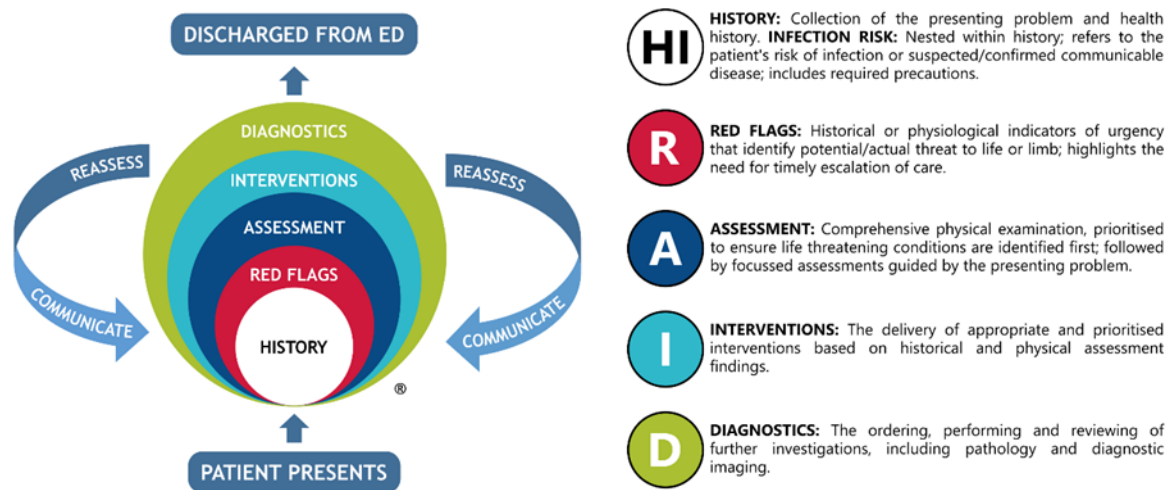
### **1.1.3 Nursing in the Emergency Department**

In rural Australia, emergency nurses play an integral role in the delivery of emergency health care, being the first, and sometimes the only, clinician a patient will see (Francis et al., 2016; S. Smith et al., 2021). In rural settings, the nursing role is complex and demanding, and many nurses report feeling unprepared (Muirhead & Birks, 2019). In many cases, they require an extended scope of practice to deliver health services to their communities (Muirhead & Birks, 2019) and may be required to work in multiple areas of the health facility based on service demands (Baker et al., 2022).

As the first clinicians to see and treat patients who present to the ED, emergency nurses must be highly skilled in patient assessment and the integration and analysis of findings to make informed clinical decisions about care priorities and treatment (College of Emergency Nursing Australasia, 2020; Jones et al., 2015). In settings with limited medical coverage, timely and appropriate judgements are needed for patient care and escalation. Where medical officers are not available, these skills serve as the foundation for emergency nurses to initiate the management of acute presentations, as guided by established protocols (Agency for Clinical Innovation, 2022).

## 1.2 HIRAID Emergency Nursing Framework

HIRAID is a validated emergency nursing framework. HIRAID stands for **h**istory, **i**nfection risk, **r**ed flags, **a**ssessment, **i**nterventions and **d**iagnostics, underpinned by reassessment and communication (Curtis et al., 2020; Munroe, Buckley, et al., 2016) (see Figure 1.1).



The HIRAID® framework encapsulates the cyclical nature of patient assessment, in which more than one element of the framework may be performed simultaneously. It also embraces the importance of **reassessment** and **communication**, which are vital components of emergency nursing.

**REASSESSMENT:** The evaluation of care and monitoring of patient progress using a structured approach and repeated at appropriate intervals per condition of the patient.

**COMMUNICATION:** Verbal/non-verbal skills necessary to effectively communicate with patients, families and clinicians, includes using: a structured approach to communicate clinical handovers; graded assertiveness to escalate if needed; and, accurate and comprehensive clinical documentation.

Figure 1.1. HIRAID emergency nursing framework.

The HIRAID framework supports emergency nurses in the assessment and clinical management of patients post ED triage. It was conceptualised by Curtis et al. (2009), who developed it as a tool for education and a guide for clinically challenging ED presentations. The framework, initially known as the 'emergency nurse assessment framework', was created for a university nursing curriculum in consultation with an education consultant and experienced emergency nurse consultants (Curtis et al., 2009). Informed by a comprehensive literature review and a Delphi study, the emergency nurse assessment framework was subsequently redeveloped into HIRAID, with each stage of the framework being underpinned by evidence (Munroe et al., 2015).

HIRAID has been comprehensively evaluated. Studies show that following a structured HIRAID education program, early career emergency nurses have improved assessment and non-technical skills in simulations, decreased anxiety and increased self-efficacy, all of which are known to influence performance (Munroe, Buckley, et al., 2016; Munroe, Curtis, et al., 2016). To establish its feasibility, HIRAID was evaluated in a real-world

setting, across four EDs in regional Australia, showing improved clinical documentation by emergency nurses (Munroe et al., 2022), reduced clinical deterioration events related to emergency nursing care (Curtis, Munroe, et al., 2021) and significant cost savings (Curtis, Sivabalan, et al., 2021).

### 1.3 Evidence–Practice Gap

Nurse assessments are integral to the delivery of high-quality care and underpins the decisions made by nurses in the management of patients presenting to the ED. The clinical efficacy and usability of HIRAID in EDs has been established in both simulated (Munroe, Buckley, et al., 2016; Munroe, Curtis, et al., 2016) and real-world settings (Curtis, Munroe, et al., 2021; Curtis et al., 2020; Munroe et al., 2022). However, at the commencement of the research presented in this thesis, there had been no formal implementation or evaluation of HIRAID beyond a few regional sites in a single health district.

A quality improvement project undertaken in the Southern NSW LHD demonstrated that patients were receiving suboptimal pain relief, and emergency nursing assessments and documentation were of low quality (see Figure 1.2). Senior clinicians identified HIRAID as an appropriate intervention to address the areas of nursing practice that needed improvement.



Figure 1.2. Justification for HIRAID—Dorothy Hughes.

Note: HIRAID was implemented in 11 emergency departments, with clinical outcomes evaluated in ten. Image reproduced from *Hear USYD Research Officer Dorothy Hughes Share her Experience of HIRAID Implementation in Southern NSW*, by K. Curtis, 2024, LinkedIn post [Video attached]

### **1.3.1 Evidence-based Interventions**

Health professionals face challenges in keeping up with technological advances and the ever-increasing volume of healthcare research (Bauer & Kirchner, 2020). Nurses have a professional and legal responsibility to maintain currency in their knowledge and skills to ensure they deliver care in line with current evidence and best practice (International Council of Nurses, 2021; Nursing and Midwifery Board of Australia, 2016) and achieve optimal patient outcomes (Giles et al., 2024). The provision of high-quality evidence-based care ensures that patients receive timely and appropriate treatment and supports the sustainability of the health system (Giles et al., 2024).

While the terms 'evidence-based intervention' (EBI), 'evidenced-based care' and 'evidence-based practice' are often used interchangeably, they have subtle differences in meaning. An EBI has demonstrated efficacy and effectiveness (Colditz & Emmons, 2017), meaning that it has the desired effect in both well-designed, controlled research conditions and real-world contexts (Bauer et al., 2015). EBIs can address evidence and practice gaps (Curran, 2020) and may include programs, policies, practices, processes, guidelines or medications (Colditz & Emmons, 2017; Weiner et al., 2023). However, evidence of the efficacy of an intervention is not sufficient to ensure its application in clinical practice. The uptake of an intervention requires planning and an implementation strategy that addresses context-specific barriers (Bauer & Kirchner, 2020). The research reported in this thesis aims to translate the HIRAID emergency nursing framework, an EBI, into practice across diverse ED settings in a single LHD.

### **1.4 Implementation Science**

Implementation science focuses on establishing the most effective strategy for implementing an EBI as part of routine practice (Weiner et al., 2023) and can explain why an EBI is or is not being used appropriately (Bauer et al., 2015; Weiner et al., 2023). The primary aim of implementation science is to identify the most effective means of promoting the uptake of an EBI to achieve improved health outcomes for a target population in a real-world setting (Handley et al., 2016).

Implementation science emerged from the recognised need to reduce the science-practice gap by decreasing the time to apply research findings in practice (Nilsen, 2024)

and reduce the persistent gaps between knowledge and practice (Weiner et al., 2023). The ineffective practical application of EBIs brings significant costs, including the financial costs associated with research (Bauer & Kirchner, 2020) and inequity in healthcare delivery and outcomes (Nilsen, 2024).

In studies based on implementation science, methods are chosen according to the complex system in which the implementation of an EBI occurs. Departing from the previously conceptualised linear process of translating evidence into practice, these methods address the interrelated and constantly changing factors that influence effective implementation (Braithwaite, Churrua, et al., 2018). The successful application of an EBI in practice requires an implementation strategy underpinned by a relevant theoretical framework that will leverage enablers and mitigate barriers (Kirchner & Bauer, 2024). Without such a theoretical framework, it becomes challenging to identify the factors contributing to the success or failure of an EBI (Nilsen, 2015). Further, a framework supports the exploration of causal relationships in the context of implementation.

#### **1.4.1 Enablers of and Barriers to Implementation**

The uptake of an EBI may be facilitated by enablers or hindered by barriers at the individual, organisational and intervention levels (Dudley-Brown, 2021). A *barrier* is something that impedes the uptake of an EBI or translation of evidence into practice, while an *enabler* supports or facilitates this uptake or translation. The successful and sustainable implementation of change in the clinical environment is complex and multifactorial, requiring adequate assessment, planning and support (Meyers et al., 2012; Nilsen, 2015) to identify and address the enablers and barriers.

The poor uptake of new EBIs may be attributed to the lack of appropriately designed, context-specific implementation strategies (Handley et al., 2016; E. Tavender et al., 2019). The geographic isolation of rural settings offers unique challenges in terms of making changes to practice, including a lack of access to education and training and limited staff for practical one-on-one support (Stockton et al., 2021). These challenges must be considered. Therefore, to optimise the implementation of HIRAID, it was necessary to identify the potential enablers of and barriers to a change in practice (McArthur et al., 2021).

### **1.4.2 Implementation in the Emergency Context**

The role of implementation science in effectively implementing EBIs in EDs to reduce the evidence–practice gap and achieve sustainable change is well recognised (de Wit et al., 2018; E. Tavender et al., 2019). The complex clinical environment has many challenges, and the implementation of EBIs must be tailored to address the subtle differences between EDs (de Wit et al., 2018; Jabbour et al., 2018; Stolldorf et al., 2025; E. Tavender et al., 2019). While the number of implementation studies in EDs is increasing, they have primarily focused on the evidence–practice gap and barriers to implementation rather than implementation design and evaluation (E. J. Tavender et al., 2016). This limits the ability to replicate studies or evaluate the adequacy of the implementation strategy. Despite well-designed implementation strategies, uptake is not always achieved (Bosch et al., 2019). Therefore, the rigorous evaluation of implementation strategies in the ED context is needed to inform modifications to further optimise uptake.

## **1.5 Research Aim and Objectives**

### **1.5.1 Aim**

The aim of the research presented in this thesis is to develop and evaluate a strategy to implement the HIRAID emergency nursing framework in EDs and multipurpose facilities across a large rural LHD in southern NSW, Australia.

### **1.5.2 Objectives**

The specific objectives of this research are to:

1. identify the enablers of and barriers to HIRAID implementation based on the Theoretical Domains Framework (TDF)
2. develop an evidence-based implementation strategy based on the Behaviour Change Wheel (BCW)
3. evaluate the implementation, guided by the RE-AIM framework, to determine implementation fidelity and effectiveness.

## **1.6 Significance of the Research**

This research draws on the principles of implementation science to develop and evaluate an evidence-based strategy to implement the HIRAID framework in a rural LHD. It also evaluates the outcomes of the HIRAID implementation in a context in which it has not

previously been evaluated. The findings support the external validity of HIRAID and its widespread application across diverse clinical settings, supporting emergency nurses in the assessment and delivery of care for a wide range of patient presentations.

## **1.7 Author Position**

When I started this research, I had been a registered nurse for 26 years, with extensive clinical experience in critical care areas. For the last 15 years, I had predominantly worked in the ED. I am passionate about patients receiving the highest-quality care. During my time in the ED, I was fortunate to work alongside highly respected emergency nurses, whose leadership fostered my appreciation of the value of constantly evaluating and critically reflecting on how we practice. Through this, I developed a keen interest in nurse-led research. This exposure to clinical research and witnessing the difference it can make to the patient journey shaped me as an emergency nurse and informed my desire to explore areas of practice with the aim of improving the work environment and how we deliver health care.

For 4 years, I worked as an emergency nurse educator in a large tertiary ED and was acutely aware of the challenges of orienting new nurses to the ED. It is extremely challenging to prioritise and coordinate care in a context with high patient turnover and diverse and undifferentiated clinical presentations, particularly for new graduates who are not yet fully proficient with basic nursing skills. These challenges are compounded when inexperienced ED nurses work alongside a variety of nurses, all of whom have their own way of practising, which can lead to a lack of clarity around work processes and a limited ability to identify priorities in care delivery.

Immediately prior to commencing my PhD candidature, I was working on a casual basis in an ED in metropolitan Sydney and part time at the University of Sydney, where I had recently completed work as a project manager on a large research project. During that time, I assisted in writing the study protocol for the research reported in this thesis. I was still connected to the project team when it successfully obtained a grant that would enable this research to be undertaken on a larger scale. This presented the opportunity for me to join the research team as a PhD candidate. My previous clinical experience as an emergency nurse educator was the real driver for my desire to evaluate HIRAID in a broader context and an interest to learn more about the use of implementation science in translational research.

## **1.8 Thesis Overview**

In Chapter 2 a scoping review of the literature on the strategies used to implement new interventions for practice change in the ED, for sustainable practice change, is presented. A multimethod study design was chosen to address the aim and objectives of this research. The theoretical frameworks underpinning each phase of the research are described in Chapter 3, and in Chapter 4 a comprehensive overview of the research methods is provided. In Chapter 5 the results of the study identifying the enablers and barriers to HIRAID implementation are reported (Publication 2). These findings informed the development of the implementation strategy for HIRAID (Publication 3). Following these publications, the results of the separate studies undertaken to evaluate the outcomes of the implementation are presented. This included a review of emergency nurse documentation (Publication 3) and a qualitative study of emergency nurses' experiences of implementation (Publication 4). In Chapter 6 the findings of the studies are integrated to present a comprehensive evaluation of the implementation strategy. Finally, in Chapter 7, the strengths and limitations of the research are discussed and recommendations for the future implementation of HIRAID in the rural context presented.

## **1.9 Conclusion**

In this chapter the integral role played by emergency nurses in the delivery of high-quality emergency nursing care in complex and diverse ED practice settings is described. The specific practice gaps in Southern NSW LHD were presented and the lack of a universal framework to support emergency nursing practice was highlighted. An overview of the HIRAID emergency nursing framework and its potential to improve nursing practice was presented, along with the challenges of translating EBIs into clinical practice and the application of implementation science to support evidence translation.

## **Chapter 2: Strategies that Contribute to Sustained Practice Change in the Emergency Department: A Scoping Review**

The paper embedded in this chapter presents a scoping review of the literature on the strategies used to implement change in the ED. Scoping reviews provide an overview of the existing evidence using a systematic approach similar to that applied in systematic reviews (Munn et al., 2018). In this context, 'strategies' refer to the methods used to support a change in practice and may include guidelines, education or environmental changes (Michie et al., 2014; Powell et al., 2015). In the context of implementation science, the 'implementation strategy' can refer to either a single strategy or a compilation of strategies used to implement an intervention (E. K. Proctor et al., 2013).

Publication 1 presents the aims, methods and findings of the scoping review. The supplementary files for Publication 1 are included in the following appendices:

- Appendix 1: Scoping review search strategy and PRISMA Extension for Scoping Reviews (PRISMA-ScR) reporting guideline
- Appendix 2: Search terms for five databases
- Appendix 3: Sample of excluded papers and rationale
- Appendix 4: Expert Recommendations for Implementing Change (ERIC) strategy frequency and mapping to activities detailed in studies.

### **2.1 Publication 1: Strategies for Sustained Practice Change in the Emergency Department: A Scoping Review**

**Kennedy, B., Kourouche, S., McCloughen, A., Munroe, B., Melville, G & Curtis, K. (2025).**  
*Strategies that contribute to sustained practice change in the emergency department: A scoping review* [Manuscript submitted for review].

## **Title page**

### **Strategies that contribute to sustained practice change in the emergency department: A scoping review.**

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**Meetings:** Not applicable the work has not been presented.

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**Conflict of Interest** -The authors declare no conflict of interest

**Data Sharing Statement-** Not applicable for this review. Template data collection forms; extracted data available on request.

**Word Count-** 3271 (manuscript excluding tables)

**Author contributions** – BK, KC, SK conceived the study and developed the study protocol. BK, SK conducted screening with supervision from KC and AM. BK completed data extraction, which as checked by BM and SK. Mapping to ERIC strategies was complete by BK and checked by SK. BK and GM completed data analysis, with advice provided by KC and SK. BK drafted the manuscript, all authors assisted with revision. BK takes responsibility for the manuscript.

1 **Strategies that contribute to sustained practice change in the emergency**  
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3 **department: A scoping review.**  
4

5 **Abstract** (Narrative per Annals scoping review author submission guidelines)  
6

7 Effective implementation of evidence-based interventions in emergency departments (ED) is  
8  
9 a priority but is challenging when considering the complexities of an ED. Successful  
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11 implementation requires the use of strategies that overcome barriers or capitalise on  
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13 enablers relevant to the context. This scoping review sought to identify implementation  
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15 strategies that result in sustainable practice change in the ED.  
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19 Published literature to March 2025 was searched in five databases: Medline, CINAHL,  
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21 Scopus, Proquest, PsychINFO. Primary research papers evaluating implementation where  
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23 ED clinician behaviour change was required, and, reported implementation strategies and  
24  
25 outcomes more than 6-months post implementation were included. Implementation  
26  
27 strategies extracted were coded per the Expert Recommendations for Implementing Change  
28  
29 (ERIC) framework. Data were reported using descriptive statistics, and inferential statistics  
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31 were used to visualise the findings.  
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35 There were 5,255 unique records, with 5,052 excluded after title and abstract screening.  
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37 Following full review of the remaining papers, 22 were included. More than three quarters of  
38  
39 the included studies achieved sustained change through use of three or more of 42 ERIC  
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41 strategies. ERIC strategies frequently related to the clusters of training and education,  
42  
43 stakeholder relationships, evaluative/ iterative and supporting clinician were used. Many  
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45 successful studies used an implementation framework, and when this occurred more  
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47 strategies were employed. The review highlights that a combination of strategy type, and use  
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49 of a framework, supports effective and sustainable implementation of interventions in the  
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51 ED. High-quality implementation studies, with longer-term evaluation, are necessary to  
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53 determine if specific strategies are more effective.  
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**Keywords** Emergency Service, Hospital; Implementation Science; Quality Improvement;  
Sustainability; Practice Change; Behaviour Change

## 1. BACKGROUND

Emergency departments (EDs) are complex environments, with high workloads, and variable presentation complexity and acuity, that frequently challenge individual and organisational resources<sup>1,2</sup>. This creates challenges for successful and sustained implementation of evidence, particularly where clinician practice change is required. Implementation science techniques are recommended in assessment, planning and delivery of an intervention<sup>3,4</sup>. These techniques provide a structured approach to identify practice gaps, along with organisational and individual changes required for effective uptake and use of an intervention by clinicians<sup>4,5</sup>.

A 2016 scoping review highlighted limited implementation science research in the ED setting<sup>6</sup>. Few studies identified barriers or enablers of implementation (19%), or evaluated the intervention or strategies used to change practice (39%)<sup>6</sup>. More recently, recommendations to implement change in the ED are emerging, however the evidence is variable<sup>7,8</sup>. With approximately 150 different implementation science theories, models and frameworks<sup>9,10</sup>, researchers have begun developing tools to support decision-making around which theory to use<sup>11</sup>. The selection of strategies to support implementation can be equally challenging<sup>12,13</sup>.

### Importance

An implementation strategy is a distinct task or action taken to contribute to achieving the implementation goal<sup>14</sup>. In most instances multiple strategies are incorporated into an overarching implementation plan, to deliver practice change<sup>14</sup>. More than 100 strategies for effective implementation and practice change are reported<sup>12,15,16</sup>, along with multiple methods to select appropriate strategies<sup>17</sup>. Decisions regarding the most appropriate strategies need to be made based on the context in which the intervention is to be implemented<sup>18</sup>, and the barrier, enabler and behaviour it is targeting. There is limited evidence that synthesises the successful strategies for sustainable practice change in the ED<sup>7</sup>. To address this gap in evidence, a synthesis of the most successful frameworks and strategies to use to enable clinician practice change in the ED is needed.

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**Goals of investigation**

The aim of this scoping review is to describe implementation strategies used in EDs, that were effective in supporting sustainable practice change, by answering the following questions:

1. What theories/ models/ frameworks were used to implement practice change in the ED?
2. What implementation strategies have been used in the ED?
3. What implementation strategies are successful in sustained clinical practice change in the ED?

**2. METHODS**

**S2.1 Study design**

A scoping review, guided by Joanna Briggs Institute methodology<sup>19</sup>, was used. Scoping reviews enable the inclusion of a wide range of studies, with varying methodologies, which was required for the purposes of this review<sup>19</sup>. The protocol was not registered; however, a search strategy was developed prior to commencement (Supplementary file 1). The study is reported per the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-SCR)<sup>20</sup>.

**2.2 Eligibility**

Studies were assessed for eligibility per the Population (P), Intervention (I), Outcome (O) and Study characteristics (S) criteria <sup>21</sup>. Eligible studies were original research (S) that included staff working in the ED (P); implementation of a new clinical intervention in the ED, with the strategies for implementation described (I); and outcomes from the intervention greater than six months from implementation (O). Systematic reviews were excluded; but were examined to identify any relevant primary studies. The inclusion/exclusion criteria are available in Table 1.

**Table 1: Eligibility of studies for inclusion per PIOS**

|                              | <b>Inclusion</b>   | <b>Exclusion</b>  |
|------------------------------|--|---|
| <b>Population</b>            | -ED clinician behaviour change   | - Mixed population, i.e. staff external to ED required to implement intervention.<br>- Intervention target patients   |
| <b>Intervention</b>          | - New intervention; AND<br>- Describes evidence informed strategies for implementation/ practice change; OR<br>- Evaluates implementation strategies based on implementation theory. | - Reports a single strategy (e.g. education, check list) where evidence informing development not described.<br>- Investigates other aspects of implementation e.g. barriers or readiness for change. |
| <b>Outcome</b>               | -Evaluates outcomes of the intervention  | - Evaluates staff perceptions<br>- Evaluation $\geq$ 6 months from implementation of the last strategy  |
| <b>Study Characteristics</b> | - Original research<br>- English language  | - Opinion pieces/ grey literature<br>- Systematic literature reviews<br>- No full text available  |

An intervention was defined as a program, policy, practice, process, product, pill or guideline<sup>22</sup>, that was new to the ED. Authors considered a strategy to implement the intervention to be evidence-informed when there was foundational work undertaken to identify barriers, or what behaviours and/or additional factors needed to change, or it was informed based on prior evidence generated in literature. Implementation science and quality improvement studies

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were included as they both require staff to change their behaviour and are relevant in informing strategies to optimise uptake of an intervention<sup>23</sup>.

The review sought to establish strategies for sustainable change. Sustainability in implementation is not consistently defined<sup>24</sup>. Through a synthesis of definitions abstracted from relevant systematic and scoping reviews, Moore et al (2017, page 6) defined sustainability as *'after a defined period of time the program, clinical intervention and/or implementation strategies continue to be delivered and/or individual behaviour change may evolve or adapt while continuing to produce benefits for individuals/ systems'*<sup>25</sup>. Guided by this definition, the authors decided that evaluation of the intervention more than 6-months beyond the commencement of implementation would reflect whether practice change was sustained.

### **2.3 Search Strategy**

A search strategy was developed with university librarians. Five databases were selected to provide a wide range of literature relevant to the search topic from nursing, medical, allied health and behavioural sciences: MEDLINE (1946- current), Scopus (1966- current), Cumulative Index to Nursing and Allied Health Literature (CINAHL, 1937-current), ProQuest central and American Psychological Association (APA) PsycINFO (1806- current).

The search strategy comprised the key concepts, implementation and emergency department, (Table 2), based on PIOS outlined in (Table 1). With an overlap between population and context, it was considered that the target population would be captured within the terms for ED. Truncation and proximity searching were applied where relevant (e.g. Behavior?r change, implementation NEAR/1 strateg\*), and relevant subject headings and Medical Subject Headings (MeSH) were used. It was necessary to use CINAHL headings, rather than MeSH in CINAHL. Terms were checked in each database to ensure relevance, and initial searches informed adjustments and tailoring to the database where required. The search strategy was reviewed by authors KC and SK prior to proceeding. Searches were limited to English; additional limits were applied in ProQuest, for example, scholarly journals, theses. The full

1 search strategy for each database is available in Supplementary File 2. Searches were  
2 completed March 2025.  
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5 **Table 2: Search terms used for each key concept for search strategy**  
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| 8 <b>Key Concepts</b>         | 9 <b>Search terms</b>  |
|-------------------------------|--|
| 10 Implementation             | 11 'Implementation strategy' OR 'Implementation fidelity' OR 'Process<br>12 evaluation' OR 'Behaviour change' OR 'practice change' OR<br>13 'Implementation methods' OR 'knowledge translation'<br>14 <b>MeSH:</b> 'Implementation science' OR 'Quality improvement' OR<br>15 'Evidence- based practice' OR 'Translational Medical Research' |
| 16 Emergency<br>17 Department | 18 'Emergency Department' OR 'Accident & Emergency' OR 'A&E' OR<br>19 'emergency room' OR 'ER' OR 'Emergency ward'<br>20 <b>MeSH:</b> 'Emergency service, Hospital' OR 'Emergency Nursing' OR<br>21 'Emergency Medicine'   |

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25 **2.3.1 Study screening process**  
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27 Data were managed in Covidence, a web-based platform that supports collaboration and  
28 streamlines processes for literature reviews<sup>26</sup>. An accurate audit trail was maintained through  
29 each stage of the review process, tracking any variation on review decisions<sup>26</sup>. Search results  
30 were exported and uploaded directly into Covidence, where duplicates were automatically  
31 removed.  
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34 Title and abstract screening were completed independently per inclusion/ exclusion criteria by  
35 two authors (BK, SK), with records rated as 'Yes' or 'Maybe' included for full text review.  
36 Following initial screening, the same authors independently reviewed full text articles and  
37 applied a rating of 'include' or 'exclude'. Conflicting ratings were resolved through discussion,  
38 and where needed, further discussion and adjudication occurred with a third author (KC).  
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50 **2.3.2 Data extraction**  
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52 Data from included studies were extracted using a purpose-built tool in Covidence<sup>26</sup> including  
53 study information, intervention details, context, methods, implementation framework use,  
54 implementation strategies and outcomes (Table 3). The instrument was piloted, and  
55 adjustments were made in consultation with the research team, for example, including  
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preselected field options instead of free text to improve functionality and analysis of data. One author (BK) extracted data, and extraction was cross-checked for accuracy by a second author (BM). On completion, data were exported to Microsoft Excel™. Quality appraisal was not conducted, as it is not required for a scoping review<sup>19</sup>. However, studies were rated per National Health and Medical Research Council levels of evidence from level I to level IV<sup>21</sup>.

**Table 3: Characteristics and variables extracted from included studies**

| Variable   | Details  |
|--|--|
| <b>General study information</b>   | Author, year published, publication title  |
| <b>Intervention details</b>  | Name and description of the intervention, target clinician to use the intervention, and the aim of the study   |
| <b>Study context</b>   | ED setting reported (i.e. ED type and/or geographical location), number of EDs involved, annual ED presentations   |
| <b>Study methods related to implementation strategy development and outcomes</b> | Evidence that informed the overarching implementation strategy development, including any framework applied to guide development of evaluation. Implementation science frameworks are considered to improve the delivery and outcomes from implementation studies <sup>27</sup> , this was therefore considered relevant as this may contribute to implementing effectiveness.<br><br>The study methods applied to evaluate the outcomes following implementation were also collected, as this was relevant to the outcomes. |

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| <b>Strategies for implementation</b> | Extraction of all activities reportedly undertaken to implement practice change using free text fields. This included the direct activities, for example education or posters, and also any documented activities conducted as part of planning for the implementation. These foundational activities also contribute to implementation effectiveness. |
| <b>Study outcomes</b>                | The results for the primary and secondary study outcomes were collected as a proxy for implementation effectiveness.   |

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### 2.3.2 Data synthesis and analysis

Before analysis, it was necessary to synthesise the strategies used in implementation. This was conducted using Expert Recommendations for Implementing Change (ERIC). ERIC is a compilation of implementation strategies developed iteratively through extensive consultation, evidence review, and validation<sup>12,28</sup>. ERIC comprises 73 strategies and definitions<sup>12</sup>, grouped into nine clusters (for example, there are 11 strategies, such as ‘conduct educational meetings’ and ‘shadow other experts’ grouped to the *Train and educate stakeholders* cluster)<sup>28</sup>. The strategies extracted from the included studies were independently mapped to corresponding ERIC strategies (or cluster where a matching strategy was not obvious) by two authors (BK and SK), who then met to review discrepancies and generate consensus.

Following mapping, data were managed in IBM SPSS Statistics 28.0 for analysis. Further analysis and visualisation were conducted using R (version 4.4.1)<sup>29</sup>, within the RStudio integrated development environment (version 2024.09.0+375)<sup>30</sup>. Plots were generated using the ggplot2 package<sup>31</sup>. Strategies were grouped into the nine conceptually similar clusters<sup>28</sup>, enabling descriptive analyses. In line with recommendations for scoping review, data were reported using descriptive statistics, as counts and percentages, mean and standard deviation<sup>19</sup>. Exploratory inferential statistical analysis was conducted to present a descriptive overview of the included literature, with a sole focus on mapping the breadth and nature of the

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evidence available. Additional data are presented through a narrative summary as recommended per scoping review guidelines<sup>19</sup>.

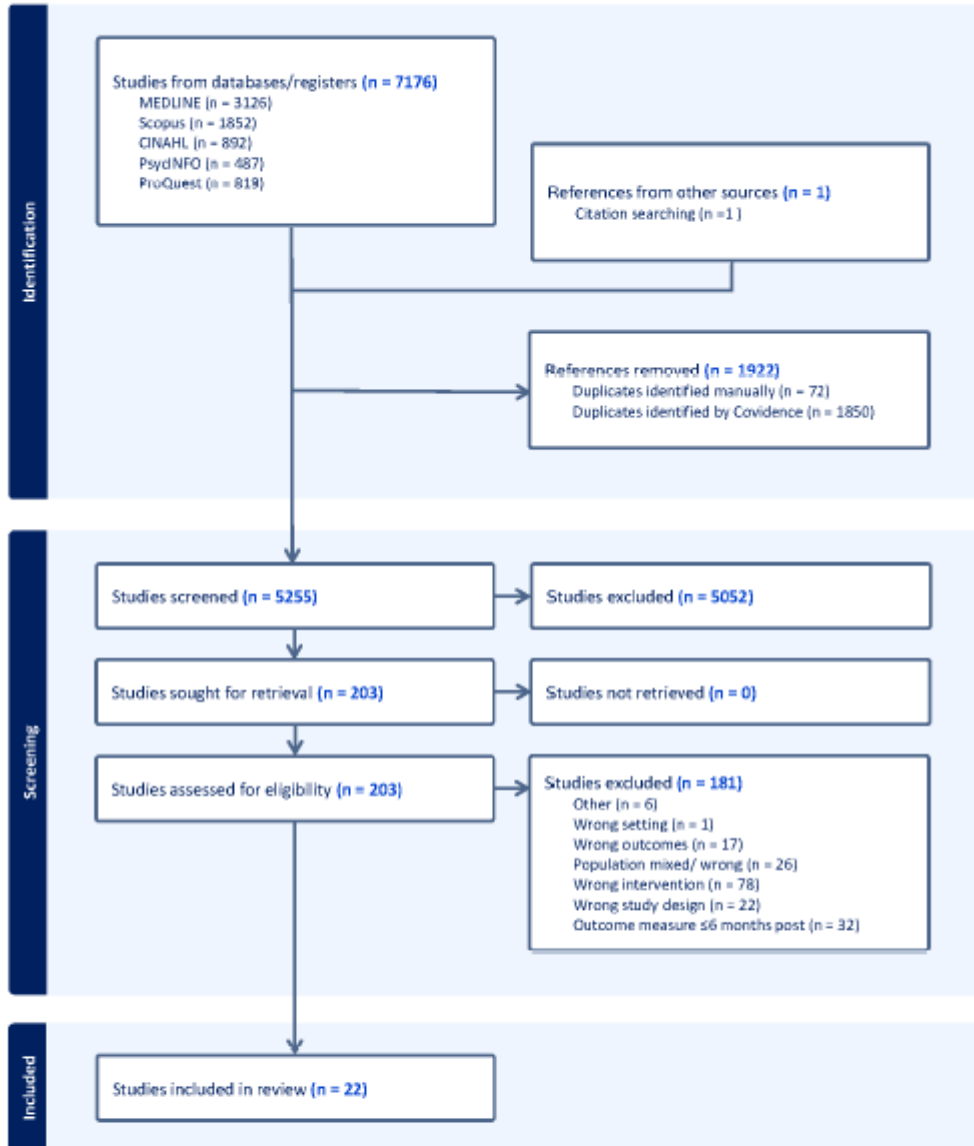
**3. RESULTS**

**3.1 Search results**

There were 7,176 records retrieved from the five databases. Following the removal of 1,922 duplicates, 5,255 records were screened by title and abstract, with a further 5,052 excluded. The main reasons for exclusion were a lack of documented evidence informing implementation strategy design or the primary objective was design of an intervention (n=78), and outcomes were not reported more than six months after implementation (n=32). One additional record was identified through hand searching. Full text review was completed for 203 records, with 22 records reporting on unique studies remaining for full data extraction (Figure 1). A sample of excluded records with reason is provided in Supplementary file 4.

Figure 1: PRISMA diagram, study screening and inclusion

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### 3.2 Characteristics of included studies

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2 Most of the 22 studies were published between 2021 and 2025 (n=15, 68.2%)<sup>19,32-46</sup>. The  
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4 earliest study was published in 2006<sup>47</sup>. Nearly half were conducted in Australia (n=10, 45.5%)  
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6 <sup>32,33,39,42,44-49</sup>, followed by the United States (n=5, 22.7%)<sup>35-38,50</sup>, Canada (n=4, 18.2%)<sup>34,43,51,52</sup>,  
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8 and one each in Ethiopia<sup>40</sup>, Belgium<sup>41</sup> and the United Kingdom<sup>53</sup>.  
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11 Over half were multisite studies (n=13, 59.1%)<sup>33-35,42-49,51,52</sup>, conducted across 2-12 EDs.  
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13 Studies were undertaken in a diverse range of EDs. Four were paediatric facilities <sup>32,36,38,50</sup>,  
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15 and seven were rural or regional <sup>33,42,44,45,47-49</sup>. (Table 4). Nine studies (40.9%) were rated as  
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17 level IV evidence <sup>33,35,37,39,41,42,44,45,53</sup>, followed by level III-3 (n=6, 27.3%) <sup>32,34,36,38,40,50</sup>, level II  
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19 (n=5, 22.7%) <sup>43,46,48,51,52</sup> and level III-2 (n=2, 9.1%) <sup>47,49</sup>. Full study and site characteristics are  
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21 presented in Table 4.  
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25 Interventions primarily encompassed clinical practice guidelines or pathways (n=10, 45.5%),  
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27 related to asthma management<sup>47,49,50</sup>, cardiology<sup>34,43,48</sup>, lower back pain<sup>41,46</sup>, sepsis<sup>40</sup> or  
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29 agitation<sup>38</sup>. Five each related to screening or risk assessment<sup>35,37,39,44,53</sup> and nursing models of  
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31 care<sup>32,33,36,42,45</sup>, and the remaining two were clinical decision rules for imaging <sup>51,52</sup>. Emergency  
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33 staff required to change their practice predominantly comprised nurses (n=17, 77.3%) and  
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35 medical staff (n=13, 59.1%), in isolation or together (Table 4).  
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39 More than three-quarters of the studies (n=18, 81.8%) reported improved outcomes from the  
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41 intervention that was implemented <sup>32-39,41-47,49-51,53</sup> (Table 4). Only four studies<sup>32,39,40,46</sup>  
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43 described how well the implementation was conducted, and three reported fidelity with  
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45 adherence to the intervention being implemented<sup>35,38,52</sup>.  
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Table 4: Included study characteristics and outcomes

| Author (Year); Country        | Aim   | Population <sup>a</sup> / Context/ Methods/ Frameworks  | ERIC Clusters  | Outcomes  | Level of evidence |
|-------------------------------|---|---|--|---|-------------------|
| Abaya (2019)<br>United States | To increase the proportion of ESI 3 or 4 asthma patients discharged within 3 hours of ED arrival by 10%, within the first 3 months. | <b>Population:</b> ED Respiratory therapists<br><b>Context:</b> Children's Hospital/ED, single site, 95,000 annual presentations<br><b>Study Design:</b> Quality Improvement<br><b>Implementation Framework:</b> Nil<br><b>Strategy evidence:</b> Process review and fishbone diagram identified barriers, informed strategies to target barrier to change.                                       | Evaluative iterative strategies<br>Develop stakeholder interrelationships<br>Train and educate stakeholders<br>Support Clinicians<br>Change Infrastructure | - 49% ESI category 3 or 4 patients discharged within 3 hrs (10% shift).<br>- reduction continuous albuterol from 43% to 23%.<br>- ED LoS for discharged patients was not reported.  | Level III-3       |
| Basu (2014)<br>United Kingdom | To improve the detection and quality of care of patients who attend the ED with confirmed or suspected DA                           | <b>Population:</b> Nurses; Medical<br><b>Context:</b> Teaching Hospital, Adult ED, single site<br><b>Study Design:</b> Quality Improvement<br><b>Implementation Framework:</b> Nil<br><b>Strategy evidence:</b> Meetings and collaborative work with community partners, along with senior members of the ED informed initiatives. Evidence of low referral rates and barriers in the literature. | Develop stakeholder interrelationships<br>Train and educate stakeholders<br>Support Clinicians<br>Engage Consumers<br>Change Infrastructure                | - an increase in referrals for DV from one, 12 months before implementation, to 172 referrals over 12 months.<br>- nurses increased confidence and ability to perform DA assessment and greater awareness of DA.  | Level IV          |
| Cabilan (2023)<br>Australia   | To describe the implementation of the digital QOVPRAO in an ED and report on early adoption metrics                                 | <b>Population:</b> Nurses<br><b>Context:</b> Metropolitan Tertiary Referral - Adult, single site, 69,000 annual<br><b>Study Design:</b> NR<br><b>Implementation Framework:</b> Implementation Guide<br><b>Strategy evidence:</b> Literature review identified barriers, and informed strategy selection guided by Implementation guide.   | Develop stakeholder interrelationships<br>Train and educate stakeholders<br>Support Clinicians<br>Engage Consumers<br>Change Infrastructure                | - 88.6% reduction occupational violence incidents in the ED, steady decline during study period.<br>- adherence to the completion of the QOVPRAO increased from 63% during first month to 70% eight months after final strategy.<br>- adherence to assessment within 30 min remained low. | Level IV          |

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| Author (Year); Country      | Aim   | Population <sup>a</sup> / Context/ Methods/ Frameworks   | ERIC Clusters   | Outcomes  | Level of evidence |
|-----------------------------|---|--|---|---|-------------------|
|                             |   |  |   | - > 75% ED nurses completed e-Learning at study conclusion.   |                   |
| Coombs (2021)<br>Australia  | To test the effectiveness of a multifaceted intervention to implement a guideline-based model of care for low back pain in the ED, by reducing harmful practices, improving clinician knowledge and not adversely affecting patient outcomes. | <b>Population:</b> Nurses; Medical; Allied Health<br><b>Context:</b> Metropolitan (3 sites), Rural (1 site)<br><b>Study Design:</b> Step- wedge cluster RCT<br><b>Implementation Framework:</b> Knowledge to Action Framework<br><b>Strategy evidence:</b> Local barrier analysis, Consultation key clinical stakeholders and patients   | Evaluative iterative strategies<br>Adapt and tailor to context<br>Develop stakeholder interrelationships<br>Train and educate stakeholders<br>Support Clinicians<br>Engage Consumers<br>Change Infrastructure | -estimated reduction in the odds of lumbar imaging (OR=0.77, 95%CI: 0.47, 1.26, p=0.29).<br>-12.3% absolute reduction in opioid medication use (OR 0.57, 95%CI: 0.38, 2.35, p=0.006).<br>-improvement in accuracy of clinician beliefs (MD 2.85, 95% CI 1.85, 3.85), and knowledge and attitudes (MD 0.48, 95% CI 0.13, 0.83).<br>- no change in other outcomes | Level II          |
| Curtis (2021a)<br>Australia | To determine if the implementation of HIRAID in the emergency care setting improves patient safety.   | <b>Population:</b> Nurses<br><b>Context:</b> Regional Referral Hospitals, 2 sites, presentations not reported<br><b>Study Design:</b> Quasi-experimental pre - post<br><b>Implementation Framework:</b> Behaviour Change Wheel<br><b>Strategy evidence:</b> Formal assessment (e.g. survey, interviews), determined barriers and enablers to inform strategy selection guided by BCW | Evaluative iterative strategies<br>Develop stakeholder interrelationships<br>Train and educate stakeholders<br>Support Clinicians<br>Change Infrastructure  | - decrease in episodes of deterioration associated with ED care (13.6% reduction, 95%CI:8-5%,18.8%, p<0.001).<br>- reduction in isolated Nurse-related causal factors (21% to 8%), with significant decrease in delays to treatment, diagnosis and escalation of abnormal vital signs.  | Level IV          |

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| Author (Year); Country      | Aim  | Population <sup>a</sup> / Context/ Methods/ Frameworks   | ERIC Clusters  | Outcomes  | Level of evidence |
|-----------------------------|--|--|--|---|-------------------|
| Curtis (2021b)<br>Australia | To describe the process and examine the impact of implementation of a consolidated electronic checklist on the risk screening completion rates for falls, pressure ulcers and substance use in the EDs of a regional health service. | <b>Population:</b> Nurses<br><b>Context:</b> Regional Health Service (4 sites), 161,000 annual presentations combined<br><b>Study Design:</b> Observational pre-post<br><b>Implementation Framework:</b> Theoretical Domains Framework<br><b>Strategy evidence:</b> Framework used to evaluate the implementation strategy | Evaluative iterative strategies<br>Develop stakeholder interrelationships<br>Train and educate stakeholders<br>Support Clinicians<br>Change Infrastructure | - significant increase in overall screening completion (1.4%-5.5%, p<0.001), though remained <50%.<br>- Waterlow and substance use history screening increased, but the falls risk screening decreased.<br>- implementation evaluation identified further intervention functions or behaviour change techniques that could have been used | Level IV          |
| Doherty (2006)<br>Australia | To determine if an evidence-based implementation could lead to the successful implementation of evidence-based care for adult asthma in small rural district hospitals.  | <b>Population:</b> Nurses; Medical<br><b>Context:</b> Rural-Remote Hospital, 8 sites, Annual presentations range 2,000- 8,000 per site<br><b>Study Design:</b> Controlled Trial<br><b>Implementation Framework:</b> Nil<br><b>Strategy evidence:</b> Formal assessment - audit to establish practice gaps, Literature.     | Evaluative iterative strategies<br>Provide interactive assistance<br>Adapt and tailor to context<br>Train and educate stakeholders<br>Support Clinicians   | - significant increase for 3/6 target indicators in asthma management: severity assessment(p<.001), spirometry (p<.001), short-term asthma management plans(p=.039).<br>- increase in use of systemic corticosteroids, (61% v 72%, p=0.255).<br>- improvement in the aggregate of all six indicators (36% v 62%, p<.001).                 | Level III-2       |
| Doherty (2007)<br>Australia | Determine if an evidence-based approach to implementation could successfully lead to the translation of evidence-  | <b>Population:</b> Nurses; Medical<br><b>Context:</b> Rural Referral and District Hospital (2 sites); 15,000 & 37,000 annual presentations<br><b>Study Design:</b> Pre-post intervention trial<br><b>Implementation Framework:</b> Nil   | Evaluative iterative strategies<br>Develop stakeholder interrelationships<br>Train and educate   | - significant change at intervention sites, for all seven clinical indicators at three months after implementation at the intervention site.  | Level III-2       |

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| Author (Year); Country           | Aim   | Population <sup>a</sup> / Context/ Methods/ Frameworks  | ERIC Clusters  | Outcomes   | Level of evidence |
|----------------------------------|---|---|--|--|-------------------|
|                                  | based guidelines for the management of acute asthma into clinical practice in a rural referral ED.  | <b>Strategy evidence:</b> Formal assessment - audit to establish practice gaps, Literature  | stakeholders<br>Support Clinicians   | -aggregate compliance significantly increased (38% to 79%), maintained at 12 months post implementation.   |                   |
| Hoffmann (2023)<br>United States | To standardize care for pediatric acute agitation management in the ED and reduce time in physical restraints.  | <b>Population:</b> Nurses; Medical<br><b>Context:</b> Academic Children's Hospital, single site, presentation not reported<br><b>Study Design:</b> Quality Improvement<br><b>Implementation Framework:</b> PDSA<br><b>Strategy evidence:</b> Process key driver diagram identified barriers and informed aims | Evaluative iterative strategies<br>Adapt and tailor to context<br>Develop stakeholder interrelationships<br>Train and educate stakeholders<br>Engage Consumers<br>Change Infrastructure  | - 59% reduction in mean time in physical restraints, from 173 minutes to 71 minutes<br>-with increased use of medication in the management of agitation.<br>- four established process measures: the first line medication choice for agitation, personalised care plans, and order set use increased.<br>- no change in intramuscular medication use as first-line treatment. | Level III-3       |
| Kennedy (2024)<br>Australia      | To determine if the implementation of HIRAIID, a structured framework for initial assessment and management post-triage, improved the accuracy of nurses' documentation across a large rural health district in Australia | <b>Population:</b> Nurses<br><b>Context:</b> Rural-Regional Hospital, 10 sites, 110,000 combined presentations<br><b>Study Design:</b> Quasi-experimental pre-post<br><b>Implementation Framework:</b> Behaviour change<br><b>Strategy evidence:</b> Not detailed   | Evaluative iterative strategies<br>Develop stakeholder interrelationships<br>Train and educate stakeholders<br>Engage Consumers<br>Utilize financial strategies<br>Change Infrastructure | - improved documented quantity of essential elements, mean (SD) 1.8 (0.6) to 2.6 (0.7), p<0.001.<br>- improved documented quality of nursing documentation, mean (SD) 1.6(0.5) to 2.2(0.6), p<0.001  | Level IV          |

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| Author (Year); Country         | Aim   | Population <sup>9</sup> / Context/ Methods/ Frameworks   | ERIC Clusters  | Outcomes  | Level of evidence |
|--------------------------------|---|--|--|---|-------------------|
| Kinsman (2012)<br>Australia    | To determine whether a five step multifaceted implementation process of CPWs for STEMIs improved the proportion of eligible patients receiving a thrombolytic drug and reduced door-to needle and ECG times in rural Victorian EDs                        | <b>Population:</b> Nurses; Medical<br><b>Context:</b> Rural Hospital, 6 sites, Annual presentation range 14,000- 45,000 per site<br><b>Study Design:</b> Clustered RCT<br><b>Implementation Framework:</b> Nil<br><b>Strategy evidence:</b> Evidence based proposals for implementation from the literature. | Evaluative iterative strategies<br>Adapt and tailor to context<br>Train and educate stakeholders<br>Support Clinicians                                     | - no change in primary and secondary outcomes between intervention or control groups (audit 108 records). Findings were attributed to a potential ceiling effect with baseline results already close to or within the target.           | Level II          |
| Kramer (2024)<br>United States | To implement a nurse-driven system for administering oral dexamethasone at triage, to reduce the time from ED arrival to dexamethasone administration from 60 to 30 minutes over 6 months in patients aged 2-18 years presenting with asthma exacerbation | <b>Population:</b> Nurses<br><b>Context:</b> Tertiary Paediatric ED, single site, 100,000 presentations<br><b>Study Design:</b> Quality Improvement<br><b>Implementation Framework:</b> PDSA<br><b>Strategy evidence:</b> ED QI team determined the project's key drivers, informing interventions           | Evaluative iterative strategies<br>Develop stakeholder interrelationships<br>Train and educate stakeholders<br>Support Clinicians<br>Change Infrastructure | - 21 minutes reduction in mean time to dexamethasone administration.<br>- no change in asthma patient admission rates (ED LoS impacted by COVID-19, increase in LoS for all ED presentations).<br>- level of significance not reported. | Level III-3       |

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| Author (Year); Country                     | Aim   | Population <sup>a</sup> / Context/ Methods/ Frameworks   | ERIC Clusters  | Outcomes   | Level of evidence |
|--|---|--|--|--|-------------------|
| Lawrence J., et al (2024)<br>United States | To establish the Brøset Violence Checklist as a patient screening tool in 11 adult ED's, with the aim to reduce the rate of workplace violence compared to the previous year. | <b>Population:</b> Nurses<br><b>Context:</b> Metropolitan urban, and suburban facilities, 11 sites, 474,000 combined annual presentation<br><b>Study Design:</b> Pre-post study design<br><b>Implementation Framework:</b> Ten step implementation science toolkit; Tailored Implementation for Chronic Diseases (TICD) framework<br><b>Strategy evidence:</b> TCID Assess determinants- Formal assessment (e.g. survey, interviews) | Evaluative iterative strategies<br>Develop stakeholder interrelationships<br>Train and educate stakeholders<br>Change Infrastructure   | - 22% reduction in workplace violence rate the year following implementation.<br>- seven out of the nine months monitored were less than rates prior to implementation.<br>- increased BVC completion rate (fidelity) from 73% at the start of implementation to 90%.<br>-reassessment rates within one hour when indicated were poor (1.4-3.4%) | Level IV          |
| Munroe B., et al (2021)<br>Australia       | To determine if the use of the structured emergency Nurses framework 'HIRAID' improved the accuracy of emergency nurses' documentation.                                       | <b>Population:</b> Nurses<br><b>Context:</b> Rural site, 14,000 annual presentations; Regional, 2 sites, 32,000 & 42,000 annual presentations<br><b>Study Design:</b> Quasi experimental pre-post study<br><b>Implementation Framework:</b> Behaviour Change Wheel<br><b>Strategy evidence:</b> Guided by framework  | Evaluative iterative strategies<br>Develop stakeholder interrelationships<br>Train and educate stakeholders<br>Support Clinicians<br>Change Infrastructure                     | - significant improvement in quantity of information recorded in nursing documentation from 5% to 80%, p<0.00.<br>- 90% uptake of the HIRAID documentation template.   | Level IV          |
| Peters S., et al. (2022)<br>Belgium        | To describe the process from protocol development to the iterative implementation approach and explore how it has influenced practice.  | <b>Population:</b> Nurses; Medical<br><b>Context:</b> Tertiary Hospital, single site, presentations not reported<br><b>Study Design:</b> No reported<br><b>Implementation Framework:</b> Knowledge to Action Framework (modified)<br><b>Strategy evidence:</b> Literature review; Informal assessment  | Evaluative iterative strategies<br>Develop stakeholder interrelationships<br>Train and educate stakeholders<br>Support Clinicians<br>Engage Consumers<br>Change Infrastructure | - reduction in x-ray imaging (28.6% v 12.7%)<br>-reduction in CT imaging (27.7% v 14.6%) of the lumbar spine.<br>- Imaging rates were continuously monitored from 2015 to 2020.  | Level IV          |

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| Author (Year); Country               | Aim   | Population <sup>a</sup> / Context/ Methods/ Frameworks  | ERIC Clusters   | Outcomes   | Level of evidence |
|--------------------------------------|---|---|---|--|-------------------|
| Puchalski Ritchie (2022)<br>Ethiopia | To address an identified gap in sepsis care, through development and evaluation of a sepsis treatment protocol tailored to the Tikur Anbessa Specialized Hospital ED.   | <b>Population:</b> Nurses; Medical; all ED staff<br><b>Context:</b> Academic Referral Hospital, single site, 20,000 annual presentations<br><b>Study Design:</b> Concurrent nested mixed methods design<br><b>Implementation Framework:</b> CFIR; COM-B; Knowledge to Action Framework; Theoretical Domains Framework<br><b>Strategy evidence:</b> Frameworks informed different stages | Evaluative iterative strategies<br>Adapt and tailor to context<br>Develop stakeholder interrelationships<br>Train and educate stakeholders<br>Support Clinicians  | - proportion of patients receiving appropriate sepsis care could not be reported due poor data quality at the study sites.<br>-no improvement in the 72-hour or 90-day survival for patients diagnosed with sepsis.<br>-no reported change in health professional knowledge. | Level III-3       |
| Southerland (2023)<br>United States  | No explicit aim documented. The processes and outcomes of implementation of geriatric screening in a large academic ED were reported, along with lessons learned from implementation in a stressed ED system. | <b>Population:</b> Nurses; Medical<br><b>Context:</b> Tertiary Referral Hospital, single site, 82,000 annual presentations<br><b>Study Design:</b> Implementation study<br><b>Implementation Framework:</b> CFIR; Lean Six Sigma<br><b>Strategy evidence:</b> Assessment guided by framework, Formal assessment (e.g. survey, interviews)   | Evaluative iterative strategies<br>Adapt and tailor to context<br>Develop stakeholder interrelationships<br>Train and educate stakeholders<br>Support Clinicians<br>Engage Consumers<br>Utilize financial strategies<br>Change Infrastructure | - increased geriatric screening from 5% to 68% over a 24-month period with a consistent upward trajectory, except for two periods of increased COVID demand.   | Level IV          |

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| Author (Year); Country  | Aim  | Population <sup>a</sup> / Context/ Methods/ Frameworks  | ERIC Clusters  | Outcomes  | Level of evidence |
|-------------------------|--|---|--|---|-------------------|
| Stiell (2009)<br>Canada | To evaluate the effectiveness of an active strategy to implement the Canadian C-Spine Rule in multiple EDs   | <b>Population:</b> Medical<br><b>Context:</b> Teaching, 6 sites; Community, 6 sites. Annual presentations not reported<br><b>Study Design:</b> Matched Pair Cluster RCT<br><b>Implementation Framework:</b> Nil<br><b>Strategy evidence:</b> Literature review and knowledge transfer expert consultation | Develop stakeholder interrelationships<br>Train and educate stakeholders<br>Engage Consumers<br>Utilize financial strategies<br>Change Infrastructure            | -12.8% reduction in C-spine imaging rates at intervention hospitals (95%CI:9.2%,16.3%)<br>-12.5% increase at control hospitals, (95%CI: 7.2%,18.2%).<br>-change imaging rates between intervention and control hospitals was significant (p<0.001).<br>- further reduction in imaging after 12 months (53.3% to 53.1%). | Level II          |
| Stiell (2010)<br>Canada | To evaluate the effectiveness and safety of an active strategy to implement the Canadian CT Head Rule at multiple EDs.   | <b>Population:</b> Medical<br><b>Context:</b> Teaching, 6 sites; Community, 6 sites. Annual presentations not reported<br><b>Study Design:</b> Matched Pair Cluster RCT<br><b>Implementation Framework:</b> Nil<br><b>Strategy evidence:</b> Current evidence and knowledge transfer expert consultation  | Develop stakeholder interrelationships<br>Train and educate stakeholders<br>Engage Consumers<br>Utilize financial strategies<br>Change Infrastructure            | - no demonstrated impact on head CT imaging rates with the implementation of the Canadian CT head Rule.<br>- an increase in CT imaging rates for minor head injuries across all groups was reported.  | Level II          |
| Stiell (2021)<br>Canada | No explicit aim. We sought to improve the care of patients with acute AF/ AFL by implementing the principles of the CAEP Checklist at multiple community and academic hospital ED's across Canada. | <b>Population:</b> Medical<br><b>Context:</b> Academic -Teaching, 7 sites; Community, 4 sites<br><b>Study Design:</b> Step- wedge cluster RCT<br><b>Implementation Framework:</b> Theoretical Domains Framework<br><b>Strategy evidence:</b> Barriers and enablers and previous experience                | Evaluative iterative strategies<br>Adapt and tailor to context<br>Develop stakeholder interrelationships<br>Train and educate stakeholders<br>Support Clinicians | -21% reduction in LoS in the intervention group (95%CI: -0.34,-0.06)<br>-increase use of rhythm control in ED 66.9% to 85.1% (OR 4.5, 95%CI:1.8,11.6).<br>- decrease in cardiology consultations in ED (50% to 40.3%, OR 0.5, 95%CI: 0.2, 1.0).   | Level II          |

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| Author (Year); Country       | Aim   | Population <sup>a</sup> / Context/ Methods/ Frameworks  | ERIC Clusters   | Outcomes  | Level of evidence |
|------------------------------|---|---|---|---|-------------------|
| Stiell (2024)<br>Canada      | To improve the quality and safety of the immediate and subsequent care of patients seen in the ED with acute AF and AFL. Primarily to decrease unsafe and suboptimal ED treatments, increase best practices performance indicators, and decrease the time to being seen at cardiology clinics | <b>Population:</b> Medical<br><b>Context:</b> Major Academic Health Sciences Centre, Regional Tertiary Care Centre; 180,000 combined annual presentations<br><b>Study Design:</b> Cohort study<br><b>Implementation Framework:</b> Nil<br><b>Strategy evidence:</b> Strategies to support adoption informed by barrier/ enabler assessment and previous implementation experience | Evaluative iterative strategies<br>Adapt and tailor to context<br>Develop stakeholder interrelationships<br>Train and educate stakeholders<br>Support Clinicians<br>Engage Consumers    | -insufficient cases to evaluate unsafe care for the management of AF/AFL, smaller than anticipated sample size limited evaluation.<br>- increase in attempts at chemical or electrical cardioversion, and similar proportions were discharged home on oral anticoagulants.  | Level III-3       |
| Williams (2025)<br>Australia | To evaluate the impact of a participatory and action-oriented implementation design, underpinned by i-PARIHS, on implementation outcomes for optimising the processes of pain care in a major paediatric ED   | <b>Population:</b> Nurses<br><b>Context:</b> Paediatric ED; 73,000 annual presentations<br><b>Study Design:</b> Hybrid type 3 implementation effectiveness<br><b>Implementation Framework:</b> i-PARIHS<br><b>Strategy evidence:</b>  | Evaluative iterative strategies<br>Provide interactive assistance<br>Develop stakeholder interrelationships<br>Train and educate stakeholders<br>Support Clinicians<br>Engage Consumers | -58% increase in nurse-initiated analgesia (RR 1.581, 95%CI: 1.350,1.852)<br>-adjusting for age and clinical urgency, time to analgesia increased by 66% (RR1.661, 95%CI: 1.483, 1.860).<br>- 170 % increase in nurse-initiated opioid analgesia (RR 2.702, 95%CI: 1.801, 4.075)<br>-46% increase in pain assessment at triage (RR 1.463, 95%CI: 1.339,1.598) | Level III-3       |

Note: AF: atrial fibrillation; AFL: atrial flutter; ESI: emergency severity index; (CAEP)Canadian Association of Emergency Physicians Acute AF/ AFL Best Practices Checklist; CPW: clinical pathway; DA: domestic abuse; DV: domestic violence; ECG: electrocardiogram; PDSA: plan-do-study-act; QOVPRAO: Queensland occupational violence patient risk assessment tool; STEMI:ST-elevation myocardial infarction .

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### 3.3 Implementation strategy development

The use of a framework to implement the intervention was reported in 14 studies (63.6%)<sup>32,33,35-46</sup>. Eight different frameworks were used. Two-thirds (n=12,66.7%) of studies that used a framework reported meaningful change in practice, or achieving study outcome<sup>32,33,35-39,41-45</sup>.

Frameworks were primarily used in the planning for and/ or guiding implementation, although in one study it was used to evaluate the implementation strategy<sup>44</sup>. Of the eight frameworks used, the most common was the Behaviour Change Wheel (BCW) (n=4<sup>33,40,42,45</sup>), followed by Theoretical Domains Framework (TDF) (n=3<sup>40,43,44</sup>), Knowledge to Action Framework (n=3<sup>40,41,46</sup>), and Consolidated Framework for Implementation Research (CFIR) (n=2<sup>37,40</sup>), and Plan-do-study-act (PDSA) (n=2<sup>36,38</sup>) (Table 4). For studies with no framework, the implementation strategy was informed by literature<sup>47,48,51,52</sup>, process reviews<sup>36,38,50</sup>, surveys<sup>34,49</sup>, or stakeholder consultation<sup>53</sup> (Table 4).

Two thirds of studies reported that assessment of barriers and enablers was conducted prior to implementation (n=15, 68.2%<sup>32,34-38,40,41,43,45-50</sup>), although less than half (n=7,46.7%) reported those barriers or enablers<sup>35-38,40,41,50</sup>.

### 3.4 Strategies used for implementation in ED

Overall, the mean (SD) number of strategies used was 10.9 (3.7). In the 18 successful studies, the mean (SD) number of strategies was 11.06 (3.5). These strategies mapped to 42/73 discrete ERIC strategies, with all clusters represented. In six studies there was a strategy that could not be mapped to a distinct ERIC strategy but were mapped to a cluster Supplementary file 4. Most studies (n=15,83.3%) reported between 6 and 13 ERIC strategies. Studies that applied an implementation science framework in designing for implementation (n=13) reported on average, around five more ERIC strategies than those that did not (12.8 vs 7.8).

The most used ERIC clusters in implementation were: *Train and educate stakeholders* (100%), *Develop stakeholder relationships* (91%), *Support clinicians* (86%) and *Evaluative iterative strategies* (82%) (Table 5). Where a framework was used, more studies used

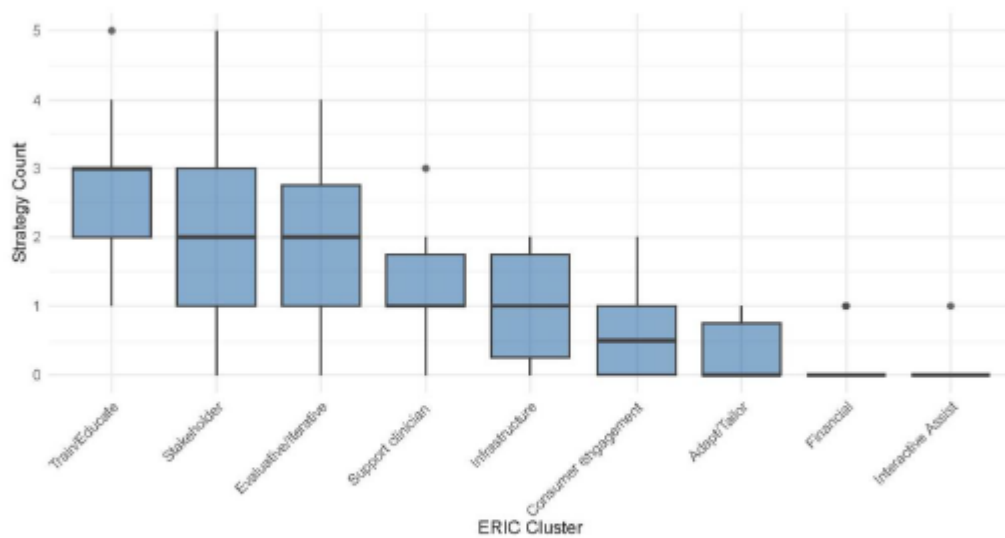
1 strategies from the *evaluative and iterative strategies* cluster (n=11, 91.7%) and the *Change*  
 2 *infrastructure* (n=10, 83.3%) clusters. For the studies that were successful, there was evident  
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 4 variability in the number of strategies used within each cluster (Figure 2).  
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7 **Table 5: Number of studies with strategies used mapped to each ERIC cluster**  
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| ERIC Cluster <sup>a</sup><br>(strategies used/ no. within cluster) | Number of studies using strategies in cluster |                             |                              |
|--|---|-----------------------------|------------------------------|
|  | Overall<br>n=22<br>n (%)                      | Successful<br>n=18<br>n (%) | Unsuccessful<br>n=4<br>n (%) |
|  | Train and educate stakeholders (7/11)         | 22 (100%)                   | 18 (100%)                    |
| Develop stakeholder interrelationships (12/17)                     | 20 (91%)                                      | 17 (94%)                    | 3 (75%)                      |
| Support clinicians (4/5)   | 19 (86%)                                      | 15 (83%)                    | 4 (100%)                     |
| Evaluative / Iterative strategies (10/10)                          | 18 (82%)                                      | 15 (83%)                    | 3 (75%)                      |
| Change infrastructure (3/8)  | 15 (68%)                                      | 13 (72%)                    | 2 (50%)                      |
| Engage consumers (4/5)   | 11 (50%)                                      | 9 (50%)                     | 2 (50%)                      |
| Adapt/ Tailor to context (2/4)                                     | 8 (36%)                                       | 5 (30%)                     | 3 (75%)                      |
| Financial structures (1/9)   | 2 (9%)  | 2 (11%)                     | -                            |
| Provide interactive assistance (1/4)                               | 1 (5%)  | 1(6%)                       | -                            |

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Figure 2: Distribution of ERIC Strategy counts by cluster for successful studies (n=18)

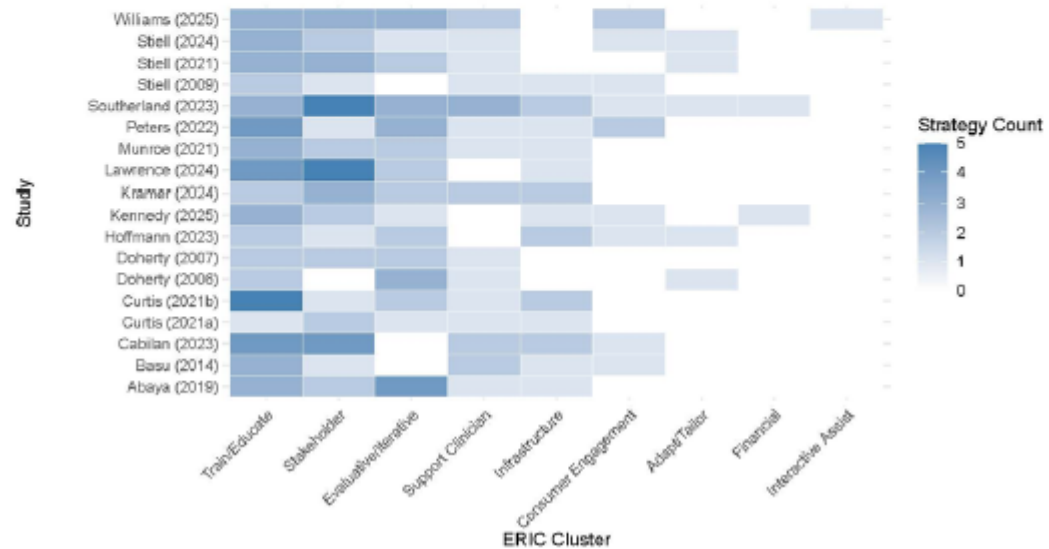


All studies used at least one strategy from the *Train and educate* cluster (Figure 1). ‘Conduct educational meetings’ was the most used ERIC strategy (n=16, 89%), followed by ‘reminders for clinicians’ (n=13, 72.2%). Further, strategies from the *Stakeholder interrelationships* cluster were used in most successful studies (n=17, 94.4%) (Table 5). There were 10/17 strategies used from this cluster in these studies, reflecting a wide selection of strategies. The most used strategy was ‘identify and prepare champions’ in half of studies (n=9, 50.0%), followed by ‘inform local opinion leaders’ in a third of studies (n=6, 33.3%). One, or both strategies were used in two-thirds of these studies (n=12, 66.7%). A detailed overview of the frequency of ERIC strategy use in the included studies is presented in Supplementary file 4.

Two clusters, *Support clinician* and *Evaluative iterative strategies*, were equally important and used in more than 80% (n=15) of successful studies (Table 5). Similarly, in the *Support clinicians* cluster 4 of 5 strategies were used across a range of studies. Specifically, ‘clinician reminders’ were used in over three-quarters (n=17, 77.3%) of successful studies. This was the second most common ERIC strategy after ‘conduct educational meetings’. Of the *Evaluative iterative* cluster, the most used strategies were ‘assess for readiness’ and ‘identify

barriers and enablers' (n=11, 61.1%). Strategies from the *Interactive assistance* and *Financial* clusters were rarely used. Figure 3 illustrates the frequency of strategies used within ERIC clusters for the successful studies.

**Figure 3: Heatmap of ERIC strategies within each cluster by study for successful studies**



a: Curtis, Munroe, et al<sup>45</sup>; b: Curtis, Quian, et al<sup>44</sup>

#### 4. LIMITATIONS

The number of eligible studies was small, limiting analysis. The number of strategies used was likely under-reported as the foci of reporting was outcome of the intervention, rather than the implementation of the intervention. Classification to ERIC strategies relied on the level of detail provided, which varied. Further, few studies reported fidelity of the implementation, that is, the degree to which the strategies were used as intended<sup>32,39,40</sup> which limited the ability to determine whether the reported outcomes were associated with implementation effectiveness.

There were methodological issues that impacted the effectiveness and reporting of outcomes for the unsuccessful studies. For example, in one study due to poor documentation the required data elements to evaluate care delivery were not consistently reported<sup>40</sup>. This

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highlights the importance of planning the mechanisms to collect data for evaluation prior to commencing implementation. Given the heterogeneity of study designs, populations, and outcome measures, these results should be interpreted with caution and are not intended to provide conclusive evidence or to replace a formal meta-analysis (which is not possible with the available evidence).

**5. DISCUSSION**

The use of an implementation framework, alongside a variety of strategies contributed to sustained implementation of clinician practice change in the ED. Studies reporting sustained implementation of practice change most often used a combination of strategies from the; *Train and educate stakeholders; Develop stakeholder interrelationships; Evaluative and iterative strategies and Support clinician clusters.*

Most studies used an implementation framework and appeared to have a higher rate of success. However, the sample was not large enough to definitively recommend which implementation science framework is best suited to the ED. We recommend increased testing to establish the most appropriate frameworks and strategies to effectively deliver practice change in the emergency context and reduce the burden on clinicians attempting to introduce change. As highlighted by a 2020 survey of health researchers where less than 50% reported involvement in implementation research in the previous five years, with barriers to application including lack of skills and training, poorly defined methods, and competing interests and priorities<sup>54</sup>.

There is debate around the number of strategies for effective change, with some researchers proposing that the use of fewer strategies is more effective<sup>55</sup>. This review suggests that it is not the number of strategies, but the variety of strategies that increases sustained change. Strategies from the *Train and educate stakeholders, Development of stakeholder relationships, Evaluative and iterative and Support clinician clusters* were used most frequently in the successful studies. 'Conduct educational meetings' being identified as the

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most common strategy is not dissimilar to previous reviews<sup>56,57</sup>. However, on their own education session are known to have small effect when targeting professional behaviour change<sup>58</sup>. Rather, strategies should link to identified barriers or enablers to implementation, to ensure purposeful application<sup>18</sup>, suited to the emergency context. Of the 36% of studies that reported barriers, a link between barriers and the selected strategies was presented through key driver diagrams, logic models<sup>35,36,38</sup>, or mapped using an implementation framework<sup>37</sup>. Strategies for implementation need to suit the emergency context, ensuring barriers to change are addressed and potential enablers are fully capitalised<sup>59</sup>.

Long-term evaluation is considered to be two to five years following implementation<sup>60</sup>, yet only four studies were evaluated beyond twelve months<sup>40,42,45,50</sup>. The time frame for evaluation of study outcomes may well impact the intervention's reported effectiveness on patient outcomes. A consensus definition of sustainable practice change would enable integration of such sustainability measures into policy, key performance indicators and reporting. This would also place the onus on sustainment of the intervention on the organisation, perhaps by ensuring ongoing evaluation systems are instigated during implementation to enable sustained change that supports clinicians and departmental managers. Ongoing monitoring of key outcomes would further inform the value of implementation strategies and those required for long term sustainable change. This could enable longer-term evaluation that is not resource intensive and increased evidence for what does and does not work in the ED.

The use of ERIC in this review to provide consistency in reporting strategies highlighted challenges with the application of ERIC in the emergency context, highlighting a need for additional strategies, or expansion of existing definitions<sup>61,62</sup>. ERIC terminology aligns more with the delivery of interventions within public health contexts, as opposed to individuals working in a clinical setting. Contextually inappropriate terms can lead to strategies being misinterpreted when applying them to implementation directed at clinicians in the acute clinical setting<sup>37</sup>. Implementation strategies also require mechanisms to link to the barriers and enablers being targeted, which is not straightforward with ERIC<sup>63</sup>. Other frameworks such as



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## **2.2 Conclusion**

In this chapter the findings of the scoping review of the literature on implementation strategies that can lead to sustainable practice change in the ED was presented. Although a range of strategies were identified, strategies that are known to be effective in the ED are lacking. The review highlighted inadequacies in the terminology and definitions related to the application of ERIC strategies when implementing interventions at the department level. The use of an implementation framework and a variety of strategies supported effective and sustainable implementation of interventions where clinicians are required to change practice in the ED. High-quality implementation studies, with longer-term evaluation, are necessary to determine if specific strategies are more effective.

The theoretical frameworks used in the design and evaluation of the HIRAIID implementation will be described in Chapter 3.

## Chapter 3: Theoretical Frameworks

The philosophical and theoretical frameworks that underpinned the design and evaluation of the HIRAID implementation strategy in a large rural LHD are presented in this chapter. The philosophical approach of pragmatism and its relevance to both implementation science in general and the research presented in this thesis specifically is discussed. A detailed overview of the implementation science frameworks—TDF, BCW and RE-AIM—used to guide the design and evaluation of an evidence-based implementation strategy for HIRAID in southern NSW is provided.

### 3.1 Research Paradigm: Pragmatism

A research paradigm refers to the beliefs that guide the researcher and underpin the research process (Creswell, 2015; Kaushik & Walsh, 2019). It is a conceptual tool used in the research process and influences all aspects of the research, including the aim, the chosen methods and the interpretation of study findings (Kaushik & Walsh, 2019).

Pragmatism is one such paradigm. The term ‘pragmatism’ has its origins in the Greek *pragma*, meaning ‘action’ or ‘affair’. Implementation studies are inherently pragmatic given that they focus on the practical, real-world implementation of a change in policy, practice or action (Hull et al., 2022; Ramanadhan et al., 2021). Therefore, the pragmatism paradigm was used to underpin this work, providing the necessary flexibility for the design of the overarching study (Morgan, 2014).

From a philosophical perspective, pragmatism is defined as seeking to understand practical consequences (Oxford English Dictionary, n.d.). Therefore, in pragmatic research, evaluations are based on the appropriateness or usefulness of an intervention. Pragmatists seek to understand the practical consequences of actions or processes and how they work in the real world (Doane & Varcoe, 2005; Ormerod, 2006). From a nursing research perspective, pragmatism may be used to align research findings with what is occurring in clinical practice (Dolan et al., 2022).

Pragmatism recognises that understanding what works in the real world cannot necessarily be done using a single approach (Dolan et al., 2022). Therefore, it permits the use of the most appropriate method, whether qualitative, quantitative or mixed, to answer a research question (Kaushik & Walsh, 2019).

## 3.2 Theoretical Framework

The effective translation of evidence into practice can be hindered by the social and environmental context and individual behaviour. Therefore, a theoretical approach may be used to support the development of an implementation strategy that can effectively translate evidence into practice by addressing contextual and behavioural barriers (Lynch et al., 2018; E. Proctor et al., 2011). Many theoretical frameworks have been developed for implementation science (Lynch et al., 2018; Nilsen, 2015) that may improve implementation outcomes (Bauer & Kirchner, 2020).

The terms 'theory', 'model' and 'framework' are often used interchangeably; however, they have distinct differences in meaning. A *theory* proposes a causal relationship between two variables or a hypothesis on how an implementation activity may work. A *model* provides a simplified non-explanatory description of a concept. A *framework* provides the basic structure or categories of a specific concept and describes observable and measurable events (Lynch et al., 2018; Nilsen, 2015).

Nilsen (2015) categorised implementation science theories, models and frameworks into five groups: (i) *process models* describe the process of planning and delivery to translate evidence into practice; (ii) *implementation theories* are theories that have been adapted or developed by implementation scientists to explain aspects of implementation; (iii) *classic theories* may also be used to explain aspects of implementation but derive from other disciplines; (iv) *determinant frameworks* describe the factors influencing implementation; and (v) *evaluation frameworks* outline the key areas to assess the effectiveness of an implemented intervention. Nilsen (2015) also categorises the theoretical frameworks used in implementation science into three groups according to their aim: (i) to describe or guide the process of translating evidence into practice; (ii) to understand or explain what influences implementation outcomes (i.e. how and why change occurs); and (iii) to evaluate the implementation (see Figure 3.1).

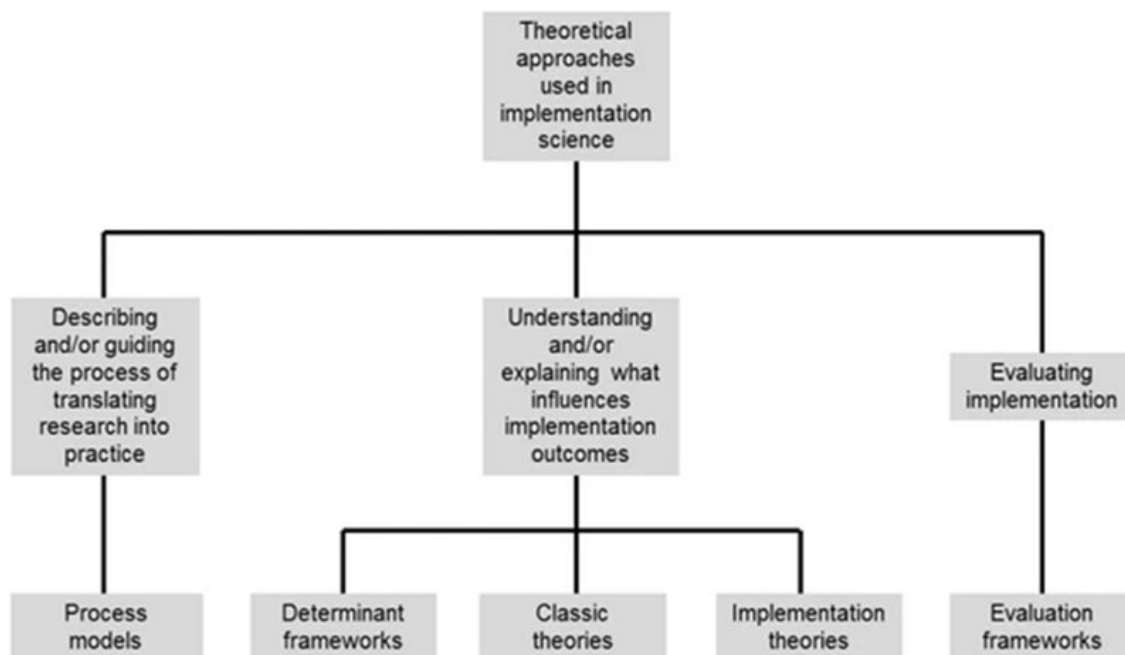


Figure 3.1. Aims of the theoretical approaches used in implementation science and five categories of theories, models and frameworks.

*Note.* Reproduced from ‘Making Sense of Implementation Theories, Models and Frameworks’, by P. Nilsen, 2015, *Implementation Science*, 10, Article 53, p. 4 (<https://doi.org/10.1186/s13012-015-0242-0>). Copyright 2015 by P. Nilsen.

Implementation science requires multilevel involvement and support to plan, implement and evaluate outcomes. An appropriate theoretical framework helps to support the processes and decisions made throughout the implementation and enhance the translation of evidence into practice (Davis et al., 2015). A range of theories, models and frameworks are commonly used in a single project (Moullin et al., 2020) to adequately fulfil each stage. The present research involved the combination of a determinant framework (TDF), a process model (BCW) and an evaluation framework (RE-AIM) to address the specific aims and objectives of this research: to develop a strategy for the implementation of an EBI and evaluate its effectiveness (see Figure 3.2).

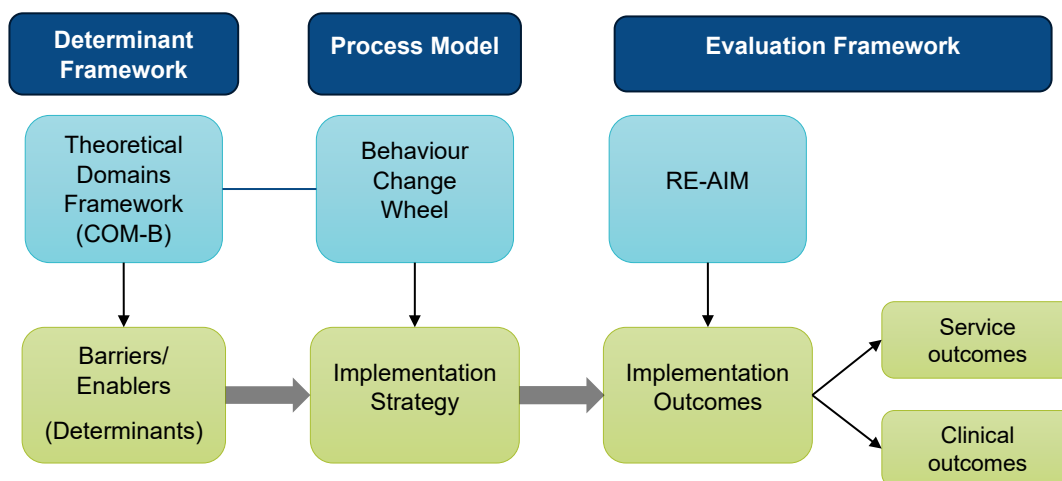


Figure 3.2. Frameworks underpinning the implementation and evaluation of HIRAID in the Southern New South Wales Local Health District.

Note. COM-B: capability, opportunity, motivation—behaviour; HIRAID: history, infection risk, red flags, assessment, interventions, diagnostics; RE-AIM: reach, effectiveness, adoption, implementation quality, maintenance.

### 3.2.1 Determinant Framework: Theoretical Domains Framework

Determinant frameworks outline the determinants (i.e. the enablers and barriers) of implementation outcomes. While they cannot establish a causal relationship, they may be used to inform the strategies employed to address the relevant determinants (Nilsen, 2015).

Human behaviour is a key determinant of whether an EBI is put into practice because this requires individuals to do things differently (Davis et al., 2015; Michie et al., 2014). Psychological theories are important for understanding the change in behaviour required to successfully implement an EBI. To simplify the psychological theories relevant to behavioural change, three expert groups comprising health psychology theorists, health services researchers and health psychologists used a consensus approach to identify 12 domains that may be used to explain behavioural change (Michie et al., 2005). The TDF is a validated framework that synthesises 128 constructs from 33 behavioural change theories (Cane et al., 2012; Michie et al., 2014). It offers a guide for researchers to consider the cognitive, social, emotional and environmental influences on human behaviour and is commonly used to identify the enablers and barriers influencing the implementation of an EBI in a specific context (Atkins et al., 2017). Further refinement and validation of the

TDF led to the identification of 14 domains that influence whether an individual engages in a specific behaviour (Atkins et al., 2017; Cane et al., 2012) (see Table 3.1).

Table 3.1. Domains of the Theoretical Domains Framework

| Domain                                   | Definition   |
|--|--|
| Knowledge                                | Awareness of the existence of something  |
| Skills                                   | Ability or proficiency acquired through practice   |
| Memory, attention and decision processes | The ability to retain information, focus selectively on aspects of the environment and choose between two or more alternatives   |
| Behavioural regulation                   | Anything aimed at managing or changing directly observed actions   |
| Social/professional role and identity    | A coherent set of behaviours and personal qualities of an individual in a social or work setting   |
| Beliefs about capabilities               | Acceptance of the truth, reality or validity about an ability, talent or facility that an individual can put to constructive use   |
| Optimism                                 | Confidence that things will happen for the better or desired goals will be attained  |
| Belief about consequences                | Acceptance of the truth, reality or validity about the outcomes of a behaviour in a given situation  |
| Intentions                               | A conscious decision to perform a behaviour or act in a certain way  |
| Goals                                    | Mental representations of outcomes that an individual wants to achieve   |
| Reinforcement                            | Increasing the probability of a response by arranging a dependent relationship or contingency between the response and a given stimulus  |
| Emotion                                  | A complex reaction pattern involving experiential, behavioural and physiological elements by which the individual attempts to deal with a personally significant matter or event       |
| Environmental context and resources      | Characteristics of an individual's context or environment that discourage or encourage the development of skills and abilities, independence, social competence and adaptive behaviour |
| Social influences                        | Interpersonal processes that can cause individuals to change their thoughts, feelings or behaviours  |

*Note.* Adapted from *The Behaviour Change Wheel: A Guide to Designing Interventions* (pp. 88–90), by S. Michie, L. Atkins, and R. West, 2014, Silverback Publishing. Copyright 2014 by Silverback Publishing.

In the current research, the TDF was used to identify the enablers and barriers to implementation (Objective 1). The TDF domains can be mapped to the capabilities, opportunities and motivations for behaviour (COM-B) model at the centre of the BCW.

### 3.2.2 Behaviour Change Wheel

The BCW, developed by (Michie et al., 2014), is a model that explains the enablers of and barriers to behavioural change. The model conceptually links underlying human behaviours to intervention functions and policies, all of which may influence the behaviour of an individual or a group (see Figure 3.3) (Michie et al., 2011).

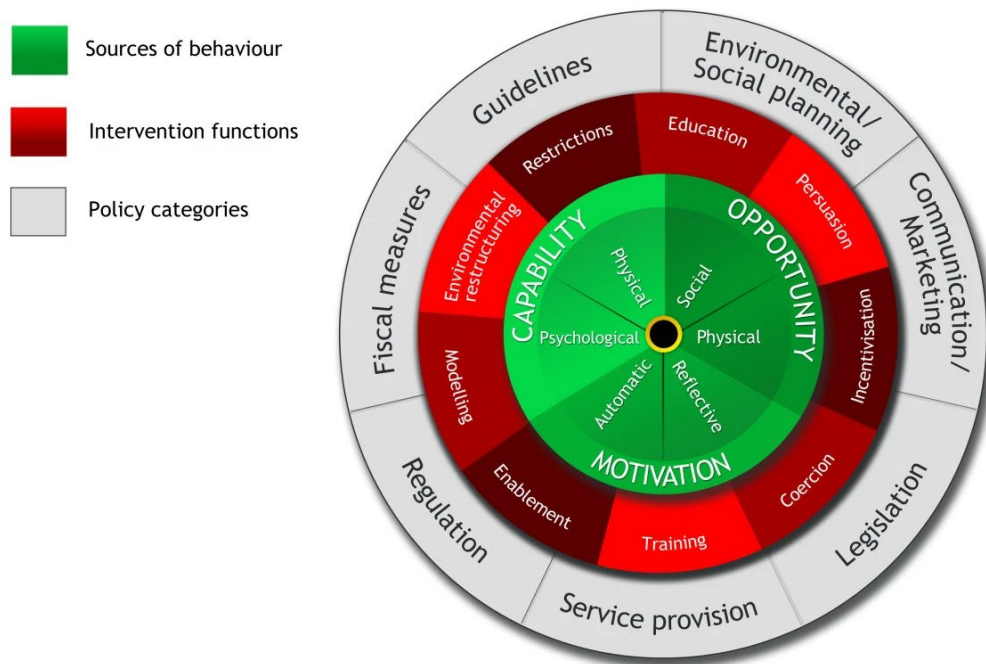


Figure 3.3. Behaviour change wheel.

*Note.* Reproduced from ‘The Behaviour Change Wheel: A New Method for Characterising and Designing Behaviour Change Interventions’, by S. Michie, M. M. van Stralen, and R. West, 2011, *Implementation Science*, 6, Article 42, p. 7 (<https://doi.org/10.1186/1748-5908-6-42>). Copyright 2011 by Michie et al.

The central wheel describes the COM-B or the inherent sources of behaviour; the middle wheel relates to the intervention functions; and the outer wheel relates to the policy categories. The process of behavioural change is not linear but involves interrelationships at each of the three layers. The BCW may be considered either a determinant framework or a process model. In this research, it was used as a process model to guide the development of the implementation strategy.

#### 3.2.2.1 Capability, Opportunity, Motivation—Behaviour

At the centre of the BCW is the COM-B model, which serves as a conceptual guide to the determinants of individual behaviour (Michie et al., 2011; Nilsen, 2015). The COM-B model may be considered an implementation theory, one specifically developed for the

purposes of implementing evidence-based practice change and explaining the causes of behaviour change (Thomas & Nilsen, 2024). COM-B is based on three interlinked elements that are needed for an individual to engage in a particular behaviour: capability, opportunity and motivation (Michie et al., 2011, 2014) (see Figure 3.4).

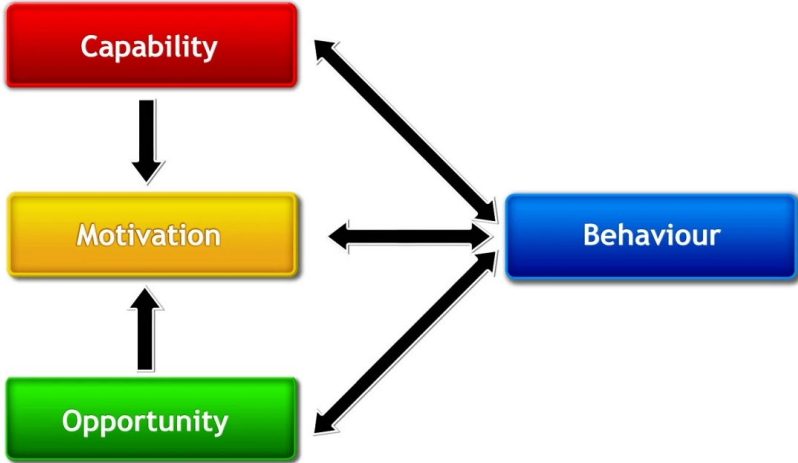


Figure 3.4. COM-B: A framework for understanding human behaviour.

*Note.* Reproduced from ‘The Behaviour Change Wheel: A New Method for Characterising and Designing Behaviour Change Interventions’, by S. Michie, M. M. van Stralen, and R. West, 2011, *Implementation Science*, 6, Article 42, p. 4 (<https://doi.org/10.1186/1748-5908-6-42>). Copyright 2011 by Michie et al.

*Capability* means that the individual has the skills and knowledge to engage in the target behaviour. *Opportunity* refers to the physical environment and social context influencing the behaviour (as opposed to considering the behaviour in isolation). *Motivation* refers to the individual’s automatic and conscious processes influencing their engagement in the target behaviour (Michie et al., 2011, 2014).

The TDF and the COM-B model may be used individually or in combination to explain the determinants (enablers and barriers) of behaviour change. When used in combination, the TDF domains may be mapped to the COM-B model (D’Lima & Lorencatto, 2024; Michie et al., 2014).

**3.2.2.2 Intervention Functions and Policy Categories**

The middle (red) ring of the BCW (see Figure 3.3) relates to the *intervention functions*, which are the broad categories of interventions that may be used in an implementation strategy to change behaviour (Michie et al., 2014). Michie et al. (2011) identified nine intervention functions that are most likely to generate a desired change in behaviour:

education, training, persuasion, incentivisation, coercion, environmental restructuring, restriction, modelling and enablement (see Table 3.2). These are referred to as *functions* rather than strategies or activities because multiple strategies or activities may serve a single function (Michie et al., 2014). For example, both posters and face-to-face training can be used to deliver education.

Table 3.2. Definitions of intervention functions

|                             |  |
|-----------------------------|--|
| Education                   | Increasing knowledge or understanding  |
| Persuasion                  | Using communication to induce positive or negative feelings or stimulate action  |
| Incentivisation             | Creating expectation of reward   |
| Coercion                    | Creating expectation of punishment or cost   |
| Training                    | Imparting skills   |
| Restriction                 | Using rules to reduce the opportunity to engage in the target behaviour or to increase the target behaviour by reducing the opportunity for competing behaviours |
| Environmental restructuring | Changing the physical or social context  |
| Modelling                   | Providing an example of people to aspire to or imitate   |
| Enablement                  | Increasing the means or reducing the barriers to increase capability (beyond education and training) or opportunity (beyond restructuring the environment)       |

*Note.* Adapted from *The Behaviour Change Wheel: A Guide to Designing Interventions* (p. 111–112), by S. Michie, L. Atkins, and R. West, 2014, Silverback Publishing. Copyright 2014 by Silverback Publishing.

The outer (grey) ring of the BCW (see Figure 3.3) refers to the seven policy categories that support the intervention functions (Michie et al., 2014).

*3.2.2.3 Behaviour Change Technique Taxonomy*

The intervention functions in the BCW provide the broad categories of interventions, which can be linked to behaviour change techniques (BCTs) that may be used to deliver an implementation strategy (Michie et al., 2014). Michie et al. (2014) describe the characteristics of a BCT to be ‘that it is observable, replicable, an irreducible component of an intervention designed to change behaviour’ (p. 145). Based on expert consensus, the BCT taxonomy was created by categorising 93 distinct BCTs with demonstrated effectiveness in healthcare settings into 16 groups (Michie et al., 2015). The BCT taxonomy enables consistency in the reporting, and evaluation, of interventions used to modify behaviour in different contexts. When planning an implementation strategy, it is

important to consider all BCTs that may be linked to the relevant intervention functions to identify those that are most suitable (Michie et al., 2014).

*3.2.2.4 Evaluating Implementation Strategy Appropriateness*

At each stage of designing a strategy for implementation, it is necessary to consider whether the selected intervention function, policy category or BCT is appropriate (Michie et al., 2014). APEASE (affordability, practicality, effectiveness/cost-effectiveness, acceptability, side-effects/safety and equity) is a framework that provides various criteria for researchers to evaluate the appropriateness of a strategy (Michie et al., 2014) (see Table 3.3). When applying the APEASE criteria, the context in which the implementation strategy will be delivered must be considered.

Table 3.3. APEASE criteria

| Criterion                        | Definition   |
|----------------------------------|--|
| Affordability                    | Cost of the intervention or delivery mode; must meet the budget to be accessible by those who require it                                     |
| Practicality                     | Ability to deliver the intervention as planned to the target audience  |
| Effectiveness/cost-effectiveness | The extent to which the intervention will achieve the planned outcomes and whether the cost of delivery and outcomes provide value for money |
| Acceptability                    | Appropriateness of the intervention as perceived by relevant stakeholders  |
| Side-effects/safety              | Unwanted side-effects or consequences (spillover)  |
| Equity                           | The influence of an intervention on equity among groups  |

*Note.* Adapted from *The Behaviour Change Wheel: A Guide to Designing Interventions* (p. 23–24), by S. Michie, L. Atkins, and R. West, 2014, Silverback Publishing. Copyright 2014 by Silverback Publishing.

**3.2.3 RE-AIM Framework**

The RE-AIM (reach, effectiveness, adoption, implementation quality and maintenance) framework is a planning and implementation framework that has been developed in response to the challenges related to translating evidence into practice in public health settings (Glasgow et al., 2019; Nilsen, 2015). It is widely used in implementation science in a diverse range of contexts, including healthcare settings, and is one of the most frequently used frameworks for evaluation (Gaglio et al., 2013; Glasgow et al., 2019). The RE-AIM framework can be used to evaluate interventions across multiple levels, from the

individual or setting level through to the system and policy levels. The framework comprises five domains (see Table 3.4).

Table 3.4. RE-AIM framework domains

| Domain                       | Definition  |
|------------------------------|---|
| Reach                        | The representativeness of eligible individuals (target population) who participate in a program or intervention   |
| Effectiveness or efficacy    | The effects of the intervention, including positive and negative effects, quality of life and economic outcomes. Includes evaluation across diverse settings to determine the consistency of outcomes   |
| Adoption                     | The proportion or number who deliver the intervention at the individual (people), or setting (facility/ organisational) level   |
| Implementation quality       | Fidelity to the intervention protocol (i.e. whether the intervention is delivered as intended), the time taken, associated costs and any adaptations made to implementation (setting). At an individual level, it is the use of the implementation strategies |
| Maintenance (sustainability) | At the organisational level, the extent to which the intervention is embedded as a part of routine practice and policy; at the individual level, the effects of the intervention on long-term outcomes  |

Note: Adapted from 'RE-AIM Planning and Evaluation Framework: Adapting to New Science and Practice with a Twenty-Year Review', by R. E. Glasgow, S. M. Harden, B. Gaglio, B. Rabin, M. L. Smith, G. C. Porter, M. G. Ory, and P. A. Estabrooks, 2019, *Frontiers in Public Health*, 7, Article 64, pp. 3–7 (<https://doi.org/10.3389/fpubh.2019.00064>). Copyright 2019 by Glasgow et al.; *What is RE-AIM?* (para. 3–7), by RE-AIM, n.d. (<https://re-aim.org/learn/what-is-re-aim/>). Copyright 2025 by RE-AIM.

There is no requirement to assess every domain in the RE-AIM framework as part of a program evaluation. However, the domains to be evaluated should be established prior to the planning phase (Glasgow et al., 2019).

### 3.3 Conclusion

In this chapter the philosophical and theoretical frameworks that underpin the research completed in this thesis were presented. First pragmatism, the philosophical paradigm that guided the research process was discussed. Then an overview of the TDF and BCW frameworks, which guide the development of an implementation strategy, were provided. Finally, the use of the RE-AIM framework for evaluation of implementation was described.

In Chapter 4 a detailed overview of each phase of the research is provided. This includes the methods used to design and evaluate the implementation of the HIRAID emergency nursing framework across a large rural LHD.

## **Chapter 4: Study Design and Methods**

An overview of the multimethod design used to implement and evaluate the HIRAID framework is presented in this chapter. How each of the frameworks described in Chapter 3 (TDF, BCW and RE-AIM) were applied in each phase to answer the research aims is documented.

First, the research aims and objectives are reiterated. This is followed by a detailed overview of the two phases of the research and the structure and resources of the study site. Then ethical considerations and potential biases of the research are discussed, followed by a brief overview of the implementation phase of the project. Five studies were undertaken to develop the implementation strategy and evaluate the implementation. The methods employed for each study are presented in this chapter. The findings of three of these studies are reported in four publications. Where there is an associated publication, additional details related to the methods can be found in the publications embedded in Chapter 5.

### **4.1 Study Aim and Objectives**

The aim of this thesis is to document the development and evaluation of a strategy to implement HIRAID in EDs and multipurpose facilities across a large rural LHD in southern NSW, Australia.

The specific objectives of this research were to:

1. identify the enablers of and barriers to HIRAID implementation based on the TDF
2. develop an evidence-based implementation strategy based on the BCW
3. evaluate the implementation, guided by the RE-AIM framework, to determine implementation fidelity and effectiveness.

### **4.2 Overarching Research Design**

A multimethod research design was used to develop an implementation strategy for HIRAID and evaluate its effectiveness. Multimethod research is the use of two or more methods in the same research to broaden the scope (Anguera et al., 2018). It is evident from the literature that there is some confusion around the meaning of multimethod research. While this term is frequently used synonymously with 'mixed methods

research', they are distinctly different (Anguera et al., 2018; Hesse-Biber & Johnson, 2015). Integration is an essential part of mixed methods research but is only required in multimethod research when the data address the same research objective (Anguera et al., 2018). Different methods can be used to address different research objectives without integrating them.

The design and evaluation of an implementation is complex. To account for this complexity and adequately address the research objectives, multiple methods were required to elicit insights into the contextual and individual characteristics that influence successful implementation (Gaglio et al., 2013; Hunter & Brewer, 2015; E. Proctor et al., 2011; RE-AIM, n.d.). In this research, three main research methodologies, either in isolation or in combination, were required to meet the research objectives in each phase of the research and broaden the scope of inquiry (Hunter & Brewer, 2015). These are outlined in the following subsections.

#### **4.2.1 Quantitative Research**

Quantitative research involves the collection and analysis of numerical data using statistical methods to test predetermined hypotheses or theories (Saks & Allsop, 2013). Quantitative research can be used to test a hypothesis through the objective exploration of the phenomenon of interest to generate findings that are applicable to different contexts (Greenhalgh et al., 2023). In this thesis, quantitative data were used to evaluate the implementation of HIRAID and its outcomes and were collected through documentation audits and staff surveys.

#### **4.2.2 Qualitative Research**

Qualitative research involves the exploration of a phenomenon to understand the what, why and how of human behaviour (J. Green & Thorogood, 2014), providing a deeper understanding of an individual's experience within their social context (Greenhalgh et al., 2023). Qualitative research commonly involves the collection of interview data but may also involve the collection of textual data from autobiographical accounts, meeting notes, policy papers or graphic depictions (LoBiondo-Wood & Haber, 2021). In the current research, a qualitative design was used to evaluate the HIRAID intervention by exploring the experiences of emergency nurses using semi-structured interviews.

### **4.2.3 Mixed Methods Research**

Mixed methods research uses a combination of qualitative and quantitative data, which are collected and analysed in parallel or sequentially. The data are then integrated to answer the research question or test the hypotheses (Creswell & Plano Clark, 2018). The research may take either a quantitatively or qualitatively driven approach. Mixed method research provides the strength of quantitative data with the depth of insight gained through exploring individual experiences (Greenhalgh et al., 2023). A mixed methods survey was used in the initial phase of this study to identify the enablers of and barriers to HIRAID implementation.

### **4.2.4 Multimethod Research**

Multimethod research aligns with pragmatism, the philosophical paradigm underpinning the current research. A multimethod design permits an exploration of separate yet interrelated concepts using methods that suit the different lines of inquiry (Hunter & Brewer, 2015). A pragmatic approach focuses on using what is best suited to answer the research question and may involve a combination of methods (Kaushik & Walsh, 2019). Various approaches were needed to address the aims and objectives of this research (described in more detail in Section 4.4).

## **4.3 Ethical Considerations**

This research was conducted in accordance with the *Australian Code for the Responsible Conduct of Research* (National Health and Medical Research Council, 2018) and the *National Statement on Ethical Conduct in Human Research* (NHMRC et al., 2018). Ethical approval was sought from the Greater Western Human Research Ethics Committee, which reviews ethics applications for the Southern NSW LHD. Ethics approval was granted on 20 October 2020 (2020/ETH02164), and site-specific approval was granted by the Southern NSW LHD (2020/STE03695) on 3 November 2020 (see Appendix 5).

Each stage of this research was conducted in accordance with the four key values and principles outlined in the *National Statement on Ethical Conduct in Human Research*: respect, research merit and integrity, beneficence and justice (NHMRC et al., 2023). For the emergency nurse surveys (see Sections 4.5 and 4.10), there were no foreseeable risks to participants aside from the time taken to complete the survey. Responses were anonymous, participants were de-identified, and all data were reported in aggregate form.

Data collected from implementation logs were also de-identified, and site champions did not record the personal details of participating staff. Where personal identifiers were available, these were removed and stored separately from the data for analysis. Data were only accessible to those directly involved in analysis and who had been approved by the ethics committee, and access was mediated by the chief investigator of the larger program of research and the lead PhD candidature supervisor. A waiver of consent was granted for the retrospective review of patient records. The study posed no direct risk to patients, and the need to seek consent may have impaired the research and risked introducing bias. Because I was not an employee of the LHD, I was engaged as a contingent worker, enabling me to access medical records for review. Contingent workers engaged for the purposes of research must meet all the requirements of regular nursing employees and are governed by the same code of conduct (Workplace Relations, 2015).

## **4.4 Research Methods**

### **4.4.1 Study Phases**

There were two phases to this multimethod research on the implementation and evaluation of HIRAID in the Southern NSW LHD (see Figure 4.1).

Phase 1 was guided by (French et al., 2012) four-step approach to the development of an evidence-based implementation strategy. An implementation strategy is used to facilitate the uptake, adoption and sustainability of a clinical intervention. It includes single or multiple activities or techniques, often referred to as strategies, which must be specified in detail, including what the strategy is, how it will be delivered, who will deliver it, who the expectant recipients are and the expected outcome (E. K. Proctor et al., 2013).

In Phase 2, the RE-AIM framework was used to guide the evaluation of the implementation strategy developed in Phase 1 and the clinical practice outcomes following the implementation of the HIRAID intervention.

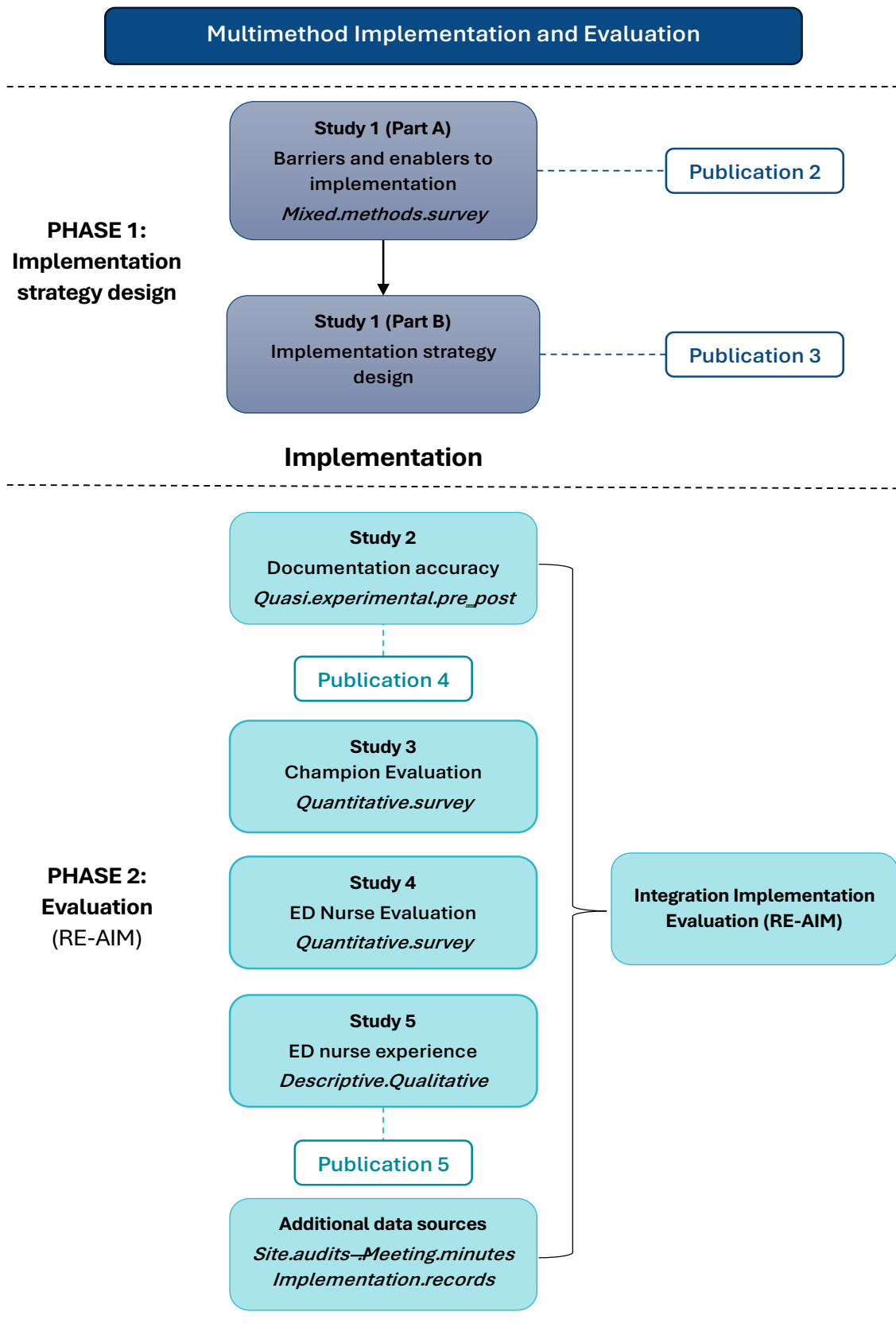


Figure 4.1. Overview of research phases.

#### 4.4.1.1 Phase 1: Designing for Implementation

Phase 1 of this research was undertaken over a 6-month period from September 2020 to February 2021. It involved consultations with key stakeholders to determine readiness for HIRAID implementation across the LHD, as well as planning and development of an evidence-informed strategy to operationalise the implementation of HIRAID. French et al.'s (2012) systematic four-step approach was used to guide the implementation strategy, which was aimed at achieving clinician behaviour change (see Table 4.1).

Table 4.1. Steps to developing an implementation strategy

|   | Step   | Tasks   |
|---|--|---|
| 1 | Identify the target behaviour  | Identify the evidence–practice gap<br>Specify the behaviour change needed to address the gap<br>Identify the group(s) that need behavioural change                                    |
| 2 | Identify the enablers of and barriers to implementation  | Select a relevant theory or framework to inform the necessary change processes  |
| 3 | Identify the intervention components and mode of delivery to address the enablers and barriers | Identify evidence to inform the selection of techniques and delivery modes to change the target behaviour<br>Use a theory or framework to inform the selection of relevant techniques |
| 4 | Select the measures to evaluate change   | Select appropriate and feasible measures to evaluate implementation and intervention effectiveness  |

*Note.* Adapted from ‘Developing Theory-Informed Behaviour Change Interventions to Implement Evidence into Practice: A Systematic Approach Using the Theoretical Domains Framework’, by S. D. French, S. E. Green, D. A. O’Connor, J. E. McKenzie, J. J. Francis, S. Michie, R. Buchbinder, P. Schattner, N. Spike, and J. M. Grimshaw, 2012, *Implementation Science*, 7, Article 38, p. 3 (<http://www.implementationscience.com/content/7/1/38>). Copyright 2012 by French et al.

Phase 1 involved initial engagement with stakeholders at each study site and the establishment of a steering committee to support the implementation. Data collection and implementation strategy design were completed in the final 4 months before implementation. The development of the implementation strategy was conducted in two parts. In Part A, an embedded mixed methods study based on the TDF was conducted to identify the enablers of and barriers to the proposed intervention. These results informed Part B: the development of the implementation strategy for the HIRAID intervention guided by the BCW (see Figure 4.1). These methods are discussed in more detail in Sections 4.5 and 4.6.

#### 4.4.1.2 Phase 2: Implementation Evaluation

In Phase 2, a multimethod design and integration (where applicable) were used to evaluate the effectiveness of the implementation guided by the RE-AIM framework (RE-AIM, n.d.). Figure 4.2 illustrates the timeline of the evaluation phase, which took place from 5 to 10 months post implementation, allowing for a transition period. Evaluation involved an audit of nursing documentation to evaluate outcomes (Study 2) and a comprehensive evaluation of the operationalised implementation strategy using three studies (Studies 3, 4 and 5). These included a qualitative study of emergency nurses' experiences of implementation and quantitative surveys to evaluate intervention fidelity and experiences. Additionally, data were extracted from study site records to inform relevant areas of evaluation. It is important to evaluate both the strategy and the outcomes because while a strategy may be effective, it will not necessarily lead to a change in clinical outcomes (Bosch et al., 2019).

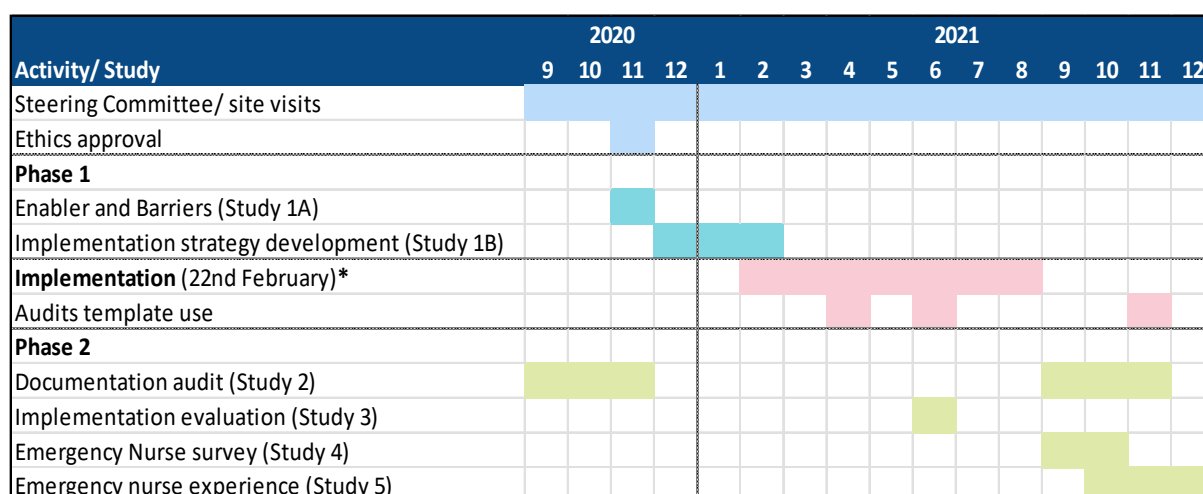


Figure 4.2. Research timeline for Phases 1 and 2.

#### 4.4.2 Study Sites

This research was conducted in the Southern NSW LHD, a single health district that delivers health services across a large, predominantly rural area. The LHD is located in the south-eastern corner of NSW, the most populous state in Australia, and covers a geographical area of approximately 44,534 km<sup>2</sup>, from Crookwell in the north to Delegate in the south, near the Victorian border. The LHD completely surrounds the Australian Capital Territory (NSW Health, n.d) (see Figure 4.3). The LHD services the far south coast of NSW to the Victorian border and comprises rural farming areas across the Southern

Tablelands, including large wilderness areas, including Kosciuszko National Park, home to the NSW ski fields and other outdoor activities in the summer months.

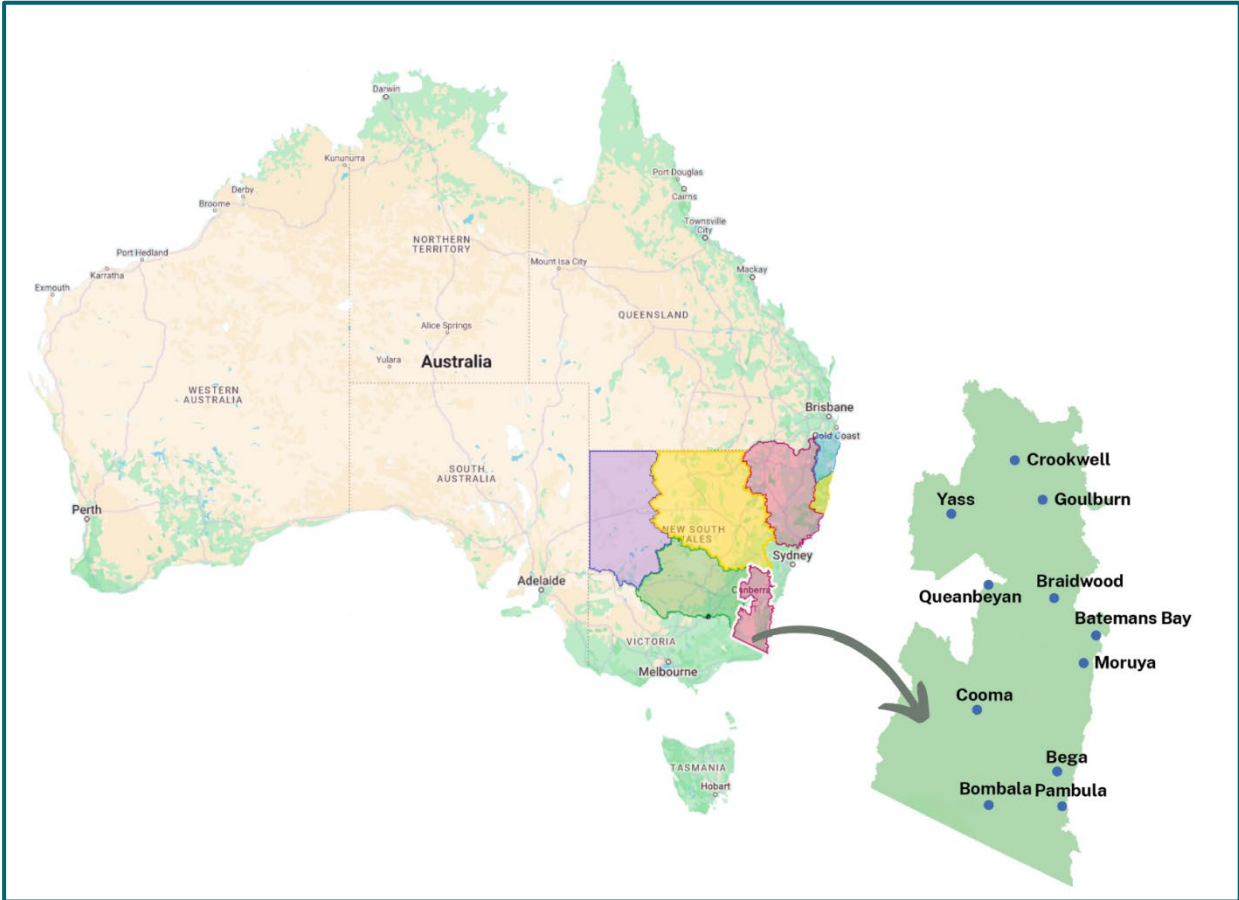


Figure 4.3. Map of the Southern New South Wales Local Health District and the 11 participating sites.

*Note.* Adapted from *Southern NSW*, by NSW Health, n.d. (<https://www.health.nsw.gov.au/lhd/pages/snswlhd.aspx>); *Map of Multipurpose Services*, by NSW Health, 2024 (<https://www.health.nsw.gov.au/regional/mps/Pages/mps-sites.aspx>). In the public domain.

In 2019, the Southern NSW LHD catered to approximately 211,122 residents and additional visitors to the south-east of NSW (NSW Health, n.d). There were 114,385 presentations to Southern NSW LHD EDs in the 2020–2021 financial year (AIHW, 2023a), with approximately 180 emergency nurses employed across the LHD to deliver emergency care. Table 4.2 shows the staffing breakdown and presentations by ED (hereafter referred to as study sites).

Table 4.2. Southern New South Wales Local Health District emergency department characteristics

| Region      | Site                              | No. ED presentations (2020–2021) | No. emergency nurses <sup>a</sup> | ED level <sup>b</sup> |
|-------------|-----------------------------------|----------------------------------|-----------------------------------|-----------------------|
| Northern    | Queanbeyan Hospital               | 23,539                           | 28                                | 3                     |
|             | Goulburn Base Hospital            | 18,342                           | 27                                | 4                     |
|             | Yass District Hospital            | 5,865                            | 16                                | 2                     |
|             | Crookwell District Hospital       | 4,284                            | 12                                | 2                     |
| Southern    | South East Regional Hospital      | 20,071                           | 24                                | 4                     |
|             | Cooma Hospital and Health Service | 10,912                           | 12                                | 3                     |
|             | Pambula Health Service            | 3,098                            | 4                                 | 2                     |
|             | Bombala Multipurpose Service      | 1,848                            | 14                                | 2                     |
| Eurobodalla | Batemans Bay District Hospital    | 13,652                           | 20                                | 2                     |
|             | Moruya Hospital                   | 10,937                           | 17                                | 3                     |
|             | Braidwood Multipurpose Service    | 1,690                            | 14                                | 2                     |
| Total       |                                   | 114,238                          | 188                               |                       |

*Note.* ED: emergency department; <sup>a</sup>Nurses on the ED roster at the time of the study. <sup>b</sup>(Strategic Reform and Planning Branch, 2021b).

In Australia, EDs are rated from Level 1 to Level 6 depending on the complexity of care and services they can provide (ACEM, 2023; Strategic Reform and Planning Branch, 2021a). Some Level 1 and 2 facilities are known as ‘multipurpose services’, which may provide integrated health and aged care depending on the health district requirements (NSW Health, 2025). They have limited diagnostic services, and medical services are often provided by a general practitioner or via virtual care, with services sometimes limited to daytime only (Strategic Reform and Planning Branch, 2021a). In contrast, Level 3 and 4 EDs accommodate the full range of emergency presentations 24 hours a day where resources permit. These EDs have a higher number of specialist emergency physicians and access to diagnostic clinical services, allied health and administrative support (Strategic Reform and Planning Branch, 2021a). In this research, ED levels ranged from Level 2 to Level 4 (Level 2:  $n = 6$ ; Level 3:  $n = 3$ ; Level 4:  $n = 2$ ) (see Table 4.2).

At the commencement of this research, each of the three geographical regions in the Southern NSW LHD (Northern, Southern and Eurobodalla) (see Table 4.2) was overseen by an emergency clinical nurse consultant (CNC). A CNC is a registered nurse with a minimum of 5 years full-time postgraduate experience as well as postgraduate qualifications relevant to the speciality area in which they work (NSW Health, 2023). All three CNCs were employed on a permanent part-time basis, with various hours of employment. Six sites had clinical nurse educators, although coverage varied. Two sites had no educator at the time of planning and implementation. Therefore, at these sites, implementation support was provided by the CNC responsible for that site.

**4.5 Phase 1 (Study 1): Implementation Strategy Design**

Phase 1 (Study 1) was guided by French et al. (2012). In this section the process used to develop the HIRAID implementation strategy is described (see Figure 4.4). First, the aims and objectives of Phase 1 are presented, followed by the behaviour targeted. Then the methods used in both parts of Study 1 are described. This phase resulted in two publications: Publication 2 (associated with Part A of Study 1) and Publication 3 (associated with Part B of Study 1).

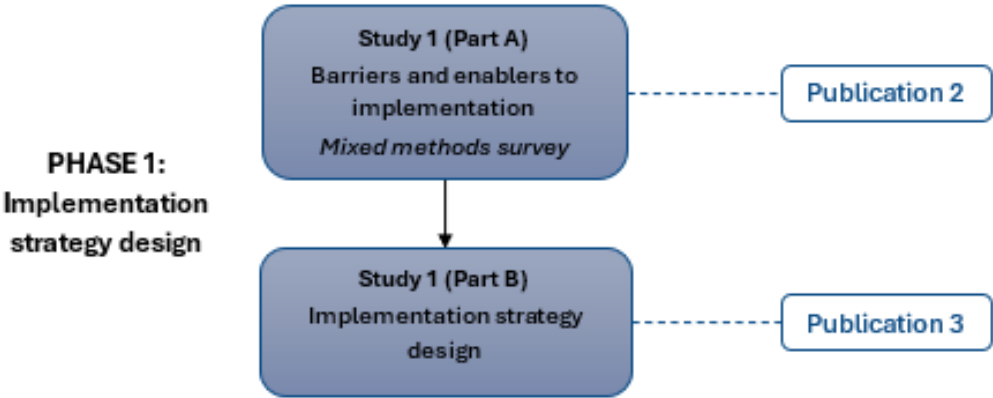


Figure 4.4. Phase 1: Development of an implementation strategy for HIRAID.

**4.5.1 Aim and Objectives**

The aim of Phase 1 was to develop an evidence-informed strategy to implement the HIRAID framework in Southern NSW LHD EDs.

The specific objectives of this phase were:

1. identify the enablers of and barriers to HIRAID implementation based on the TDF (Publication 2)

2. develop an evidence-based implementation strategy based on the BCW (Publication 3).

#### **4.5.2 Target Behaviour for HIRAID Implementation**

As described by (French et al., 2012), the first step was to establish the target behaviour. Human behaviour is a key component of any implementation activity. While the context can be modified to support uptake of an intervention, it is unlikely to succeed without the engagement of the individuals required to enact it (Michie et al., 2011). Therefore, specifying the behaviour defines not the problem but the behaviour that must change to resolve the problem (Michie et al., 2014). Considering a problem in behavioural terms requires the researcher to consider who is expected to perform the behaviour and in what context (Michie et al., 2014). In the Southern NSW LHD, the problem was inconsistency in nursing care, which was identified in a local quality improvement project (see Chapter 1). The HIRAID intervention promotes consistency in emergency nursing care. The framework is applied by emergency nurses when assessing patients in the ED and making decisions about their management and care. Therefore, the target behaviour in this case was emergency nurses' approaches to the post-triage assessment of patients presenting to the ED. This clear behavioural target was required for progression to Step 2, where the TDF was applied to establish the enablers of and barriers to the target behaviour.

#### **4.5.3 Part A: Enablers of and Barriers to Implementation**

Part A of Study 1 relates to Step 2 of the implementation design strategy: identify the enablers of and barriers to implementation (French et al., 2012). In this study, a theoretical framework was used to identify the enablers of and barriers to the implementation of HIRAID. Publication 2 presents the results of Study 1, Part A (see Section 5.2.1). A brief overview of the study methods is presented in the following sections along with additional details not included in the publication.

##### *4.5.3.1 Study Design and Methods*

An embedded mixed methods design based on both quantitative and qualitative methods was used to identify the enablers of and barriers to the implementation of HIRAID across the study sites. The gathered data were primarily quantitative, with qualitative data being used to provide greater detail or context, in turn providing richer insights into the quantitative findings (see Figure 4.5) (Creswell & Plano Clark, 2007).

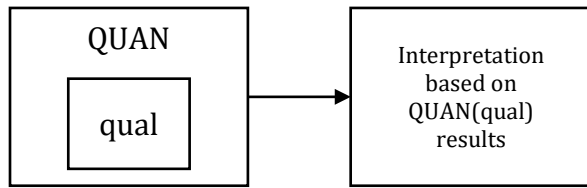


Figure 4.5. Embedded mixed methods design.

*Note.* QUAN: quantitative; qual: qualitative. Reproduced from *Designing and Conducting Mixed Methods Research* (p. 68), by J. W. Creswell and V. L. Plano Clark, 2007, SAGE Publications. Copyright 2007 by SAGE.

With the Southern NSW LHD covering a large geographic area and including 11 sites, it was beyond the scope of this research to undertake extensive site visits for the purposes of data collection. Therefore, a survey was used to simultaneously collect quantitative and qualitative data. Surveys are commonly used in research because they are cost-effective and enable the collection of data from a population that may be otherwise difficult to access (C. A. Green et al., 2015).

#### 4.5.3.2 Participant Recruitment

All nursing staff permanently employed in an ED or multipurpose service across the study site were eligible to participate. All communications were accompanied by a participant information sheet (see Appendix 6).

#### 4.5.3.3 Data Collection

Data were collected using a previously validated survey instrument informed by the TDF (Curtis et al., 2020). The first section of the survey gathered basic demographic information. The second section comprised a behavioural survey based on 16 questions related to the implementation of a new intervention and mapped to the TDF domains (see Appendix 7). All statements had to be answered for a survey to be complete and to control for missing data. Free text comments were optional.

#### 4.5.3.4 Data Analysis

The quantitative and qualitative survey data were independently analysed before integrating and mapping them to the TDF domains. Qualitative and quantitative analyses informed the preliminary enablers of and barriers to HIRAID implementation.

#### 4.5.3.4.1 Level of Agreement

To identify the enablers and barriers based on respondents' level of agreement with survey statements the literature was reviewed, and thesis supervisors were consulted. The academic literature varies with respect to the identification of enablers and barriers from survey results (Murphy et al., 2019; Spooner et al., 2018). Some studies specify a  $\geq 70\%$  agreement with statements (Amemori et al., 2011; Murphy et al., 2019), while others have no predetermined level of agreement (Spooner et al., 2018). There were concerns related to using a 70% agreement level due to low staff numbers (see Table 4.2), where a few individuals could have a significant influence on implementation. Thus, potential barriers may have been overlooked. Given this, it was considered appropriate to use an 80% level of agreement (or disagreement) with survey items to ensure that potential enablers or barriers were not overlooked. Therefore, quantitative survey items were considered enablers if there was  $\geq 80\%$  disagreement with a negatively worded statement or  $\geq 80\%$  agreement with a positively worded statement. Qualitative free text data were also used to inform the enablers and barriers.

#### 4.5.3.4.2 Integration

The quantitative and qualitative survey findings were integrated (Fetters et al., 2013) to establish the final set of enablers of and barriers to the implementation of the HIRAID framework. Following integration, the findings were mapped to the TDF to identify the specific domains that were enablers of or barriers to implementation. Publication 2 (embedded in Section 5.1.1) provides further details of the study methods along with the findings:

Kennedy, B., Curtis, K., Kourouche, S., Casey, L., Hughes, D., Chapman, V., Fry, M. (2024). Establishing enablers and barriers to implementing the HIRAID® emergency nursing framework in rural emergency departments. *Australasian Emergency Care*, 27(4), 290–298. <https://doi.org/10.1016/j.auec.2024.08.002>

The next section details Phase 1, Part B, which aligns with Steps 3 and 4 outlined by French et al. (2012) (see Table 4.1). Part B was informed by the results of Part A and involved the development of the implementation strategy for HIRAID in Southern NSW LHD.

**4.5.4 Part B: Interventions Appropriate to the Enablers and Barriers**

In Part B of Phase 1, I used the TDF and BCW to inform the development of the implementation strategy (Michie et al., 2014). The 14 TDF domains can be mapped to the intervention functions in the BCW. In this research, the TDF domains identified as the enablers and barriers of HIRAID implementation in Part A were used to select to the relevant intervention functions.

*4.5.4.1 Methods to Develop an Implementation Plan*

A systematic process, outlined by Michie et al. (2014), was used to select the relevant intervention functions and BCTs. First, the relevant intervention functions were determined by mapping them to the TDF domains identified as enablers and barriers in Part A (see Table 4.3).

Table 4.3. Links between theoretical domains and intervention functions

| Intervention Functions      | Theoretical Domains |           |  |                        |                                       |                           |          |                           |            |       |               |         |                           |                   |
|-----------------------------|---------------------|-----------|--|------------------------|---------------------------------------|---------------------------|----------|---------------------------|------------|-------|---------------|---------|---------------------------|-------------------|
|                             | Skills              | Knowledge | Memory, attention and decision processes | Behavioural regulation | Professional/social role and Identity | Belief about capabilities | Optimism | Belief about consequences | Intentions | Goals | Reinforcement | Emotion | Environmental context and | Social influences |
| Education                   |                     |           |  |                        |                                       |                           |          |                           |            |       |               |         |                           |                   |
| Persuasion                  |                     |           |  |                        |                                       |                           |          |                           |            |       |               |         |                           |                   |
| Incentivisation             |                     |           |  |                        |                                       |                           |          |                           |            |       |               |         |                           |                   |
| Coercion                    |                     |           |  |                        |                                       |                           |          |                           |            |       |               |         |                           |                   |
| Training                    |                     |           |  |                        |                                       |                           |          |                           |            |       |               |         |                           |                   |
| Restriction                 |                     |           |  |                        |                                       |                           |          |                           |            |       |               |         |                           |                   |
| Environmental restructuring |                     |           |  |                        |                                       |                           |          |                           |            |       |               |         |                           |                   |
| Modelling                   |                     |           |  |                        |                                       |                           |          |                           |            |       |               |         |                           |                   |
| Enablement                  |                     |           |  |                        |                                       |                           |          |                           |            |       |               |         |                           |                   |

*Note.* Adapted from *The Behaviour Change Wheel: A Guide to Designing Interventions* (p. 113), by S. Michie, L. Atkins, and R. West, 2014, Silverback Publishing. Copyright 2014 by Silverback Publishing.

These intervention functions were then mapped to the corresponding BCTs, which may be associated with one or more intervention functions (Michie et al., 2014). All relevant BCTs associated with the identified intervention functions were considered and selection was in consultation with my lead supervisor. Decisions related to BCT selection were informed by the definition of the BCT and consideration of barriers and enablers. This process was supported by the BCT Taxonomy mobile app and the resources provided in *The Behaviour Change Wheel: A Guide to Designing Interventions* (Michie et al., 2014).

These resources provided an easy reference to intervention functions and their associated BCTs and definitions. The mobile app assisted in selecting the correct BCT, with alternative BCTs according to the planned operationalisation provided in the application when considering BCT selection.

When identifying intervention functions and relevant BCTs, it is important to consider the mode of delivery (E. K. Proctor et al., 2013). In consultation with stakeholders, the appropriate targets for delivery were identified. Evaluation metrics facilitate the evaluation of fidelity (i.e. determining whether an intervention is used as intended). Given that not all intervention functions, BCTs or modes of delivery are suitable for all situations, decisions were based on context and guided by the APEASE criteria in each stage (Michie et al., 2014) (see Chapter 3).

Publication 3 (embedded in Section 5.1.2) provides further information on the methods used in Study 1, Part B:

Kennedy, B., Curtis, K., Kourouche, S., Casey, L., Hughes, D., & McCloughen, A. (2024). Development of an evidence-based strategy to implement the HIRAID® emergency nursing framework in rural emergency departments using behaviour change theory. *International Emergency Nursing*, 77, Article 101538. <https://doi.org/10.1016/j.ienj.2024.101538>

## **4.6 HIRAID Emergency Nursing Framework Implementation**

This section provides a brief overview of the implementation of HIRAID across the 11 study sites, guided by the implementation strategy developed in Phase 1. A steering committee comprising district-level nurse managers, senior nurses and a medical director representing all study sites was convened in September 2020 and ran until the conclusion of data collection in December 2021. As outlined in Section 4.5, attendance at the meetings was reviewed as part of the evaluation. Meetings were coordinated and chaired by an emergency CNC and a district nurse manager.

Once ethics approval was granted in November 2020, planning the implementation and established a definitive timeline was established. Following the development of the implementation plan in Phase 1, two Essentials of Care program coordinators (non-ED CNCs) in the Southern NSW LHD presented the plan to nurse end users at the study sites. The plan was also circulated to senior ED clinicians, who had the opportunity to provide

feedback. Based on this feedback and each site's capacity to avail staff of the required resources (e.g. HIRAID documentation templates and e-learning), implementation was planned for the final week of February 2021.

To implement the HIRAID framework at each site, a train-the-trainer model was used. This involved training of appropriately skilled clinicians to instruct others in the clinical intervention. This model has demonstrated effectiveness in the clinical setting (Pearce et al., 2012). Therefore, prior to the implementation, training was delivered to emergency nurses selected to fulfil the role of 'HIRAID champion' at each study site.

#### **4.6.1 Champion Recruitment**

Emergency nurses from across the LHD were recruited following expressions of interest for the role of HIRAID champion. The chair of the steering committee, an emergency district CNC, consulted with site managers and emailed emergency nurses with an invitation to become a HIRAID champion and attend a train-the-trainer course. Champions are those who work to promote an intervention, troubleshoot any problems and overcome resistance by their colleagues (Powell et al., 2015). In this study, they were also expected to assist with training where required. Nurses who were engaged to deliver the HIRAID training and support implementation were referred to as HIRAID champions.

The invitation emails for expressions of interest included an information sheet that provided an overview of the HIRAID framework, some background on the project and contact details at each site (see Appendix 8). Interested nurses were encouraged to discuss the opportunity with their managers. The original intention was to recruit staff who had self-nominated for the champion role to ensure that they would be motivated to participate in change. However, some staff in leadership roles (e.g. clinical nurse educators or nurse practitioners) were recruited by their managers.

#### **4.6.2 Train-the-Trainer Course**

In the week commencing 15 February 2021, three 1-day train-the-trainer courses were run at three separate sites across the LHD, making them easily accessible to participants. An additional course was delivered in April 2021 to capture the small number of senior staff who had been unable to attend the initial training. An additional nurse was trained by one of the CNCs at a different time. Staff who attended the training were paid as usual.

The first 3 days of training ensured that there would be champions at ten sites, with one of the CNCs responsible for one small site without a trained HIRAID champion.

Prior to attending the train-the-trainer course, participants were required to complete the e-learning module and prereading to ensure they had adequate baseline knowledge of the HIRAID intervention. Face-to-face training was then delivered in a 6-hour workshop, providing more detailed information about HIRAID, it also covered the content of the face-to-face training that would subsequently be delivered to all emergency nurses. This allowed the participants to understand how to deliver the education in their respective workplaces. The course incorporated an overview of the strategies in the implementation plan and how they were to be operationalised. Attendees had the opportunity to discuss the challenges that could occur during implementation, including resistance from staff, and they shared strategies to mitigate these challenges along with the pathways for communication and escalation if required. All sites were provided with the necessary resources to deliver HIRAID training to emergency nurses. Champion training was targeted at senior clinicians, including nurse educators and clinical nurse educators, who could support and champion the implementation of HIRAID in the clinical setting. The live implementation of HIRAID was scheduled for Monday, 22 February 2021.

#### **4.6.3 HIRAID Templates**

Documentation templates were a key implementation strategy, designed to capture emergency nurse assessment findings and nursing actions. There are six documentation templates designed for adult, paediatric, trauma, mental health, low acuity presentations and re-assessment in the ED. Templates are tailored to ensure that the necessary assessment and treatment details completed by emergency nurses are captured. A sample of a HIRAID template is published in Publication 4, section 5.2.1.

#### **4.6.4 Tracking Implementation and Adaptations**

During the train-the-trainer course, attendees were provided with a full overview of the research, the data to be collected following the HIRAID implementation, a summary of their responsibilities as a HIRAID champion (see Appendix 9) and a participant information sheet (see Appendix 10). This was to ensure that all champions were aware of the research activities should they choose to participate.

The instructions to participants included the record-keeping requirements, as well as the use of templates to record any challenges with and adaptations made to the delivery of activities and a log to track implementation (see Appendix 11). Tracking the implementation also involved assisting with audits of the HIRAID templates to confirm that it was being used. The audit included only patients allocated to a bedspace. Given that the nurses completing the audit were not consistently provided dedicated time to complete, the audit only required confirmation that the templates were used for initial nursing assessment documentation, and that the appropriate template was used. The process was reiterated via email when all who had attended the training were contacted approaching 6- and 12-weeks into implementation. The intent of this audit was twofold: first, it provided an opportunity to ensure that all champions had access to the templates and to remove any outdated templates; and second, it helped identify when individuals or sites required more assistance if uptake was low.

In conjunction with an emergency nurse assisting with the project, a further comprehensive audit of the medical records of all nursing staff on the ED roster at 9 months post implementation (November 2021) was conducted. For each nurse, three consecutive entries were audited for patients who were triaged as Category 2–4 and allocated a bedspace for more than 90 minutes. At smaller sites, audits of each staff member were conducted for up to 4 weeks to capture three consecutive entries, by nurses, for patients that met the criteria. To minimise bias, the audit in the department where the emergency nurse assisting was employed was conducted by the thesis author.

HIRAID champions at each site had access to their local CNC for support where required. In addition to providing a reminder ahead of the audit, champions were contacted via email every 2–3 weeks during implementation to offer support if required. This was the most feasible means of communication given their varied work patterns.

In the next section the process used to comprehensively evaluate the implementation across the study sites in Phase 2 of the research is presented. Subsequent sections include a detailed overview of the methods used in the Phase 2 studies.

## **4.7 Phase 2: Implementation Evaluation**

The methods used in Phase 2 to evaluate the implementation of HIRAID and its outcomes, as guided by the RE-AIM framework will be presented in this section. There were four discrete studies to evaluate the implementation of HIRAID across the study sites, and a review of the implementation records was also completed. The findings of Studies 2 and 5 are reported in Publications 4 and 5 respectively (see Figure 4.6). First the overarching aim of Phase 2 will be presented, followed by the methods of evaluation. The subsequent subsections then include the methods of each of the four studies.

Evaluating an implementation is critical to understand how and why changes occur (Glasgow et al., 2019). To quantify the effect of an implementation strategy, both the implementation strategy and the outcomes of the intervention must be evaluated (Glasgow et al., 2019; J. D. Smith & Hasan, 2020). While there may be observed changes in practice or clinical outcomes following the implementation of an intervention, without an evaluation of the overarching implementation strategy, these changes cannot necessarily be attributed to the intervention (Powell et al., 2019). Therefore, implementation evaluation needs to occur across multiple levels to determine the effectiveness of the implementation strategy (Glasgow et al., 2019).

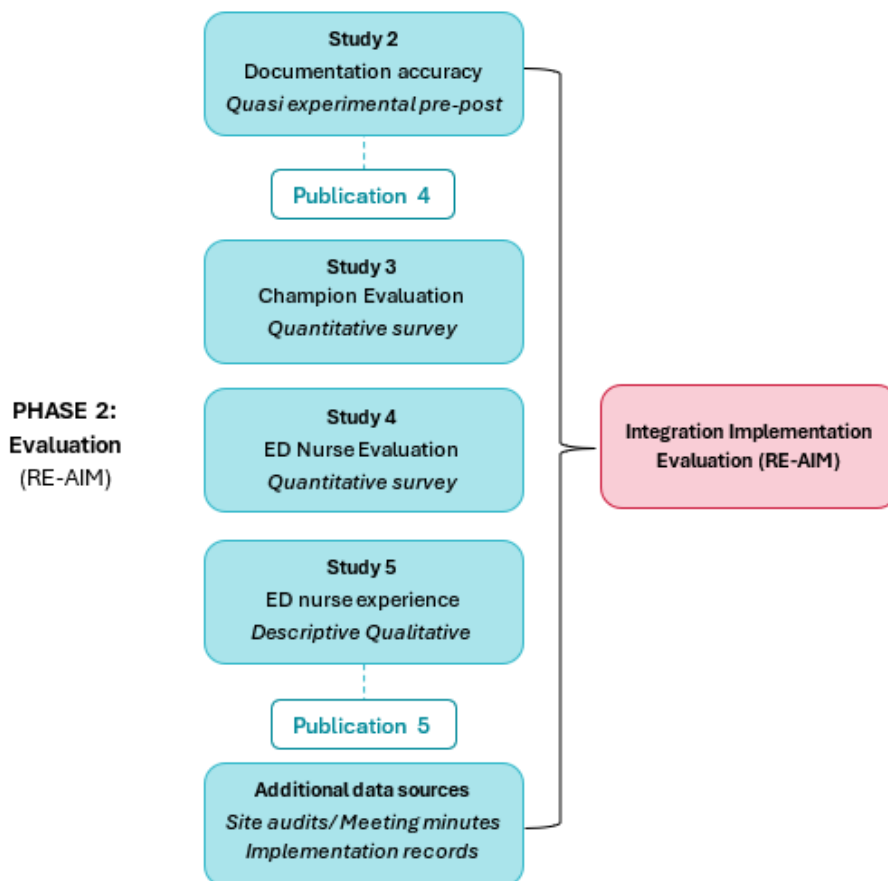


Figure 4.6. Phase 2: Evaluation of HIRAID implementation.

#### 4.7.1 Aim

The aim of Phase 2 was to evaluate the HIRAID implementation strategy according to the RE-AIM framework (i.e. reach, effectiveness, adoption, implementation quality and maintenance).

#### 4.7.2 Design and Methods

Evaluation of the implementation strategy was guided by the RE-AIM framework. To comprehensively evaluate the intervention strategy using the RE-AIM framework, it was necessary to use multiple methods and data sources (Glasgow et al., 2019) because no single method would have provided adequate detail on all domains.

Four primary data sources informed the evaluation of the HIRAID implementation:

- documentation audits (outcome effectiveness) (Study 2)
- champion (instructor) surveys (Study 3)
- emergency nurse surveys (Study 4)
- staff interviews (Study 5).

Additionally, documents such as training records, implementation logs and steering committee minutes were used to inform the evaluation where appropriate. Each study site was provided with templates to track and record implementation activities (as described in Section 4.6.3).

#### 4.7.3 RE-AIM Domains and Links to Data Sources

The five domains of the RE-AIM framework used for the evaluation of the HIRAID implementation in the Southern NSW LHD are as follows:

1. **Reach:** refers to the number and percentage of eligible emergency nurses who participated in the HIRAID education program (measured through site implementation records).
2. **Effectiveness:** measured in two ways:
  - emergency nurse opinions on the usefulness of HIRAID in clinical practice using a survey (Study 4) and interviews (Study 5)
  - the accuracy of initial assessment documentation (Study 2).<sup>1</sup>
3. **Adoption:** the proportion of eligible sites that adopted the HIRAID emergency nursing framework as part of their routine ED care delivery and with nurses trained as champions (setting), and the proportion of emergency nurses who used HIRAID framework for patient assessments (individual).
4. **Implementation quality:** measured according to dose (the number of courses delivered, and staff trained), fidelity (delivery of implementation strategies by champions) and quality (the level of staff satisfaction with training); measured using staff surveys (Studies 3 and 4) and staff interviews (Study 5).
5. **Maintenance:** The routine adoption of HIRAID at the organisational level (i.e. HIRAID embedded in emergency nurse orientation and training) and the individual level (i.e. the ongoing use of HIRAID in practice by emergency nurses).

Table 4.4 presents an overview of the data sources for each RE-AIM domain.

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<sup>1</sup> The effect of HIRAID on patient outcomes and costs were evaluated as part of a larger program of research Curtis, K., Fry, M., Kourouche, S., Kennedy, B., Considine, J., Alkhouri, H., Lam, M., McPhail, S. M., Aggar, C., Hughes, J., Murphy, M., Dinh, M., & Shaban, R. (2023). Implementation evaluation of an evidence-based emergency nursing framework (HIRAID): Study protocol for a step-wedge randomised control trial. *BMJ Open*, 13(1), e067022. <https://doi.org/http://dx.doi.org/10.1136/bmjopen-2022-067022> and is outside of the scope of this thesis.

Table 4.4. RE-AIM benchmarks for HIRAID evaluation and data sources

| RE-AIM domain          | Data source   |                  |                  |                 |                        |
|------------------------|---------------|------------------|------------------|-----------------|------------------------|
|                        | Nurse surveys | Nurse interviews | Champion surveys | Medical records | Implementation records |
| Reach                  |               |                  |                  |                 |                        |
| Effectiveness          |               |                  |                  |                 |                        |
| Adoption               |               |                  |                  |                 |                        |
| Implementation quality |               |                  |                  |                 |                        |
| Maintenance            |               |                  |                  |                 |                        |

During the planning stage, in consultation with local stakeholders, the targets for each activity in the implementation strategy were considered. The determined targets were integrated into the relevant RE-AIM domains. Additional data sources and measures to evaluate were determined prior to implementation.

Table 4.5 provides an overview of the RE-AIM domains and associated measures and targets. This provides a framework for the integration of data sources used to inform the evaluation (Fetters et al., 2013), described in the next section.

Table 4.5. RE-AIM benchmarks for implementation evaluation

| RE-AIM domain          |      | Measure  | Target   |
|------------------------|------|--|--|
| Reach                  |      | Proportion of ED nurses who complete the HIRAID training either partially or in full (i.e. face-to-face and/or e-learning)             | ≥ 80%  |
| Effectiveness          |      | Modified D-Catch score of emergency nurses' initial documentation pre and post implementation (setting)                                | Improved documentation quality (clinical outcome)  |
|                        |      | ED nurse (individual) opinions on HIRAID usefulness (e.g. HIRAID helps them recall the required assessment and management of patients) | ≥ 80%  |
| Adoption               |      | Proportion of EDs that implement HIRAID (setting)  | 100%   |
|                        |      | Proportion of sites with at least one HIRAID champion / instructor (setting)   | 100%   |
|                        |      | Proportion of nurses who use the HIRAID documentation when indicated (individual)  | ≥ 80%  |
| Implementation quality | Dose | No. courses/sites (train-the-trainer and provider) delivered   | -  |
|                        |      | No. HIRAID champions per site  | At least one who is not part of the education team |
|                        |      | Proportion of emergency nurses who complete face-to-face training, e-learning and/or view the HIRAID video                             | ≥ 80%  |
|                        |      | Percentage of flip cards received and used   | 100%   |
|                        |      | Formal communication from the executive outlining expectations   | Minimum of one                                     |
|                        |      | Steering committee meetings and attendance   | -  |
|                        |      | Percentage of intervention delivery within 3 months  | ≥ 80%  |
| Fidelity               |      | Percentage of implementation tasks performed <i>always</i> or <i>most of the time</i>  | 80%  |
|                        |      | Adaptations made to HIRAID delivery or implementation strategy   | Adaptations made                                   |
| Quality                |      | Percentage of staff that rated the train-the-trainer course as engaging  | Staff satisfaction                                 |
| Maintenance            |      | Inclusion of HIRAID in emergency nurse orientation and training (e.g. First Line Emergency Care Course)                                | Embedded in health district                        |
|                        |      | Percentage of sites with HIRAID templates in use at ≥ 6 months   | ≥ 80%  |
|                        |      | Percentage of emergency nurses reporting use at ≥ 6 months   |  |

Note. ED: emergency department.

#### **4.7.4 Analysis and Integration**

Quantitative and qualitative data (see Sections 4.7–4.10) were analysed for each discrete study that informed the evaluation. Data were integrated by merging the quantitative and qualitative findings into the corresponding RE-AIM domains (see Table 4.4). Additional data sources were reviewed and included as a descriptive summary of the relevant findings aligned with the appropriate RE-AIM domains.

Merging the data enables the findings from each data source to be integrated and, where appropriate, compared (Fetters et al., 2013). This process provides a more comprehensive understanding of the outcomes for each RE-AIM domain. When merging the data, it was necessary to assess the outcomes of the studies and determine the ‘fit’ of the data. This process of assessing fit informed whether the findings measuring the same domain were congruent, revealing inconsistencies and providing new insights or additional details to expand the findings (Fetters et al., 2013). Chapter 6 reports the results of the data integration.

A detailed overview of the methods, instruments and data collection processes for each of the studies that informed the evaluation of the implementation is now provided in the following sections.

#### **4.8 Study 2: Accuracy of Nursing Documentation**

Study 2 (see Figure 4.7) evaluated the effectiveness of the HIRAID implementation based on the accuracy of emergency nurses’ post-triage documentation. Additional patient and health service-related outcomes were evaluated as part of the broader program of research (Curtis et al., 2023). Documentation templates were a key strategy in the HIRAID implementation to capture nurses’ assessment findings. Therefore, Study 2 assessed the effect of HIRAID on the accuracy of nursing documentation. The following subsections provide a brief overview of the aim, study design, inclusion criteria and data collection and analysis. Additional details related to the study methods and results can be found in Publication 4 (Kennedy, Lam, et al., 2025) embedded in Chapter 5.

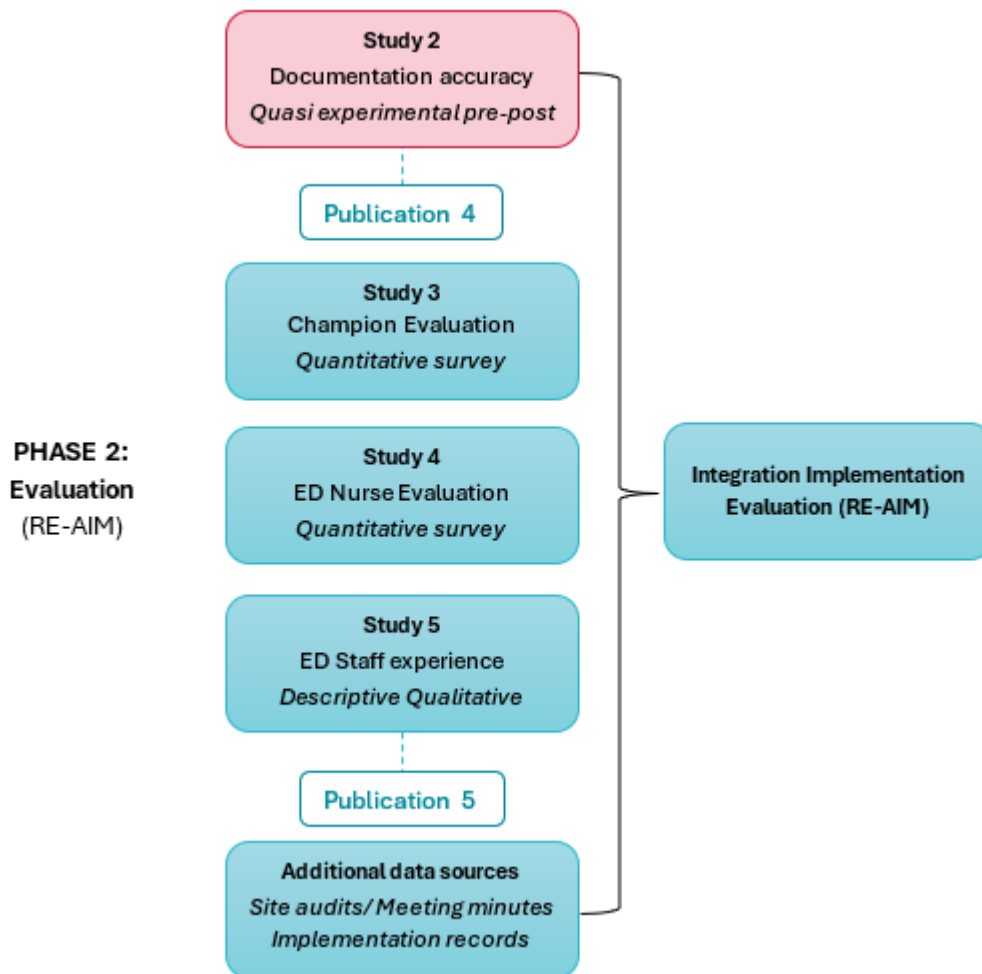


Figure 4.7. Study 2: Documentation evaluation.

#### 4.8.1 Aim

The aim of this study was to determine whether HIRAID improved the accuracy of nurses' documentation across a large rural health district.

#### 4.8.2 Design and Methods

A quasi-experimental pre-post study design was used to evaluate emergency nurses' post-triage documentation. Quasi-experimental designs are used to determine causality when subjects cannot be randomised into groups (Siriwardena, 2013). Given the nature of the intervention, it was not feasible to conduct a randomised study because implementation necessitated system-wide changes that would be applicable to all emergency nursing staff. Therefore, to evaluate the outcomes of the HIRAID implementation, a random sample of clinical records that met the inclusion criteria (see below) for the 3-month period prior to HIRAID implementation were compared with a random sample of clinical records for the 3-month period commencing 6 months after HIRAID implementation.

### **4.8.3 Inclusion Criteria for Review**

Five presenting complaints that are among the most common presentations to EDs in NSW (Dinh et al., 2016) were selected as the focus of the documentation audit. The inclusion criteria were adult or paediatric patients who:

- presented with shortness of breath, fever or abdominal, chest or limb pain
- were triaged on the Australasian Triage Scale as Category 2, 3 or 4
- were admitted to or transferred from ED for ongoing care
- had an ED length of stay greater than 1 hour.

The records to be reviewed were determined in consultation with thesis supervisors and senior clinicians from the LHD during the planning phase to identify the presentations where emergency nurses would be expected to apply HIRAIID and complete relevant documentation. Initially, these included records documenting the administration of analgesia or nurse protocols for both admitted and discharged patients. However, on initial review, it became apparent that nurse protocols were not being consistently recorded, making it difficult to identify nurse involvement, particularly for patients who had been cared for by nurses in the waiting room. After consulting with thesis supervisors, it was decided to amend the inclusion criteria to exclude patients who had been discharged. This is because patients who are admitted or transferred are assessed by emergency nurses throughout their ED stay. Senior clinicians agreed that this would be the expectation.

### **4.8.4 Sample Size and Record Selection**

Based on previous work (Munroe et al., 2022) and the five presenting complaints listed above, we calculated that to achieve 80% power, a significance of 5% and an effect size of 0.3, the sample size must be at least 110 records (22 for each presenting complaint) both before and after the intervention. Power analysis was conducted using two independent *t*-tests.

An emergency CNC employed in the LHD generated a report of patient attendance to the ED using FirstNet, an electronic medical record software designed for and used in public EDs in NSW. To identify records for review, the report included all the following presenting complaints:

- Respiratory, shortness of breath

- Respiratory, asthma
- Fever
- Pain, abdominal
- Pain, chest
- Pain, limb lower/hip
- Pain, limb upper/shoulder
- Pain, joint.

The CNC systematically cleaned the data based on the inclusion and exclusion criteria listed in Section 4.8.3. All records that met the inclusion criteria were retained and allocated a unique identifier. Any identifiable data were separated and securely stored. The CNC created an Excel spreadsheet containing the unique identifiers, facility and presenting complaint and transferred via a secure platform.

With the assistance of a biostatistician, a stratified random sample of the records in the spreadsheet received from the CNC was generated. The sample was stratified based upon the estimated number and proportion of presentations per region for the 12-month period prior to study commencement (see Table 4.6). The generated random sample was returned to the CNC, who was provided instruction to link the randomised records in the spreadsheet to the full records using the identifiers. The CNC then uploaded the full records into the REDCap (Research Electronic Data Capture) web application to enable the full review (see Section 4.12 for further details on data management).

Table 4.6. Emergency department presentations by region in the Southern New South Wales Local Health District, 2019–2020

| Region      | No.     | Percentage |
|-------------|---------|------------|
| Eurobodalla | 25,914  | 23.4%      |
| Southern    | 33,700  | 30.4%      |
| Northern    | 51,192  | 46.2%      |
| Total       | 110,806 | 100%       |

During the 6-month implementation phase of the study, one of the Level 2 EDs changed its model of care. Therefore, investigators at the University of Sydney and the Southern NSW LHD decided to exclude it from the evaluation because nurses at this facility were not required to use the HIRAIID framework and documentation templates.

#### **4.8.5 Data Collection Instrument**

The accuracy of emergency nurses' post-triage documentation was assessed using a modified D-Catch instrument, which has previously been used in a review of emergency nursing documentation following HIRAID implementation (Munroe et al., 2022). The instrument includes emergency presentation and patient details and evaluates nurses' initial documentation, including the essential elements of emergency nursing care: patient history, red flags, assessment, interventions, diagnostics and plan for ongoing care. Publication 4 (Kennedy, Lam, et al., 2025), presented in Chapter 5, provides a more detailed overview of the study methods, modified D-Catch instrument and essential elements of emergency nursing care. Appendix 12 shows the modified D-Catch data dictionary, including the rating scales and descriptors, included in Publication 4. For each presenting complaint, a comprehensive list of red flags was extracted from evidence-based clinical guidelines (Curtis & Moules, 2020) (see Appendix 12). Reviewers were able to record additional red flags not available for selection if required.

#### **4.8.6 Data Collection**

Prior to commencing data collection and guided by a detailed data dictionary, a sample of ten records were reviewed to test the D-Catch instrument and ascertain the location of the required data elements in the electronic medical records. These details were recorded in the data dictionary to ensure consistency in data collection. These records were reviewed in full by the thesis author, with guidance from supervisors when required. Challenges related to data collection were discussed with supervisors during the data collection process.

#### **4.8.7 Data Analysis**

After extracting the data into Excel from REDCap™, it was imported into IBM SPSS Statistics 28.0 for analysis. The data were summarised using descriptive statistics—mean and standard deviation (*SD*) or median and interquartile range (*IQR*) for continuous variables and number and percentage for categorical variables. The pre- and post-intervention medical records were compared using the two-sample *t*-test for continuous variables and Pearson's chi-squared test for categorical variables.

Publication 4 (Kennedy, Lam, et al., 2025), embedded in Section 5.3.1, provides further details on the methods and results of Study 2.

## **4.9 Study 3: HIRAID Champion Evaluation of Implementation**

Study 3 (see Figure 4.8) was conducted to evaluate the *implementation quality* domain in the RE-AIM framework. The HIRAID champions played a crucial role in implementing the HIRAID strategies. A train-the-trainer model was used to train senior emergency nurses to become HIRAID champions and provide onsite support (see Section 4.6). The engagement of senior clinicians as HIRAID champions was critical given the geographical spread of the Southern NSW LHD, particularly for sites with no onsite educational support, and to provide after-hours support at all sites. All nurses who completed the training were invited to participate in two surveys—one to evaluate the train-the-trainer course and the other to assess their fidelity to the HIRAID implementation.

### **4.9.1 Design and Methods**

Quantitative surveys were used to evaluate the train-the-trainer course and assess HIRAID champions' fidelity to the implementation strategy. This survey design enabled evaluation over a large area at a single point in time, providing a cross-sectional sample of the population (Saks & Allsop, 2013). It also enabled the use of a standardised measure (Saks & Allsop, 2013) to determine participants' level of satisfaction with the train-the-trainer course and the degree to which they used the implementation strategies as intended during HIRAID implementation.

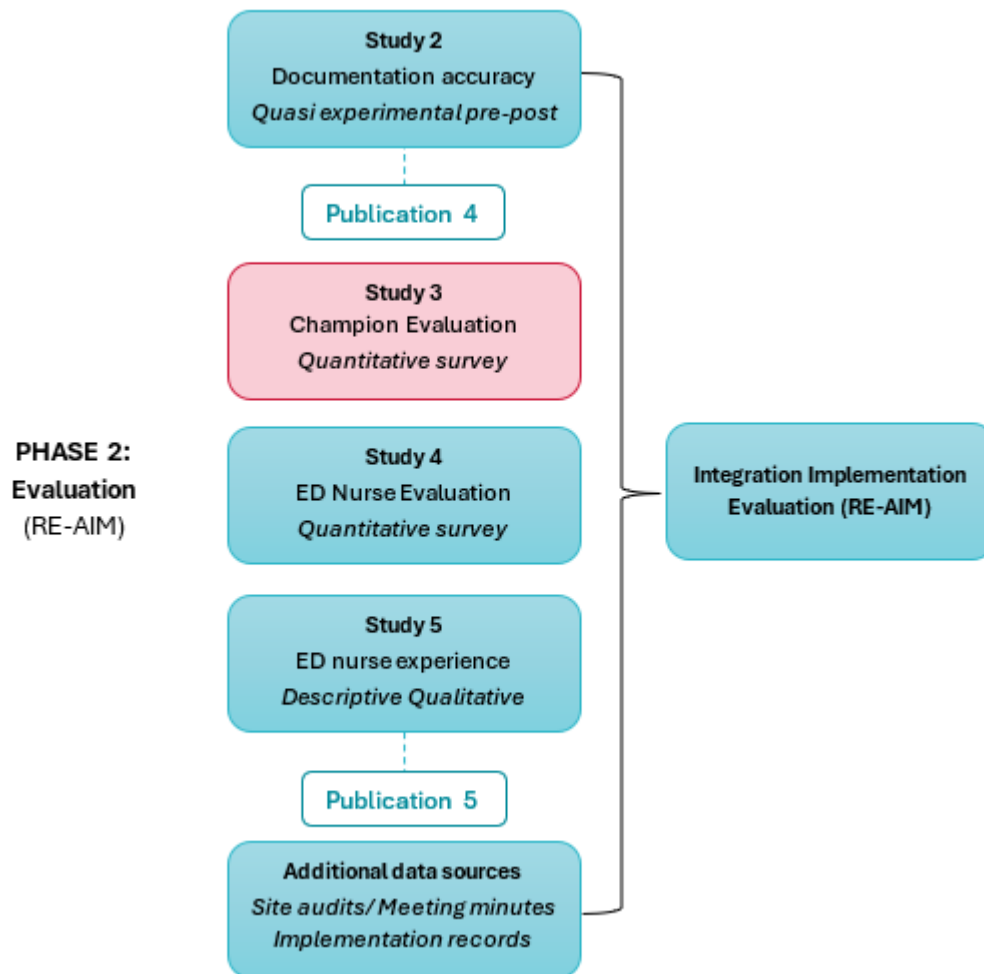


Figure 4.8. Study 3: HIRAID instructor evaluation of implementation.

#### 4.9.2 Survey Distribution to Instructors

Survey 1 was used to evaluate nurses' perceptions of the train-the-trainer course. All emergency nurses who attended the HIRAID champion (instructor) training were provided with a hard-copy survey during the course to allow time for completion. Completion of the survey was voluntary. A box was placed at the venue exit for participants to return the survey if they chose to complete it. Consent was implied with the return of the survey on completion of training.

Survey 2 was used to evaluate nurse instructors' fidelity to the HIRAID implementation strategy. A unique survey link with an invitation to participate and a participant information sheet (see Appendix 10) was sent via REDCap to the email addresses of all nurses who had completed the training. The survey was open for 4 weeks, and automatic weekly reminders were sent to those who had not yet completed it. Participants who completed the survey were given a A\$30 gift voucher. The initial plan was to distribute

the survey 12 weeks following HIRAID implementation. However, because of implementation delays at some sites, this was delayed for a further 5 weeks. Surveys were distributed in mid-July 2021.

#### **4.9.3 Survey 1: Instructor Course Evaluation**

Survey 1 was used to evaluate the delivery of the train-the-trainer course and inform future improvements. Evaluation was based on participants' perceived engagement with the course and perceived preparedness to implement HIRAID following the course.

The survey instrument included the date of the course, followed by six questions on course delivery and nurse preparedness. Answers were based on a five-point Likert scale (1 = *strongly disagree* to 5 = *strongly agree*). Two open-ended questions—one related to suggestions for course improvement and the other to general feedback—gave participants the option to provide feedback (see Appendix 13). The survey was based on a standard survey used in the evaluation of course delivery in LHDs, with some questions specifically tailored to HIRAID course delivery. No personal details were collected.

#### **4.9.4 Survey 2: Instructor Implementation Fidelity**

Survey 2 was used to evaluate the extent to which HIRAID was implemented according to the implementation strategy (fidelity). The survey instrument comprised 14 questions on whether the strategies were implemented as intended, with answers based on a four-point Likert scale (1 = *not completed* to 4 = *always/almost always completed*). Nurse instructors who made any adjustments to the education program could provide details on the changes made in an additional question. Respondents were asked to write free text on specific implementation activities and what they did or did not like about HIRAID (see Appendix 14). No personal details were collected because respondents were identifiable via their email if required and their hospital facility and position were already known. The survey instrument was managed in REDCap and tested for face validity by three senior clinicians at the study site. Some functional adjustments to the survey were required before distribution.

#### **4.9.5 Data Analysis**

Quantitative descriptive data analysis was conducted in IBM SPSS Statistics 28.0. Statistics were reported for the LHD overall and according to the level of the ED (i.e. Level 2 and Levels 3/4 combined). Continuous data were tested for normality, with non-

parametric methods being used for non-normal distributed variables. The data were summarised using descriptive statistics (means and SDs or medians and IQRs for continuous variables and counts and percentages for categorical variables). Where relevant, results were compared according to ED levels using two-sample *t*-tests for continuous variables and Pearson's chi-squared test for categorical variables. Given their brevity, qualitative data (free text responses) were managed in Excel and grouped according to common themes. A descriptive overview and exemplar quotes are provided where relevant.

Fidelity was measured according to respondents' level of agreement with statements. This was guided by the literature and the measures established during Phase 1. Fidelity instruments and measures vary considerably, with little consensus on the appropriate level of agreement (Bond & Drake, 2020; Wickersham et al., 2011). Fidelity was measured as 'high fidelity' with  $\geq 80\%$  agreement with a score of 4 (i.e. the strategy was delivered as intended), 'moderate fidelity' as 60%–79% agreement and 'low fidelity' as  $< 60\%$  agreement.

#### **4.10 Study 4: Emergency Nurse Evaluation of Implementation**

Study 4 (see Figure 4.9) involved a survey of emergency nurses and informed the evaluation of three RE-AIM domains: effectiveness, implementation quality and maintenance. The survey was distributed in September 2021, 6 months post implementation. The following subsections include an overview of the aim, survey design, methods and analysis.

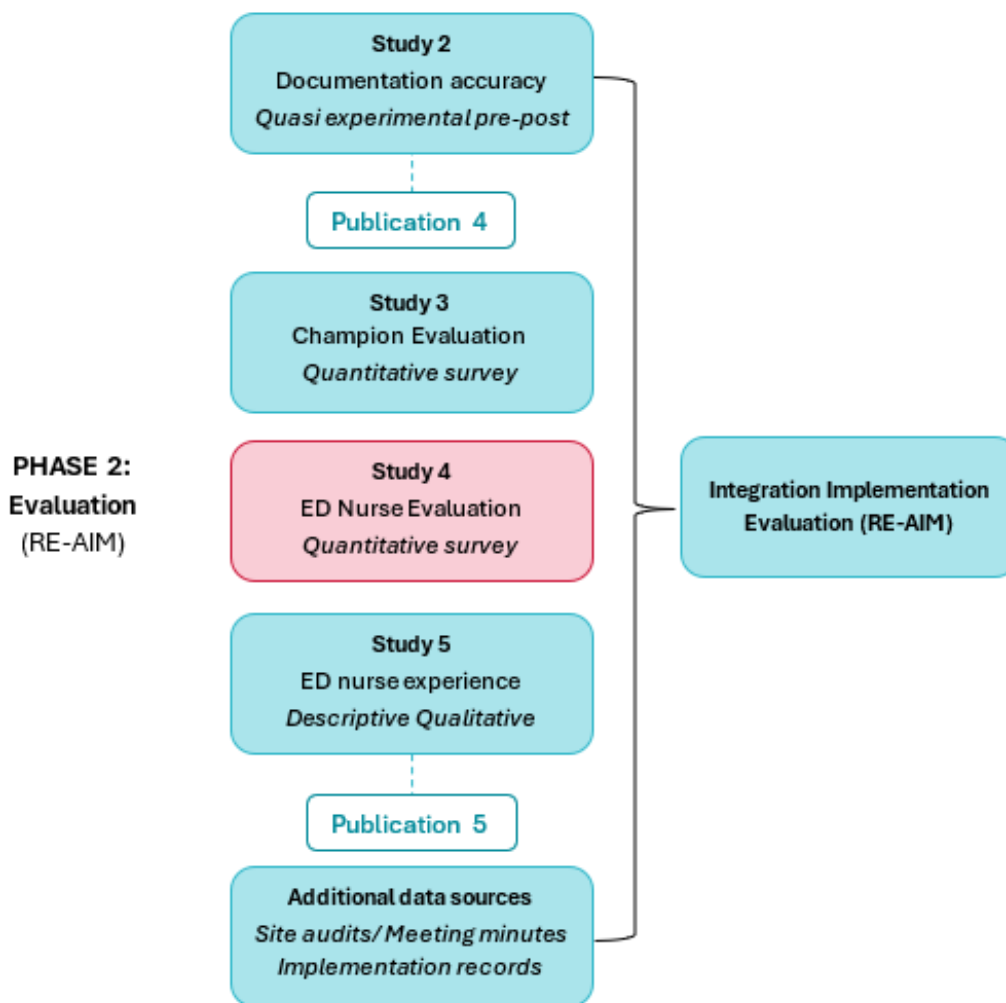


Figure 4.9. Study 4: Emergency nurse evaluation of implementation.

#### 4.10.1 Aim

The aim of Study 4 was to evaluate the HIRAID implementation strategy in terms of its delivery, use and adaptation.

#### 4.10.2 Design and Methods

A cross-sectional quantitative survey was used to evaluate emergency nurse perspectives of HIRAID 6 months after implementation. A cross-sectional survey provides a snapshot at a point in time and offers flexibility because it can be administered electronically across a large geographic area (Connelly, 2016). It provides a standardised approach to evaluate clearly defined items and enable comparisons between sites (Saks & Allsop, 2013).

The survey comprised 15 questions plus additional questions that allowed respondents to expand on their initial responses. The first section collected basic demographic information (years of experience, place of work, postgraduate qualifications). The second

part comprised the survey on emergency nurses' evaluation of HIRAID implementation strategies (see Appendix 15). Three questions were related to whether nurses received the implementation strategies, with answers based on a yes or no response. This was followed by a series of questions on the degree to which the implementation strategies were used, with answers based on a five-point Likert scale (1 = *never* to 5 = *always*). REDCap has an in-built validation, with all items requiring a response to enable survey completion and prevent missing data. Respondents also had the option to provide free text responses to expand on why they did or did not use a strategy. The survey was tested for face validity and functionality by three senior clinicians, and their input informed the expansion of options for education delivery.

#### **4.10.3 Participant Recruitment**

The participant recruitment process was described in Section 4.5.3.2. All nursing staff permanently employed in an ED or multipurpose service in the Southern NSW LHD were eligible to participate. A participant information sheet accompanied all communications (see Appendix 6).

The survey was conducted in early September 2021, 6 months after the commencement of HIRAID implementation. Initially, the survey was intended to be open for 4 weeks, but, following consultation with senior clinicians at the study site, this was extended by a week to 13 October 2021 because of the low response rate.

#### **4.10.4 Data Analysis**

Section 4.9.5 provided an overview of the data analysis for all surveys used to evaluate the HIRAID implementation. To evaluate the degree to which respondents were exposed to or engaged in an implementation strategy, the proportion of those who rated statements as 4 or 5 on the Likert scale (i.e. *most of the time* or *always*) was calculated.

#### **4.10.5 Challenges**

From late June 2021, NSW experienced extensive COVID-19 lockdowns and travel restrictions (Xiao et al., 2021), preventing travel to study sites until November 2021. During this period, the travel restrictions changed constantly, and local outbreaks in some rural communities required people to quarantine. These issues affected staffing and placed increased demands on emergency staff. These effects were not uncommon, as indicated by the findings of a scoping review on the effect of the pandemics on rural EDs

(Barnes & Crilly, 2022). Because of these restrictions, emergency CNCs and nurses who had completed the train-the-trainer course were requested to make staff aware of the surveys to increase response rates.

#### **4.11 Study 5: Emergency Nurses' Experiences of Implementation**

Study 5 (see Figure 4.10) was conducted to evaluate two domains in the RE-AIM framework: effectiveness and quality of the HIRAID implementation. Qualitative methods provide greater clarity on the effect of an intervention and how it operates in certain contexts and build on the findings of quantitative methods (Glasgow et al., 2019; Hamilton & Finley, 2019). Implementing the HIRAID framework required emergency nurses to apply it in practice. Therefore, it was important to gather the experiences of emergency nurses to obtain insights into the perceived effects of the framework in practice and how implementation was executed across the study sites.

The manuscript related to this study—Publication 5 (Kennedy, Curtis, et al., 2025)—has been submitted to a journal for review and is included in Chapter 5 (Section 5.3.4) of this thesis. The following subsections provide a brief overview of the aim, methods and data analysis for Study 5.

##### **4.11.1 Aim**

The aims of Study 5 were to explore:

- emergency nurses' understanding of HIRAID
- the effect of HIRAID on emergency nursing practice
- emergency nurses' experiences of the strategies used to implement HIRAID in practice.

##### **4.11.2 Design and Methods**

Given the absence of qualitative studies related to emergency nurses' experience of HIRAID implementation, a qualitative descriptive study was used as a pragmatic approach to explore this little-understood phenomenon (Kim et al., 2017). Semi-structured interviews were conducted to explore nurses' experiences of HIRAID and its implementation, providing a standardised approach but enabling flexibility to explore concepts as the interviews progressed (C. A. Green et al., 2015).

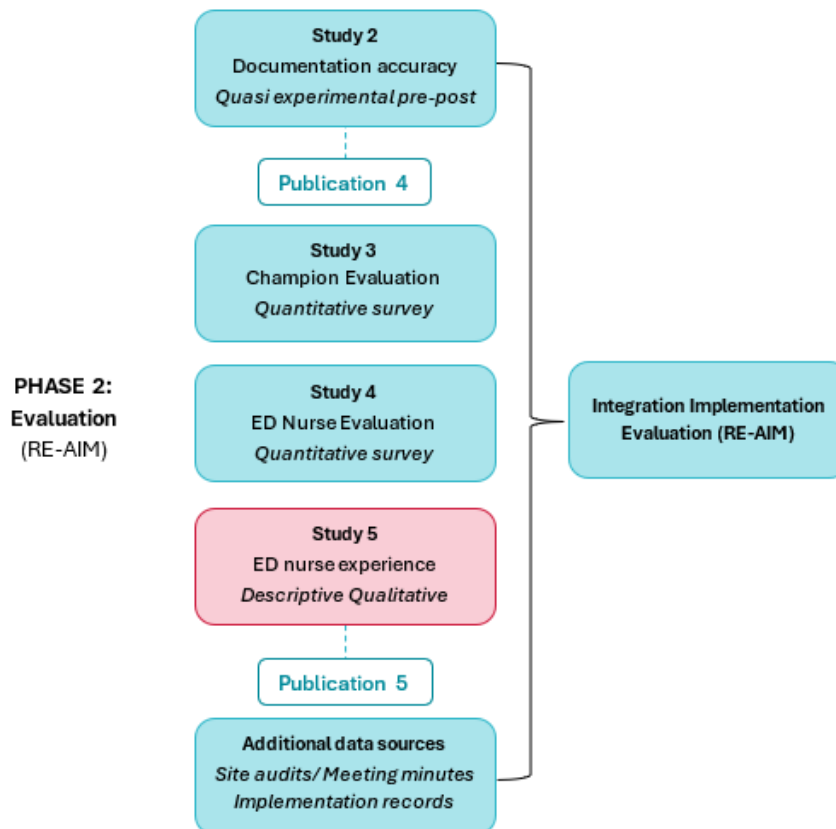


Figure 4.10. Study 5: Emergency nurses' experiences of HIRAID and its implementation.

#### 4.11.3 Participant Recruitment and Consent

Emergency nurses indicated whether they were willing to participate in interviews when completing either the implementation evaluation survey or the emergency nursing survey. A participant information sheet was made available to nurses for review prior to indicating their expression of interest (see Appendix 16).

Nurses who had expressed interest in participating in an interview were emailed an invitation to schedule an interview time using Microsoft Bookings, which enabled them to select their preferred day (Monday to Saturday) and time over a 6-week period and collected their contact details. Once a booking was made, the interviewee received an email confirmation along with thesis author's contact details and an option to modify the booking online if required. Additionally, a calendar booking was sent to thesis author including the interviewee's contact details. Appendix 17 shows an example of the invitation email, booking page and confirmation.

#### **4.11.4 Interview Guide Development and Interviewer Training**

An interview guide was developed, in consultation with supervisors, that included a preamble (ensuring that all requisite processes were consistently followed), four brief demographic questions and a series of questions about the HIRAID framework and implementation activities (see Appendix 18). Interviewees' basic demographic information was collected prior to commencing the interview.

Following development and refinement of the interview schedule, five pilot interviews were conducted with a supervisor, who was also an ED clinician with extensive experience and expertise in qualitative research. An additional pilot interview with a second supervisor who had ED expertise but was not as familiar with the interview schedule was also completed. Testing the interview schedule enabled the thesis author to check the clarity, order and flow of the interview questions and prompts to ensure it would elicit the subjective experiences of emergency nurses (McGrath et al., 2019).

The first three pilot interviews were completed over a 1-week period, with the supervisor providing feedback on interview technique. Given that I had no previous experience conducting qualitative interviews, this was invaluable. The feedback helped to develop my interview skills, including active listening, which is essential for qualitative interviews.

#### **4.11.5 Data Collection**

Semi-structured interviews over a 6-week period from October to December 2021. Because of the COVID-19 pandemic, all interviews were conducted via telephone to provide consistency in data collection. Moreover, some rural areas experience unstable internet access, and interviewees' familiarity with online meeting platforms could not be guaranteed.

All interviews were audio recorded on two devices in case of equipment failure, with written notes taken during the interviews as required. Following the initial interviews, I met with a supervisor to openly reflect on how they went. This process assisted in further developing my interview skills and identifying areas that warranted more exploration in subsequent interviews. Section 4.13 provides details related to my position as researcher and actions taken to minimise bias.

#### **4.11.6 Data Analysis**

Data analysis was based on qualitative content analysis (Graneheim & Lundman, 2004) using NVivo 14. Publication 5 (Kennedy, Curtis, et al., 2025), which is included in Chapter 5 (Section 5.3.4), provides a detailed overview of data analysis and findings.

#### **4.12 Data Management and Storage**

All data were managed according to a research data management plan (see Appendix 19), the *Australian Code for the Responsible Conduct of Research* (NHMRC, 2018) and University of Sydney policy. The Research Data Store (RDS) is the University of Sydney's data storage platform, which provides secure hosting and routine backup of research data. It is accessible only to investigators nominated by the chief investigator (lead supervisor).

All surveys apart from the instructor course evaluation survey were created in REDCap (<https://catalyst.harvard.edu/services/redcap/>), a secure web-based application for data capture (Harris et al., 2009) that is managed and maintained in a secure server by the University of Sydney.

The documentation review instrument was also created in REDCap. To mitigate the risk of transferring identifiable data from the records, all data were handled by LHD employees who were nominated on the ethics application, and records for review were uploaded directly into REDCap (see Section 4.8.4). On completion of data collection in REDCap, data were exported and stored directly in the RDS. Personal identifiers associated with the implementation survey (see Section 4.9) and nurse interviews (see Section 4.11) were stored securely in the RDS, separate from the data source, along with details collected for the purposes of vouchers.

The champion training evaluation survey was paper based. Following the completion of the training, I entered all survey responses into Excel. The hard-copy surveys were scanned, and the Excel file and scanned copies were stored in the RDS. The paper copies were securely destroyed.

All data related to the project will be stored for a minimum of 15 years in accordance with the *Australian Code for the Responsible Conduct of Research* (NHMRC, 2018).

### **4.13 Researcher Bias**

Researcher bias occurs when the personal opinions of the researcher influence the research findings (Buetow & Zawaly, 2022). Bias may be intentional or unconscious and can occur at any stage in the research process (Roulston & Shelton, 2015). The definition of bias varies to some extent. In quantitative research, there are multiple sources of potential bias, from selection bias, which refers to interference in the sampling process, to confirmation bias, where data are selectively reported to support the researcher's hypothesis. These create threats to study validity, resulting in the misrepresentation of study findings (Roulston & Shelton, 2015). Irrespective of whether the research is qualitative or quantitative, it is important for the researcher to critically reflect on how their personal values or suppositions may influence the research process from conceptualisation and design to data analysis and interpretation of findings.

As an experienced emergency nurse who had been previously exposed to the HIRAID framework, I was acutely aware of my personal thoughts and beliefs around emergency nursing practice. It is impossible to overlook this knowledge. Being aware of my opinions on the role of HIRAID in emergency nursing was particularly important when conducting the interviews to ensure I did not project them when asking questions or reacting to responses. As the interviewer, I had to be conscious of my knowledge of emergency nursing and nursing practice in general to ensure that I sufficiently explored interviewees' responses and understood their perspectives rather than making assumptions about their meaning based on my own experience. When an interviewee sought to validate their response or experience (e.g. 'Is that what you are looking for?'), I explained that there was no right or wrong answer and that I wished to understand their own experience, which may differ for everyone.

Throughout the course of this research, I had regular meetings with my supervisors, providing me with the opportunity to review each stage of the research, reflect on the findings and receive guidance on additional areas to explore as the research progressed. This process of review and reflection ensured transparency at all stages of the research, and notes were taken for every meeting, documentation decision and action.

#### **4.14 Conclusion**

In this chapter a comprehensive overview of the multimethod design for the research presented in this thesis was provided. First, the methods used in the embedded mixed methods study in Phase 1 were discussed, the results of which informed the development of a HIRAID implementation strategy in the Southern NSW LHD. Then an overview of Phase 2, specifically the evaluation methods guided by the RE-AIM framework was presented. A detailed overview of the methods for each of the discrete studies informing the evaluation was included. In Chapter 5 the results of each of the discrete studies conducted for this thesis is presented.

## **Chapter 5: Results**

In Chapter 4 the design and methods for the research presented in this thesis were detailed. In this chapter the results of the studies conducted in Phases 1 and 2 are reported. It includes four publications (Publications 2–5) that have either been published or submitted for review at the time of thesis submission.

Phase 1 of the research pertained to Study 1, which generated two publications: Publication 2 reports on the potential enablers of and barriers to HIRAID implementation, while Publication 3 maps the findings from Publication 2 using the BCW to inform the development of an evidence-based implementation strategy.

Phase 2 of the research involved four studies, generating two publications. First, Study 2 involved an audit of emergency nurses' post-triage documentation to evaluate implementation effectiveness, the results of which are presented in Publication 4. Study 3 involved two quantitative surveys of HIRAID champions who had completed the train-the-trainer course. The surveys gathered their perspectives on course delivery and HIRAID implementation. Study 4 involved a quantitative survey of emergency nurses to capture their experiences of HIRAID implementation and use. Finally, Study 5 involved qualitative interviews of emergency nurses to understand their experiences of HIRAID implementation, the results of which are presented in Publication 5. Figure 5.1 reorients the reader to the phases of the research and studies discussed in this chapter.

### **5.1 Phase 1: Designing for Implementation**

The results of Phase 1 are reported in Publications 2 and 3. The research reported in Publication 2 addresses Objective 1: to identify the enablers of and barriers to the implementation of HIRAID based on the TDF. Publication 3 addresses Objective 2: to develop an evidence-based implementation strategy using the BCW.

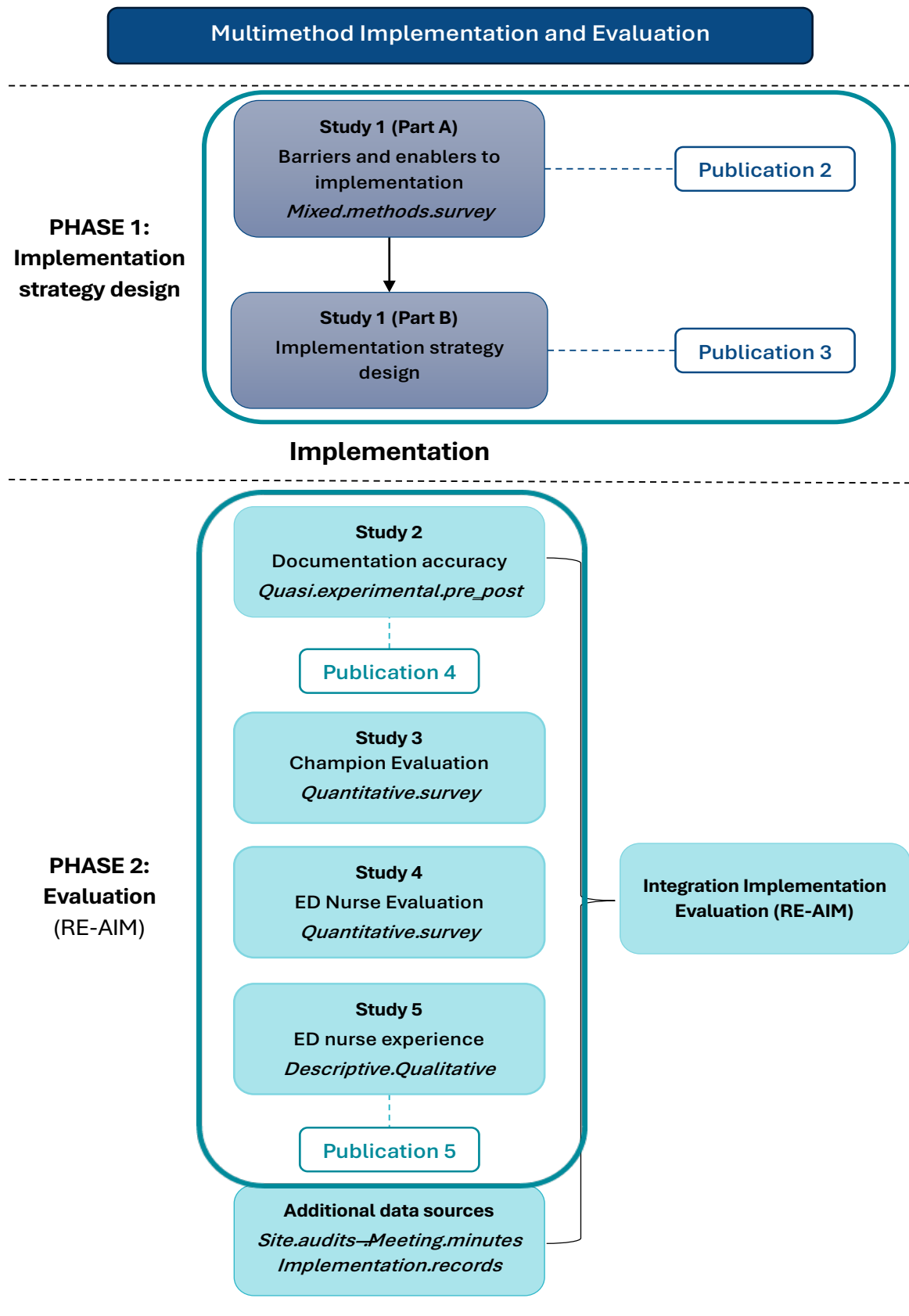


Figure 5.1. Overview of research phases and studies.

### **5.1.1 Study 1, Part A (Publication 2)**

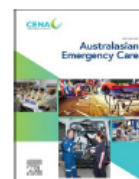
Publication 2 fulfils Objective 1: To identify the enablers of and barriers to HIRAID implementation using the TDF:

Kennedy, B., Curtis, K., Kourouche, S., Casey, L., Hughes, D., Chapman, V., Fry, M. (2024). Establishing enablers and barriers to implementing the HIRAID® emergency nursing framework in rural emergency departments. *Australasian Emergency Care*, 27(4), 290–298. <https://doi.org/10.1016/j.auec.2024.08.002>



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## Australasian Emergency Care

journal homepage: [www.elsevier.com/locate/auec](http://www.elsevier.com/locate/auec)

## Establishing enablers and barriers to implementing the HIRAID® emergency nursing framework in rural emergency departments

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## ABSTRACT

**Background:** Rural Australia has large geographic distances between emergency departments with variability of services and medical support. Emergency nurses must be appropriately skilled to assess and manage unpredictable and diverse presentations. HIRAID® is an evidence-based framework to support emergency nurses in assessment and care delivery. To inform implementation, the study aimed to identify the enablers and barriers to introducing HIRAID® in practice.

**Methods:** This embedded mixed methods study was conducted in 11 rural, regional emergency departments in Southern New South Wales, Australia. Respondents completed a 22-item survey, indicating their level of agreement on statements related to practice change, free text responses were optional. Quantitative data were analysed using descriptive statistics and qualitative data using content analysis. Results were identified as barriers or enablers, then integrated and mapped to the Theoretical Domains Framework.

**Results:** The survey was completed by 102 (54 %) nurses. Two enablers and four barriers to implementation were identified and mapped to 10 Theoretical Domains Framework domains. Key barriers were workplace limitations, such as time and resources, and knowledge of the HIRAID® intervention.

**Conclusion:** Barriers varied between facilities related to adequate support to implement and the impact on patient care. The results will inform a strategy to implement HIRAID®.

## Introduction

Emergency Departments (ED) are challenging clinical environments, with diverse patient presentations of varying complexity and acuity. Australia encompasses an area of 7,992,024 km<sup>2</sup> with more than 70 % of the population residing in major cities [1]. The challenges to meet the healthcare needs of rural communities are compounded by large geographic distances and service availability [2]. Rural Australians have poorer health outcomes and a greater incidence of chronic disease compared to their metropolitan counterparts, this is in part attributed to challenges in access to healthcare [2].

Service provision in rural areas is further impacted by limited nursing and medical staffing [3,4]. EDs in smaller rural towns have

reduced medical cover, with many reliant on general practitioners and on-call medical cover [5]. For serious conditions, telehealth is often used to support nurses in managing patients [6].

Emergency nurses across rural Australia are vital in the delivery of emergency care as they are the first (and sometimes only) clinician a patient will see [5–7]. They must have the knowledge and capability to effectively assess and make informed, sound clinical decisions to select and deliver quality interventions and care. Emergency nurses must be appropriately skilled to critically analyse and integrate findings obtained from the patient's history and physical examination to establish the priorities in clinical care [8]. Appropriate synthesis of information supports nurses in clinical decision-making, skills recognised as essential by the College of Emergency Nursing Australasia [9].

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Despite these required core skills, there is no widely used standardised emergency nursing assessment framework. Standardised assessment frameworks support nurses in the assessment and management of patients. Particularly frameworks that consider the undifferentiated patient, support detection of medical or surgical emergencies and early evidence-based interventions and diagnostics [10].

HIRAID® is an emergency nursing framework (History including Infection risk, Red flags, Assessment, Interventions, Diagnostics, communication, and reassessment) developed to support emergency nursing practice (Fig. 1) [11]. HIRAID® was piloted in regional and metropolitan EDs for usability [12] demonstrating improved nursing assessment quality in the simulated environment [13], improved documentation [14], decreased adverse events linked to ED [15] and reduced treatment costs [16]. With many inexperienced ward nurses and non-permanent (casual) or temporary contract nurses working in ED, the local health district (LHD) nursing leadership wanted to ensure emergency nurses were adequately supported. Therefore, the LHD planned to implement the HIRAID® across the district.

Poor uptake of new interventions can be attributed to a lack of appropriately designed, context specific implementation strategies [17, 18]. To optimise implementation of HIRAID® it was necessary to establish the potential barriers and enablers, that may hinder or improve uptake of practice change [19]. Successful and sustained implementation of change in the clinical environment is complex and multifactorial, requiring adequate assessment, planning and support [20,21].

This study aimed to establish the enablers and barriers to implementation of HIRAID® across a rural health district, to inform future development of an evidence-based implementation strategy.

**Methods**

This embedded mixed methods [22] study was conducted in 11 EDs in Southern New South Wales Local Health District (SNSWLHD). The LHD covers a geographical area of approximately 44,534 km<sup>2</sup> and provides services for approximately 211,000 residents plus additional

seasonal visitors [23]. The EDs catered to more than 110,000 annual presentations in 2020–21 [24]. There are six level 2 (small) EDs, three level 3 and two level 4 (larger) EDs [25]. Level 2 EDs have limited diagnostic and medical services onsite, often provided by a general practitioner, or virtual care. Level 3 and 4 EDs have 24 h medical coverage, with greater availability of physicians with specialist emergency training, as well as access to diagnostic clinical services, allied health and administrative support [6]. At the time of the study there were 188 emergency nurses employed in SNSWLHD. Study investigators (KC, BK) visited 10 study sites to meet with staff in September 2020, two months prior to survey distribution. The visits provided an opportunity

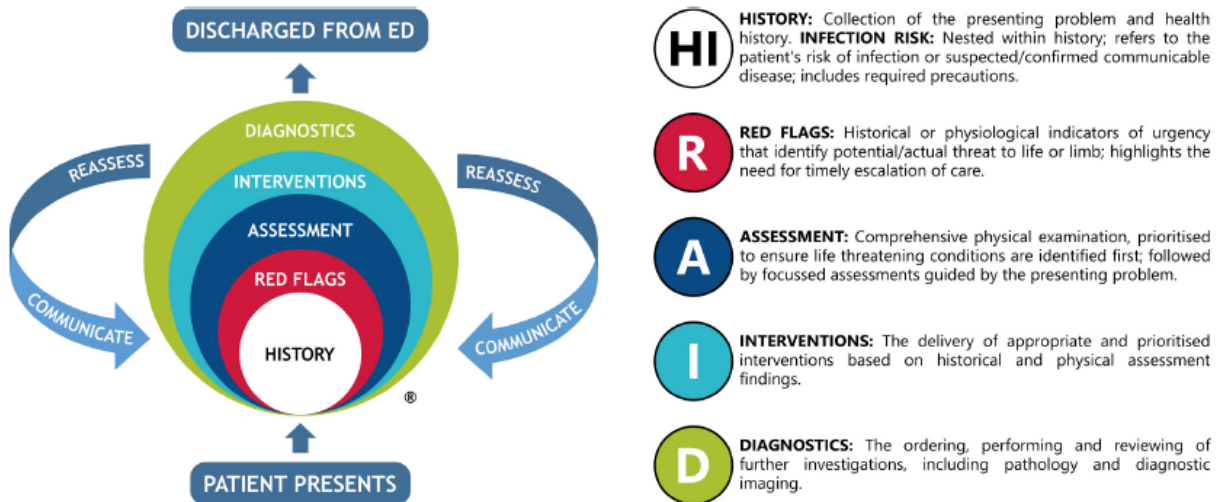
**Table 1**  
Southern NSW Local Health District Emergency Department characteristics.

| Study Site                               | Total ED presentations 2020/21 | Emergency Nurses <sup>a</sup> | ED Level <sup>b</sup> |
|--|--------------------------------|-------------------------------|-----------------------|
| Queanbeyan Hospital                      | 23,539                         | 28                            | 3                     |
| South East Regional                      | 20,071                         | 24                            | 4                     |
| Goulburn Base Hospital                   | 18,342                         | 27                            | 4                     |
| Batemans Bay                             | 13,652                         | 20                            | 2                     |
| Moruya Hospital                          | 10,937                         | 17                            | 3                     |
| Cooma Hospital                           | 10,912                         | 12                            | 3                     |
| Yass District                            | 5865                           | 16                            | 2                     |
| Crookwell District Hospital <sup>c</sup> | 4284                           | 12                            | 2                     |
| Pambula Hospital <sup>c</sup>            | 3098                           | 4                             | 2                     |
| Bombala MPS                              | 1848                           | 14                            | 2                     |
| Braidwood MPS <sup>c</sup>               | 1690                           | 14                            | 2                     |
| <b>Total</b>                             | <b>114,238</b>                 | <b>188</b>                    |                       |

<sup>a</sup> Nurses on ED roster at the time of the study;

<sup>b</sup> Level 2: limited diagnostic and/or medical services, often general practitioner or virtual care led. Level 3 and 4 have 24-hour medical coverage, access to diagnostic clinical services;

<sup>c</sup> Triage category 1 patient cohort not reflected in total ED presentations, < 5 annual presentations.



The HIRAID® framework encapsulates the cyclical nature of patient assessment, in which more than one element of the framework may be performed simultaneously. It also embraces the importance of **reassessment** and **communication**, which are vital components of emergency nursing.

**REASSESSMENT:** The evaluation of care and monitoring of patient progress using a structured approach and repeated at appropriate intervals per condition of the patient.

**COMMUNICATION:** Verbal/non-verbal skills necessary to effectively communicate with patients, families and clinicians, includes using: a structured approach to communicate clinical handovers; graded assertiveness to escalate if needed; and, accurate and comprehensive clinical documentation.

**Fig. 1.** HIRAID® Emergency Nursing Framework.

to engage with stakeholders and answer questions related to the project. Table 1 provides a breakdown of ED characteristics by facility. Ethics approval for this study was obtained from Greater Western Human Research Ethics Committee (2020/ETH02164).

#### Survey Instrument

A 22-item electronic survey was used to aid identification of potential enablers and barriers to inform the development of a HIRAID® implementation strategy. A previously validated survey [12] was adapted to ensure the terminology aligned with the local context and tested for face validity by two local emergency nurse leaders on readability, flow and content before distribution. This resulted in minor editorial adjustments.

The first section of the survey comprised respondent characteristics such as age, place of work and level of experience. Then, 16 questions concerning how respondents liked to learn; their agreement on statements related to practice change; and if HIRAID® was implemented what would support the implementation process. Three open ended questions sought to explore respondent opinion on why they 'would' or 'would not' support HIRAID®, and their perceived needs to implement HIRAID®.

#### Data collection and management

The survey was distributed using REDCap (Research Electronic Data Capture) (<https://catalyst.harvard.edu/services/redcap/>), a secure web-based application for data management and survey tool [26] managed by The University of Sydney. On completion of the survey all data were downloaded and stored in the Research Data Store (RDS), with access mediated by the principal investigator, in line with University of Sydney policy and 2018 NHMRC Australian Code for the Responsible Conduct of Research [27].

#### Recruitment

Surveys were distributed to all eligible staff by a district emergency clinical nurse consultant, with a participant information sheet clearly stating the voluntary nature of the survey and anonymity of survey responses. Consent was implied upon completion of the survey. Surveys were open for four weeks, with weekly reminders. Respondents created their own unique identifier and could withdraw by contacting the research team providing their unique identifier. Incentives are a key strategy known to increase response rates [28]. Therefore, \$20 vouchers suitable to the respondent's location were offered on completion to local businesses, selected as a gesture of support during recovery from recent catastrophic bushfires.

#### Analysis

Quantitative data were analysed with descriptive statistics using SPSS v28 [29]. Continuous variables were tested for normality, non-parametric methods were used for non-normal distributed variables. Aggregate data were generated for the LHD overall, and by ED level [level 2 (n = 6) and level 3 and 4 grouped together (n = 5)]. Quantitative items were considered enablers if greater or equal to 80 % agreement on a positively worded statement or disagreement with a negatively worded statement, overall and by ED level. Where items did not meet the threshold they were classified as a barrier. Due to small numbers of eligible participants at some sites, results could easily be skewed towards the positive or negative therefore, a level of 80 % would ensure relevant enablers or barriers were identified.

Qualitative data from the three open ended questions were explored using NVivo version 12 [30] by two researchers (BK,SK). The first step was to code and then develop themes. The themes were reviewed and consensus reached with only minor adaptations made. Conventional

content analysis was used to gain a more in depth understanding of the data rather than analysing according to pre-determined themes [31]. Themes were considered enablers or barriers based on positively or negatively worded reported statements.

#### Integration of quantitative and qualitative results and mapping to the Theoretical Domains Framework (TDF)

The preliminary enablers and barriers identified from quantitative and qualitative results were integrated by merging qualitative and quantitative findings in a table to generate the final enablers and barriers. Integration was used to determine the data 'fit' [32] and provide greater insight into the findings [32]. That is, whether results from sources were consistent (qualitative data supported the quantitative findings) or inconsistent (contradicted) [32].

The identified preliminary enablers and barriers were mapped to the TDF by two researchers (BK, KC) to generate final enablers and barriers to HIRAID® implementation. The TDF contains 14 domains recognised to influence human behaviour, and has been used frequently in healthcare settings [33]. Human behaviour is essential to the successful implementation and sustained compliance of any intervention in healthcare [33]. The TDF is a validated synthesis of 128 theoretical constructs from 33 theories related to human behaviour and change [34].

#### Results

There were 102 (54 %) surveys fully completed. All 11 EDs (100 %) were represented, and nearly half (42 %, n = 43) of respondents worked in smaller EDs. Respondents reported a median (IQR) 16 (7–30) years' experience as a nurse and 8 (3–16) years' experience working in ED. Respondents from smaller EDs had more nursing experience than those from larger EDs [23(10–35) and 14(6–25) years respectively (U=928.5, p = 0.021)] (Table 2).

#### Quantitative results (preliminary enablers and barriers)

Seven preliminary enablers and seven preliminary barriers to the implementation of HIRAID® were identified. The majority (85.3 %, n = 87) of respondents perceived a benefit to using the same structured approach for nursing assessment. For the small proportion (3.9 %, n = 4) who responded no, the main reason reported was that nurses work differently, and a single method does not suit all nursing contexts (Table 3).

Respondents (99 %, n = 101) overwhelmingly disagreed with both of the statements 'I don't want to learn something new' and 'Too hard to remember anything new', they also disagreed with 'the way we do things is fine, no need to change anything' (93.1 %, n = 95), and 'I am worried I will not know what to do' (83.3 %, n = 85). Most agreed they 'want to do what is best for patient care' (92.2 %, n = 94).

Across the LHD, barriers were predominantly related to concern that 'nothing will change' (72.5 %, n = 74), 'not enough time to change the way of working' (75.5 %, n = 77), and 'I do not understand what HIRAID® is' (76.5 %, n = 78). At smaller EDs only 58.1 % (n = 25) of respondents disagreed 'it will not change the way I care for my patient' compared to 93.2 % (n = 55) at larger EDs. Fewer respondents from the smaller EDs also disagreed 'no one will help with questions' (72.1 %, n = 31), when compared to their colleagues at larger EDs (83.1 %, n = 49), indicating a barrier at the smaller EDs. These differences were not statistically significant (Table 3).

#### Qualitative results (preliminary enablers and barriers)

Thirty-nine (38.2 %) respondents provided free text responses to the three statements related to why they would/ would not support HIRAID® implementation, and what was required if implemented. Five

**Table 2**  
Survey respondent characteristics (n = 102).

|  | Overall<br>n = 102 | Small<br>ED <sup>a</sup><br>n = 43 | Large<br>ED <sup>a</sup><br>n = 59 | P value <sup>b</sup>    |
|--|--------------------|------------------------------------|------------------------------------|-------------------------|
| <b>Current position</b>                            | n(%)               | n(%)                               | n(%)                               |                         |
| Registered nurse                                   | 66<br>(64.7 %)     | 27<br>(62.8 %)                     | 39<br>(66.1 %)                     |                         |
| Endorsed Enrolled Nurse                            | 5 (4.9 %)          | 3 (7.0 %)                          | 2 (3.4 %)                          |                         |
| Leadership role[1]                                 | 29<br>(28.4 %)     | 11<br>(25.6 %)                     | 18<br>(30.5 %)                     |                         |
| Nurse Practitioner                                 | 2 (2 %)            | 2 (4.7 %)                          | 0                                  |                         |
| <b>Gender</b>                                      |                    |                                    |                                    |                         |
| Male   | 20<br>(19.6 %)     | 10<br>(23.3 %)                     | 10<br>(16.9 %)                     |                         |
| Female   | 80<br>(78.4 %)     | 33<br>(76.7 %)                     | 47<br>(79.7 %)                     |                         |
| Rather not say                                     | 2 (2 %)            | 0                                  | 2 (3.4 %)                          |                         |
| <b>Years working as nurse</b>                      |                    |                                    |                                    |                         |
| Median (IQR)                                       | 16<br>(7 – 30)     | 23<br>(10 – 35)                    | 14<br>(6 – 25)                     | U= 928.5,<br>P = 0.021  |
| <b>Years working in ED</b>                         |                    |                                    |                                    |                         |
| Median (IQR)                                       | 8 (3 – 16)         | 10<br>(3 – 20)                     | 7 (3 – 13)                         | U= 1022.5,<br>P = 0.095 |
| <b>Highest post-graduate nursing qualification</b> | n(%)               | n(%)                               | n(%)                               |                         |
| None   | 31<br>(30.4 %)     | 10<br>(23.3 %)                     | 21<br>(35.6 %)                     |                         |
| Graduate Certificate                               | 41<br>(40.2 %)     | 20<br>(46.5 %)                     | 21<br>(35.6 %)                     |                         |
| Graduate Diploma                                   | 18<br>(17.6 %)     | 6<br>(14.0 %)                      | 12<br>(20.3 %)                     |                         |
| Masters or higher                                  | 12<br>(11.8 %)     | 7<br>(16.3 %)                      | 5 (8.5 %)                          |                         |

<sup>a</sup> ED Level – Small (Level 2) and Large (Level 3 and 4),  
<sup>b</sup> inferential statistics not reported on categorical variables due to cell counts being insufficient for reliable analysis

main themes (with 12 sub themes from 78 codes) were generated: i) impact on nursing process/ work (n = 35); ii) organisational support and/or resource availability (n = 15); iii) knowledge or awareness of HIRAID® (n = 12); iv) receptiveness to learning and change (n = 11); and v) impact on patient care (n = 4). There were six enablers and seven barriers within the main themes. Aside from organisational support and resource availability (barrier) and impact on patient care (enabler), the remaining themes were mixed and considered enablers and barriers (Table 4).

**Impact of nursing process/ work**

Respondents described the potential impact of HIRAID® on the nursing process and ways of working as mainly positive, it was perceived the intervention would support practice, provide consistency, and ensure use of evidence-based practice. Applying evidence-based practice was perceived as positive and seen as being part of a nurse's responsibility.

*'Nursing and medicine change so often we should all be prepared to practice with best evidence and keeping up with person centered care changes in the workplace.'* (Respondent 44, level 3 ED)

Respondents also reported that the intervention may support and/or improve current practice,

it would *'improve the way we provide information re patients. Documentation is poor'* (Respondent 28, level 4 ED)

Conversely some respondents also expressed uncertainty around any HIRAID® benefit. Some reported that the intervention would potentially have a negative impact increasing the workload for nurses,

**Table 3**  
Staff response to statements about the plan to introduce HIRAID® (n = 102).

| Item  | Overall <sup>a</sup><br>n = 102<br>n (%) | Small ED<br>n = 43<br>n (%) | Large ED<br>n = 59<br>n (%) | P value <sup>b</sup> |
|---|--|-----------------------------|-----------------------------|----------------------|
| <i>Do you think using the same structured approach to assess patients would be beneficial in your ED? (E)</i> |  |                             |                             | P = 0.901            |
| No/ unsure  | 15<br>(14.7 %)                           | 8<br>(18.6 %)               | 7<br>(11.9 %)               |                      |
| Yes   | 87<br>(85.3 %)                           | 35<br>(81.4 %)              | 52<br>(88.1 %)              |                      |
| <i>Are you willing to learn or adopt something new? (B)</i>   |  |                             |                             |                      |
| No / unsure   | 9 (8.8 %)                                | 9<br>(20.9 %)               | 0 (0 %)                     |                      |
| Yes   | 93<br>(91.2 %)                           | 34<br>(79.1 %)              | 59<br>(100 %)               |                      |
| <i>Proportion of respondents that disagreed on statements related learning HIRAID®</i>                        |  |                             |                             |                      |
| <i>Too hard to remember anything new (E)</i>  | 101<br>(99 %)                            | 42<br>(97.7 %)              | 59<br>(100 %)               |                      |
| <i>I don't want to learn something new (E)</i>  | 101<br>(99 %)                            | 42<br>(97.7 %)              | 59<br>(100 %)               |                      |
| <i>I don't have the headspace to learn something new (E)</i>  | 90<br>(96.1 %)                           | 39<br>(90.7 %)              | 59<br>(100 %)               |                      |
| <i>The way we do things is fine, no need to change anything (E)</i>   | 95<br>(93.1 %)                           | 38<br>(88.4 %)              | 57<br>(96.6 %)              |                      |
| <i>I am worried I won't know what to do (E)</i>   | 85<br>(83.3 %)                           | 36<br>(83.7 %)              | 49<br>(83.1 %)              | P = 0.929            |
| <i>Unsupported by management (B)</i>  | 84<br>(82.4 %)                           | 33<br>(76.7 %)              | 51<br>(86.4 %)              | P = 0.205            |
| <i>I am worried no one will help me with questions when I try and use it (B)</i>                              | 80<br>(78.4 %)                           | 31<br>(72.1 %)              | 49<br>(83.1 %)              | P = 0.184            |
| <i>It will not change the way I care for my patient (B)</i>   | 80<br>(78.4 %)                           | 25<br>(58.1 %)              | 55<br>(93.2 %)              |                      |
| <i>I don't understand what HIRAID is (B)</i>  | 78<br>(76.5 %)                           | 32<br>(74.4 %)              | 46<br>(78.0 %)              | P = 0.677            |
| <i>Not enough time to change the way of working (B)</i>   | 77<br>(75.5 %)                           | 31<br>(72.1 %)              | 46<br>(78.0 %)              | P = 0.496            |
| <i>Nothing will change (B)</i>  | 74<br>(72.5 %)                           | 27<br>(62.8 %)              | 47<br>(79.7 %)              | P = 0.59             |
| <i>I want to do what is best for patient care (E)</i>   | 8 (7.8 %)                                | 3 (7.0 %)                   | 5 (8.5 %)                   |                      |

<sup>a</sup> Enablers for quantitative items were greater or equal to 80 % agreement on a positively worded statement or disagreement with a negatively worded statement, overall and by ED level. Where items did not meet the threshold, they were classified as a barrier.

<sup>b</sup> comparison between ED Level 2 (small) and Level 3/4 (large), P value not reported where cell counts < 5

*'if this creates more work that reduces time spent with patients, I would not support it.'* (Respondent 32, level 3 ED).

**Organisational support and/ or resource availability**

Respondents were concerned there would be a lack of support for HIRAID® due to inadequate organisational support and resource availability. This was attributed to the current workload and lack of staffing and general resources,

*'I am happy to learn new things I just feel we don't get the opportunity to learn new things, due to being worked into the ground with minimal staff'* (Respondent 100, level 4 ED); and *'We do not have ANY of the resources to support the education or implementation of the program. It is unreasonable in the current climate at (sic)'* (Respondent 10, level 2 ED)

Importantly, some alluded to a lack of educational and or managerial support,

**Table 4**  
Qualitative analysis themes and sub themes.

| Theme/ sub theme  | Codes |
|---|-------|
| Impact on nursing process or work (E/B)                                       | 35    |
| Support nursing practice (support and/or enhance) (E)                         | 10    |
| Uncertain on benefit or believe there will be no change with intervention (B) | 8     |
| Benefit to standardised approach to ED nursing practice (E)                   | 8     |
| Intervention increases workload (B)   | 6     |
| Evidence based practice beneficial (E)  | 3     |
| Organisational support or resource availability (B)                           | 15    |
| Lack of support or time for education (B)                                     | 4     |
| Lack of resources, including staff (B)  | 6     |
| Current high workload or time constraints (B)                                 | 5     |
| Receptive to learn or change practice (E/B)                                   | 12    |
| Willing to learn (E)  | 9     |
| Resistant to change (B)   | 3     |
| Knowledge or awareness of HIRAID (B/E)  | 11    |
| Familiar with HIRAID and support implementation (E)                           | 5     |
| HIRAID is primarily a documentation tool (B)                                  | 6     |
| Impact on patient care (E)  | 4     |
| Improve patient care or outcomes  |       |

*'Senior management are happy for the nurse to extend their learning and capability with little or no support, sort of self-directed learning!'* (Respondent 65, level 4 ED)

#### Receptive to learn/ change

Respondents indicated they were receptive to learn and change practice to use HIRAID®, particularly those from larger EDs.

*'I am up for learning something new, it's just ironing out the creases when we implement it.'* (Respondent 35, level 3 ED)

While there was a willingness to learn, there were reported potential challenges. In particular, potential resistance from more senior staff. For example,

*'Road blocks from other staff (older more experienced staff). I look to them for advice on ED patients. If they aren't interested in learning something new, then it won't work.'* (Respondent 39, level 2 ED)

#### Knowledge or awareness of HIRAID®

Some respondents reported existing knowledge of the intervention, they were already using or had learnt HIRAID®,

*'I have seen HIRAID used and think it is a good tool to use.'* (Respondent 72, level 3 ED)

There were some negative comments from respondents who perceived HIRAID® was only related to clinical documentation,

*'The HIRAID is very lengthy to put on notes. It is thorough but repeats info from triage and Dr assessment. It takes a while to fill out properly which can be difficult to fit into a busy ED timeframe.'* (Respondent 21, level 2 ED)

#### Impact on patient care

The final category incorporated respondents perceived benefit to the patient and health outcomes. Responses were positive and expressed support for implementation as it would,

*'Increase patient safety and outcomes of health.'* (Respondent 92, level 2 ED)

#### Integration of quantitative and qualitative results and mapping to the TDF

Seven preliminary enablers and barriers were identified in the quantitative results and six preliminary enablers and seven preliminary

barriers from the qualitative results. Final enablers and barriers were generated through integration of the quantitative and qualitative data. Integration confirmed two final enablers, four final barriers and one combined enabler/ barrier mapped to the TDF. The enablers identified were: i) nurses' capacity to learn new practice; and ii) benefit to nursing practice and patient outcomes. The four barriers included: i) work environment and resources hinder change; ii) lack of knowledge or understanding of HIRAID®; iii) the belief change will not occur, and iv) inadequate support for change. One integrated finding demonstrated discordance in findings, "willingness to learn" was a mix of enabler and barrier (Table 5).

#### Enabler 1: Capacity to learn new practice.

The first enabler respondents believed they had the cognitive capacity to learn. Most respondents disagreed (99 %) that it was too hard to remember something new and they also disagreed that they did not have the headspace for something new. Capacity was further supported with respondent confidence. Respondents were not concerned about knowing what to do when HIRAID® was implemented. This enabler mapped to the TDF domains: *Memory, attention and decision processes, and Belief about Capabilities.*

#### Enabler 2: Beneficial to nursing practice and patient care.

With the second enabler respondents perceived benefit to HIRAID®, with the quantitative findings supporting the structured approach of the framework, and qualitative data suggesting a standardised approach would improve practice. This was further supported with respondents indicating HIRAID® could improve and provide optimal patient care. While respondents indicated broad support, they did not specify why they supported the standardised approach or how HIRAID® would improve practice. This was linked to the TDF domain *Belief about consequences.*

#### Barrier 1: Work environment and resources hinder change.

The first barrier related to the work environment and resources, including time, insufficient staff resources and support. A larger proportion of respondents from smaller EDs indicated there was a lack of support from management in quantitative results which was reflected in the qualitative data. However, respondents were nonspecific about 'who' the support was expected from. These findings were linked to *Environmental Context and Resources* and *Social influences* domains on the TDF.

#### Barrier 2: Lack of knowledge of understanding of HIRAID®.

This barrier highlights the complexity related to an individuals' knowledge and understanding of HIRAID®. The quantitative results highlighted a knowledge deficit, with respondents indicating they did not understand HIRAID®. This finding was supported by the qualitative results and expanded demonstrating respondents believed HIRAID® was solely a framework for clinical documentation. Respondents also expressed uncertainty on the benefit or how HIRAID® was different to current practice. The uncertainty was further supported by quantitative and qualitative findings with respondents' belief it would not change current practice but rather add to the current workload. The TDF domains *Knowledge* and *Belief about Consequences* were mapped to this barrier.

#### Barrier 3: Practice will not change.

The third barrier to HIRAID® implementation raised the notion that respondents across the LHD perceived that nothing would change. Quantitative results indicated that this barrier was greater at the smaller EDs. Qualitative findings raised concern that other nurses would hinder implementation if they chose not to engage. These findings were associated with the TDF domains *Optimism* and *Social/ professional role and identity.*

#### Barrier 4: Inadequate support to implement.

The final barrier identified that respondents were concerned about lack of support when implementing HIRAID® or capacity given the current volume of work. Quantitative results demonstrated staff were worried no one would help, particularly at the smaller EDs. Whereas the qualitative data was more related to capacity with their current

**Table 5**  
Integration of quantitative and qualitative results mapped to the Theoretical Domains Framework.

| Barrier (B) / Enabler (E) <sup>a</sup>              | Quantitative   | Qualitative  | TDF Domains[33]   |
|---|--|--|---|
| Work environment and resources hinder change (B)    | 75.5 % disagree there is not enough time to change way of working.<br>76.7 % small ED v 86.4 % large ED disagree unsupported by management (overall 82.4 %)  | Organisational support or resource availability<br>– lack of resources, including staff (n = 6)<br><i>‘We are under increasing pressure at current with short staffing and many staff voicing burn out. I think this may impact the implementation of a new project’ (R44, level 3)</i><br><br>– lack of support or time for education (n = 4)<br><i>‘Nurses often work outside of business hours. These times can be hard to gain support or assistance if concerns arise with the new system’ (R31, level 3)</i>   | Environmental context and resources are elements of an individual’s environment or situation that hinder or enable the personal development of skills and abilities.<br>Social Influences - the potential influence of social interactions on an individual’s thoughts, emotions, or actions.                   |
| Lack of knowledge or understanding of HIRAID® (B)   | 76.5 % disagree -Do not understand what HIRAID® is.<br><br>78.4 % disagree - It will not change the way I care for my patient.<br>(58.1 % disagree at smaller EDs v 93.2 % at larger EDs)  | Knowledge awareness of HIRAID®<br><br>– Perception primarily documentation (n = 6)<br><i>‘having already used HIRAID I find it time consuming taking away time that can be used for other things such as procedures and patient care. I have seen other nurses spend 20 –30 min on completing HIRAID information, a lot of it not relevant to the presentation.’ (R4, level 2)</i><br>Impact nursing process/ work<br><br>– Uncertain benefit, no different current practice (n = 8)<br><i>‘I am very willing to learn new ways of working, so long as it is proven to be beneficial’ (R32, level 3)</i><br><br>– Intervention increases workload (n = 6)<br><i>‘I would worry that we will not have time to do a large/long structured assessment for each patient before another priority has come along. We do not allocate patients here, so who’s role will it be if everyone is busy’ (R19, level 3)</i> | Knowledge- the recognition of the presence of something<br><br>Belief about Consequences- the acceptance that the application of a behaviour in a specific situation will result in true, real or valid outcomes.   |
| Practice will not change (B)                        | 72.5 % disagree- nothing will change.  | Receptive to learn / change- resistance to change (n = 3)<br><i>‘Some nurses may not want to change.’ (R12, level 3)</i>   | Social/professional role and identity - an individual’s personal qualities and demonstrated behaviours in work or social environments.<br>Optimism - the assurance that it will be the best process and relevant goals will be achieved.  |
| Inadequate support to implement (B)                 | 78.4 % disagree worried no one will help when they try to use HIRAID.<br>(72.1 % small ED v 83.1 % large ED)   | Organisational support and resource availability- time constraints/ workload (n = 5)<br><i>‘we do not have the staff and time available to document a comprehensive assessment. we barely have the time and staff to attend to basic nursing care and document same. (R9, level 3)</i><br>(No qualitative data related to this theme)  | Reinforcement- increased likelihood of the desired response, establishing a dependent or contingent relationship between a given stimulus and the response.<br>Belief about Capabilities - the recognition that a skill or talent is legitimate and one that an individual can apply for constructive purposes. |
| Capacity to learn/ adopt new practice (E)           | 99 % disagree – too hard to remember something new<br>96.1 % disagree - I do not have headspace for something new.<br>83.3 % disagree - I am worried I will not know what to do.   |  | Memory, Attention and Decision Processes - the capacity to store information, concentrate on detail in the environment and make decisions involving multiple alternatives.<br>Belief about Capabilities   |
| Beneficial to nursing practice and patient care (E) | 85.3 % indicated the same structured approach to assess patients would be beneficial in their ED   | Impact on nursing process/ work<br>– Support and/ or enhance nursing practice (n = 10)<br><i>‘HIRAID is an ‘opportunity to enhance nursing clinical practice’ (R65, level 4)</i><br>– Standardised approach beneficial (n = 8)<br><i>‘I think HIRAID is brilliant and will standardise care provided in ED and we should implement it’ (R44, level 3)</i><br>– Impact on patient care (n = 4)<br><i>‘streamline and normalise information for best patient care’ (P70, level 4)</i>  | Belief about consequences   |
| Willing to learn and engage in change (E/ B)        | 99 % disagree – I do not want to learn something new.<br>79.1 % small ED v 100 % large ED willing to learn and adopt new practice (overall 91.2 %)<br>92.2 % agree- I want to do what is best for patient care.<br>93.1 % disagree - the way they do things is fine and no need to change anything | Receptive to learn / change - willing to learn (n = 9)<br><i>‘I am open to learning anything that may benefit my delivery of care to my patients’ (R6, level 2)</i><br><br>Knowledge awareness of HIRAID® - using HIRAID (n = 5)<br><i>‘Already using HIRAID’ (R88, level 2)</i>   | Intentions – a deliberate decision to perform a particular behaviour.<br><br>Social/professional role and identity  |

<sup>a</sup> Enablers for quantitative items were greater or equal to 80 % agreement on a positively worded statement or disagreement with a negatively worded statement, overall and by ED level. Where items did not meet the threshold, they were classified as a barrier.

workload, these respondents were mainly from the larger level 3 and 4 EDs'. *Reinforcement* and *Belief about Capabilities* TDF domains were mapped to this barrier.

Enabler/ barrier: Willing to learn and engage in change.

The final finding from the integration of data was an enabler and barrier. When asked specifically related to implementing HIRAID®, respondents quantitative results highlighted a willingness to learn and all wanted to do what was best for patient care. Over 90 % disagreed that current practice was fine and did not need to change. This was supported by qualitative findings with staff willing to learn new ways of working. Quantitative findings also detailed, respondents reporting there was a need to change the way they practiced. In contrast, when asked about willingness to learn and change practice, not specifically related to HIRAID®, this was a barrier in smaller EDs. For level 2 EDs a much smaller proportion of respondents positively responded, 79.1 % responded 'yes' compared to 100 % at level 3 and 4 EDs. These findings map to the TDF domain *Intentions*, and *Social/professional role and identity*.

The identified enablers and barriers mapped to 10 of the 14 TDF domains (Table 5). There were four TDF domains associated with enablers and barriers – *Belief about consequences*, *Belief about capabilities*, *Social/professional role and identity* and *Intentions*. The barriers were mapped to an additional five TDF domains - *Environmental context and resources*, *Knowledge*, *Social Influences*, *Optimism*, and *Reinforcement*. A final TDF domain *Memory, attention and decision processes* was mapped to enablers.

## Discussion

The enablers and barriers to the implementation of HIRAID® across a large rural local health district as identified by 102 emergency nurses are reported in this study. Although all final barriers and enablers were common to all sites, there was some variability in preliminary findings between smaller and larger EDs. Specifically, smaller EDs believed they would not be supported by management, there would be inadequate support when implementing and it would not change the way care is delivered. While differences noted between ED levels were not statistically significant, they may be clinically significant and it is crucial to consider the variability between the ED levels when designing an implementation strategy.

The most prominent barriers were centred around a lack of resources, a perceived lack support for change and knowledge about the proposed HIRAID® intervention. Respondents reported there was a lack of time or resources to change current practice, with many expressing concerns about staffing levels. These concerns raised are likely not solely related to the implementation of HIRAID®, but reflective of broader challenges in the clinical setting. Lack of time and staffing were among the top ten barriers in a systematic review completed in 2022 focusing on nursing and allied health in public hospitals [35]. Like all specialist areas, widespread staff shortages across EDs remain a challenge [36]. Workforce shortages have been further exacerbated following the COVID-19 pandemic where emergency nurses worked under significant pressure on the frontline leading to high dissatisfaction and burnout [37].

Staff shortages in regional areas are acknowledged as more severe than metropolitan areas, with difficulties in both recruitment and retention there are national programs working to address the problem [38]. Workforce strategies include nursing scholarships to support professional development and rural placements to encourage graduates to work in rural areas [38]. Most programs aim to increase and support the medical workforce, more needs to be done to support, recruit and retain nurses in regional areas. Inadequate nurse staffing levels are associated with poorer patient outcomes [39–41]. While evidence specific to ED is limited, low staff levels are associated with delays to emergency care, more patients not waiting and lower patient satisfaction [42]. It is critical that the identified constraints of staffing or time to complete the

necessary training be considered when designing the delivery of implementation activities.

There was variability in barriers in smaller versus larger EDs. For example, respondents in the smaller (level 2) EDs reported they would be unsupported implementing HIRAID® in practice, and more broadly by management. These clinicians also believed the intervention would not change the way care was delivered in their ED. The context in which implementation of an intervention takes place can influence implementation activities [43,44]. This variability of context relates to not only the physical environment and resource availability, but also the established networks and organisational structure. The level of staffing and availability of clinical resources in smaller EDs differs when compared to larger settings [6]. Differences in resource allocation ultimately result in different work practices in the delivery of emergency care. These contextual differences will need to be considered in the development of an implementation strategy for HIRAID®. Consideration of any relevant adaptations, for smaller EDs, may be required to ensure these barriers unique to the smaller sites are appropriately addressed.

The concerns around lack of support may be related to staffing models at the smaller EDs. Unlike larger facilities where there is a permanent clinical nurse consultant and or a clinical nurse educator, smaller departments do not always have this resource. It is not uncommon to have an educator, or clinical nurse consultant, that covers multiple sites. The geographic distance means that in-person support is not always readily available when required to support education and implementation of practice changes. Smaller emergency care settings may also only have two nursing staff rostered for a shift. These settings often require the nurses from the wards or aged care facility onsite who may not have ED training or experience to support ED staff.

The most prominent enablers focused on respondents being willing to learn and engage in change. Most respondents expressed a need change practice within their clinical context. There was support for HIRAID® as they recognised the need for evidence-based practice. The potential for HIRAID® to support emergency nurse practice providing consistency and improved delivery of patient care was also considered beneficial. Motivation to change, particularly influenced by perceived benefit to patient care is recognised as an enabler [35]. This inclusion and emphasis of the enablers should be capitalised in future implementation.

Changing practice in the clinical setting is complex and requires a considered approach to facilitate effective and sustainable change [17]. With variations in clinical practice widespread despite availability of evidence [45], the challenge of translating evidence to practice is well recognised [18]. Evidence based implementation science activities can achieve the desired change in practice and clinician behaviour, in particular, those informed by behaviour change theory. Modification of human behaviour is key to making change in the delivery of healthcare interventions [46]. Firstly, application of behaviour change theory assists in identification of target behaviour and associated barriers and enablers [17]. This diagnostic work enables the targeted selection of appropriate behaviour change techniques to address identified barriers and enhance enablers in implementation activities [33].

## Limitations

This study was conducted in a single rural LHD and the findings may not be applicable to other rural contexts. The nurses on leave at the time of the survey is unknown, the response rate is based on the nursing staff recorded on ED rosters at the commencement of the study. While the response rate is above response rates reported in the literature for electronic surveys [47], and all sites were represented, with just over half of eligible staff participating the potential exists that enablers and barriers to implementation may not have been identified.

## Conclusions

The barriers and enablers to the implementation of the HIRAID® emergency nurse framework across multiple rural sites were identified in this study. Nurses strongly indicated the need to change current practice. However, perceived barriers such as workload and available human resources to support practice change may hamper implementation and sustainability. The design of implementation strategy should ensure all barriers are addressed and consider adaptations based on contextual variability between sites.

## CRedit authorship contribution statement

**Belinda Kennedy:** Project administration, Formal analysis, Investigation, Writing – Original Draft, Writing – Review and Editing. **Kate Curtis:** Conceptualization, Methodology, Validation, Formal analysis, Writing – Original Draft, Writing – Review and Editing, Supervision, Project administration, Funding acquisition. **Sarah Kourouche:** Writing – Review and Editing, Methodology, Formal analysis, Funding acquisition, Supervision. **Louise Casey:** Investigation, Writing- Review and editing. **Dorothy Hughes:** Investigation, Writing- Review and editing. **Vivienne Chapman:** Writing- Review and editing. **Margaret Fry:** Conceptualization, Methodology, Validation, Formal analysis, Writing – Review and Editing, Supervision, Project administration, Funding acquisition.

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## Competing interests statement

HIRAID® has been trademarked in Australia by the University of Sydney, and education materials are copyrighted. Kate Curtis, Sarah Kourouche and Margaret Fry hold positions on the editorial board of Australasian Emergency Care.

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### 5.1.2 Study 1, Part B (Publication 3)

Publication 3 fulfils Objective 2: To develop an evidence-based implementation strategy using the BCW:

Kennedy, B., Curtis, K., Kourouche, S., Casey, L., Hughes, D., & McCloughen, A. (2024). Development of an evidence-based strategy to implement the HIRAID® emergency nursing framework in rural emergency departments using behaviour change theory. *International Emergency Nursing*, 77, Article 101538. <https://doi.org/10.1016/j.ienj.2024.101538>

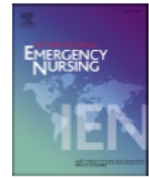
Appendix 20 shows the supplementary file for Publication 3 outlining the proposed implementation strategy.



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## Development of an evidence-based strategy to implement the HIRAID® emergency nursing framework in rural emergency departments using behaviour change theory

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## ABSTRACT

**Introduction:** Emergency nurses are critical to emergency care delivery, particularly in rural areas with limited medical support. To support nurses, the validated emergency nursing framework, HIRAID®, was to be implemented. Implementing interventions in the emergency context is notoriously difficult and rural areas have added challenges with limited resources across large geographic areas. This study aims to develop an evidence-informed strategy to implement HIRAID® across a large rural/regional health district.

**Methods:** The behaviour change wheel and Theoretical Domains Framework were used in developing the implementation strategy. The theoretical domains, linked to barriers and enablers to implementing HIRAID®, were mapped to intervention functions. Associated Behaviour Change Techniques were considered to determine suitability to address barriers or enhance enablers, as well as suitability according to and the APEASE criteria.

**Results:** Seven intervention functions, such as modelling, education, and incentivisation, were deemed suitable for inclusion. The intervention functions were mapped to 20 BCTs and planned to be operationalised through 11 delivery modes, including a flexible education program, documentation templates, and support in the workplace.

**Conclusions:** This study determined the relevant BCTs and mechanisms of delivery to mediate change in behaviour and support uptake of the HIRAID® emergency nursing framework in a rural health district.

### 1. Introduction

Australia is the sixth largest country in the world, however, the population density is significantly lower compared to countries of similar size [1]. With over 70 % of the Australian population located in major cities [2], challenges exist to meet the healthcare needs of those residing rurally [3]. Reduced healthcare access contributes to poorer health outcomes among the rural population [3]. Further, the complexity of care that can be delivered in rural facilities is limited compared to facilities in regional/ metropolitan areas [4,5]. Many rural

facilities operate without 24-hour medical cover and have established on-call arrangements [6] through local general practitioners or virtual care. Emergency nurses have an integral role in the delivery of emergency healthcare in rural Australia being the first, and sometimes only, clinician a patient will see [4–7].

As the first clinicians to see and assess patients, emergency nurses initiate care and make decisions for ongoing management, this can be challenging for rural nurses with infrequent exposure to some presentations [6]. Appropriate decision making is contingent on emergency nurses being skilled to effectively assess patients, integrate and critically

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analyse findings to make informed clinical decisions related to care priorities and treatment [8,9]. The HIRAID® emergency nursing framework (History including Infection risk, Red flags, Assessment, Interventions, Diagnostics, reassessment, and communication.) was developed to assist in supporting nurses through the emergency nursing process and care delivery (Fig. 1) [10]. HIRAID® is the only validated framework [11–13] that supports emergency nurses in the initial assessment and management of patients and has demonstrated benefit to emergency nurses and patient care. Implementation of HIRAID® in four EDs in regional Australia improved nurse self-efficacy and assessment [12] and reduced clinical deterioration events related to ED nursing care [14]. The reduction in patient deterioration resulted in an estimated cost saving of \$1,914,252 at the study site [15].

We planned to implement HIRAID® in a large rural health district in Southern New South Wales (NSW). The rapidly changing advances in emergency care and the challenges to translate these into clinical practice are recognised by clinician researchers [16,17]. The rural setting provides unique challenges for implementation of practice change such as geographic isolation creating challenges for education and training, limited staffing to provide practical in person support [18], characteristics unique to the rural context need to be considered. Poor uptake of practice changes can result from inappropriately designed, non-context specific implementation strategies [16,19]. Implementation science is the study of systematically identifying the methods and strategies, informed by relevant evidence, that will effectively result in change in the real world setting [19].

The key to successful implementation and sustained compliance with an intervention is individual and collective human behaviour [20]. To maximise successful uptake of HIRAID®, prior to implementation four barriers and two enablers to implementation were identified through a survey of 102 emergency nurses from 11 EDs, reported elsewhere [21]. The most prominent barriers reported by emergency nurses were related to the work environment and resources, particularly staff resources and management support at smaller EDs, and knowledge deficit related to

the HIRAID® emergency nursing framework. The biggest enabler was the willingness of staff to engage and learn, with recognition of room for improvement in current practice [21]. The barriers and enablers were mapped to 10 of the 14 Theoretical Domains Framework (TDF) domains – including Belief about consequences, Belief about capabilities, Environmental context and resources, Intentions, Knowledge, Memory attention and decision processes, Optimism, Reinforcement, Social Influences, and Social professional role and identity [21].

This study aimed to develop an evidence-informed strategy for implementing the HIRAID® emergency nursing framework across a health district in rural Australia, addressing the identified barriers to practice change.

2. Methods

This study was conducted in 11 Emergency Departments (ED) in a predominantly rural Local Health District (LHD), in Southern NSW (SNSW). The study was completed according to HREC approvals obtained from Greater Western Human Research Ethics Committee (2020/ETH02164) and reported per StaRi guidelines [22].

2.1. Study sites

Southern NSW LHD (SNSWLHD) provides health services to around 211,000 residents, plus seasonal visitors to the coastal and snow regions of NSW [23]. The region spans approximately 44,534 km<sup>2</sup>, and extends to the south eastern border of NSW [23]. There were more than 110,000 presentations to SNSWLHD EDs in 2020–21 [24], cared for by around 180 emergency nurses. The study EDs comprised a mix of Level 2–4 emergency departments [25], which is commensurate with the available onsite medical and/or diagnostic services [5]. Six of the EDs are classified level 2, with limited diagnostic and/or medical services frequently provided by a local general practitioner or virtual care. Level 3 and 4 EDs have 24-hour medical cover, more availability of physicians with

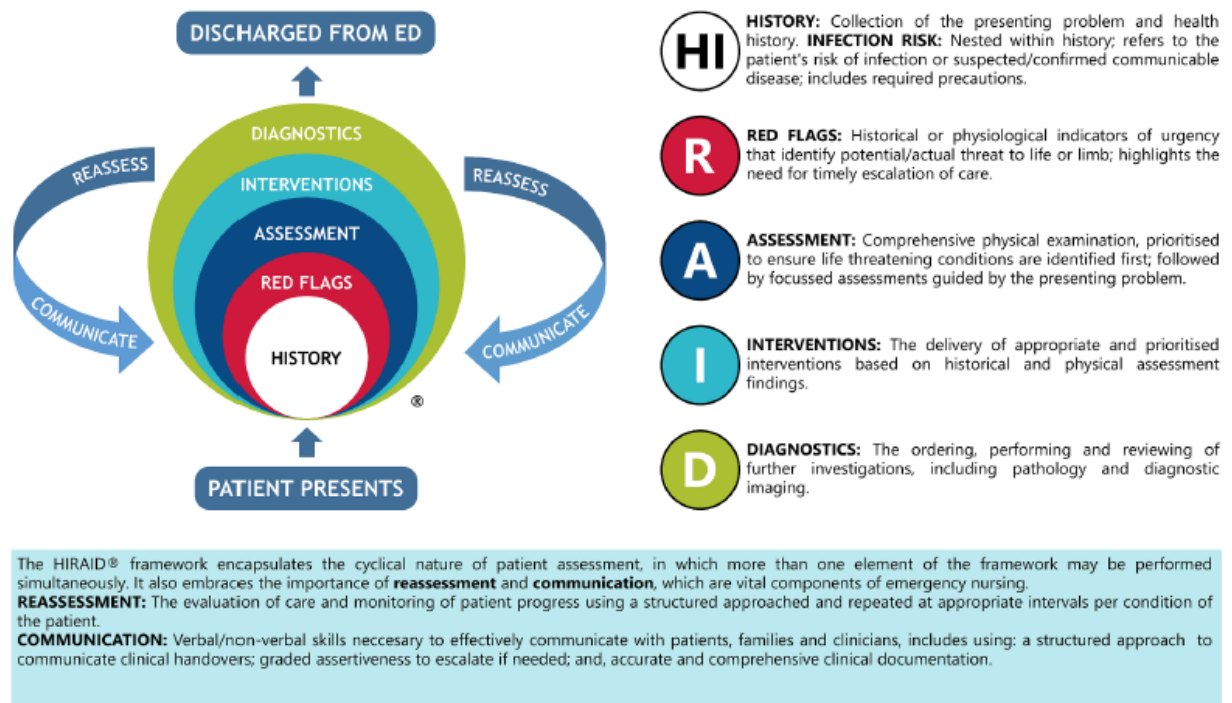


Fig. 1. HIRAID® Emergency Nursing Framework.

specialist emergency training, along with increased onsite diagnostic resources, allied health and administrative services [25].

## 2.2. Theoretical approach

The development of the implementation strategy followed the four-step approach outlined by French and colleagues [26]: establish the target behaviour (complete), identify the enablers and barriers to implementation (complete), identify the intervention components along with mode of delivery that will address the enablers and barriers (this paper), establish the measures to evaluate change (Table 1). The process was guided by the behavior change wheel and the Theoretical Domains Framework (TDF) [27] in an iterative process, through consultation with end users, nurse educators and hospital executives.

The TDF is a validated synthesis of 128 theoretical constructs from 33 theories related to human behaviour and change [28]. Used frequently in healthcare settings, the TDF consists of 14 domains recognised to influence human behaviour [27]. The 10 TDF domains associated with the identified enablers and barriers, were mapped to the relevant intervention functions. Intervention functions are the broad categories of interventions that can be employed in an implementation strategy to change behaviour. There are nine intervention functions associated with the TDF domains: education, training, persuasion, incentivisation, coercion, environmental restructuring, restriction, modelling and enablement [27].

The Behaviour Change Techniques (BCT) Taxonomy is a synthesis of 93 distinct BCTs with demonstrated effectiveness in healthcare research [29]. BCTs are discrete, observable elements of an intervention, or 'active' ingredients [29], implemented to change behaviour that can be replicated [27]. For each intervention function there are BCTs established as appropriate and effective [27]. BCTs are operationalised through implementation strategies integrated and delivered through a variety of modes or activities, used to improve uptake or implement an intervention, for example, education, structural changes, local champions/ facilitators. Two investigators (BK, KC) reviewed all BCTs associated with the relevant intervention functions for each TDF domain, where barriers and/ or enablers were identified. When considering the chosen BCTs, decisions were made based on the BCT definition and the target barriers/ enablers to be addressed. This informed the mode of delivery, or activity, through which the BCT would operate. In addition,

**Table 1**  
Process to develop theory-informed behavior change intervention for HIRAID®.

| Step  | Detail / Process   |
|---|--|
| 1. Establish the target behaviour (complete)  | Nurses from SNSWLHD EDs to apply HIRAID® emergency nursing framework in their initial nursing assessment post triage.  |
| 2. Identify the enablers and barriers to implementation (complete)                                | Four barriers, two enablers and one combined barrier/enabler were identified through a survey of 102 emergency nurses representing all study sites. These were mapped to 10 TDF domains.   |
| 3. Identify the intervention components and mode of delivery to address the barriers and enablers | Using 10 TDF domains, established in step 2, to determine intervention functions. Behaviour Change Techniques related to each intervention function to be evaluated to select appropriate BCT for barriers/ enablers. Appropriate mode of delivery for each BCT is determined in consultation with local stakeholders. |
| 4. Establish the measures to evaluate change.   | Outcome measures determined to measure both implementation and intervention effectiveness  |

Note: Steps 3 and 4 are reported in this study. TDF = Theoretical Domains Framework; BCT = Behaviour change technique.

for each strategy, investigators had to consider *how* and *when* it would be delivered, *by who*, and the target *dose*, for example, the number of sessions or number of staff trained [30].

Not all intervention functions, BCTs and modes of delivery may be appropriate for all situations, therefore throughout each stage, investigators made assessment in line with the APEASE criteria – for Acceptability, Practicability, Effectiveness/ cost-effectiveness, Affordability, Side-effects/safety and Equity – to assist with determining suitability for inclusion in the implementation strategy [27]. Stakeholders were consulted regarding the proposed content and delivery of the interventions determined based on identified BCTs, to ensure they met the APEASE criteria considering the LHD context. The draft strategy was circulated and consultation with end users at the study sites occurred with LHD representatives, independent of the research team. Feedback on the strategy was provided to study investigators to allow for adjustments where required.

## 3. Results

All nine intervention functions were associated with the ten theoretical domains. The final selected intervention functions were mapped to 20 BCTs, which were executed through 11 delivery modes, including, for example, stakeholder engagement, education and environmental modifications.,

The nine intervention functions were mapped to the APEASE criteria. Considering each intervention function in line with the APEASE criteria, seven of nine intervention functions were found to be appropriate. Both restriction and coercion were deemed unsuitable for inclusion, and the remaining seven were modelling, training, education, incentivisation, environmental restructuring, enablement and persuasion. A summary is provided in Table 2.

The remaining seven intervention functions were mapped to 20 BCTs. Training and Persuasion intervention functions had the highest number of BCTs, with five BCTs each, and Enablement and Education, each with four BCTs, respectively. Three BCTs were used across multiple intervention functions: 2.2 Feedback on Behaviour, 6.1 Demonstration of the Behaviour; and 7.1 Prompts and Cues. (Table 3).

A multifaceted implementation strategy was developed to overcome the barriers and use the identified strengths (enablers) in implementing an emergency nursing framework (HIRAID®). The 20 BCTs were embedded within 11 modes of delivery, such as eLearning, video, and documentation template. A detailed summary of the modes of delivery and content outline is available in the [supplementary file](#).

After development of the implementation strategy, feedback from end users on the proposed activities resulted in a minor change. Nurses preferred incentives provided as material rewards to be awarded collectively to sites based on overall site performance rather than individual rewards for performance.

## 4. Discussion

This study reports the development of an implementation plan for an emergency nursing framework across 11 emergency departments in a large rural local health district. Central to the implementation activities are a multi-modal education program, engagement and support of hospital executive/managers, and environmental changes. These activities incorporate the BCTs that address the identified barriers to implementation of HIRAID®, and capitalise on the enablers [21].

### 4.1. Education program

Education was a key mechanism in the implementation activities. It incorporated a multi-modal program consisting of instructor training (train-the-trainer) targeted at senior nurses, and an eLearning module and 45- minute face-to-face training session (provider training) for all nurses. It was important to have respected senior nurses and those

**Table 2**  
Ten TDF domains identified to contain Barriers and Enablers (vertical mapped to nine intervention functions (horizontal) with APEASE).

|   | Education  | Persuasion | Incentivisation | Coercion | Training | Restriction | Environmental Restructure | Modelling | Enablement |
|---|--|------------|-----------------|----------|----------|-------------|---------------------------|-----------|------------|
| Knowledge (B)   | ✓  |            |                 |          |          |             |                           |           |            |
| Environmental context and resources (B)   |  |            |                 |          | ✓        | ✓           | ✓                         |           | ✓          |
| Belief about Capabilities (E/ B)  | ✓  | ✓          |                 |          |          |             |                           | ✓         | ✓          |
| Belief about Consequences (B)   | ✓  |            |                 |          |          |             |                           | ✓         |            |
| Social professional (B/ E)  | ✓  | ✓          |                 |          |          |             |                           |           |            |
| Optimism (B)  | ✓  |            |                 |          |          |             |                           |           |            |
| Reinforcement (B)   |  |            | ✓               | ✓        | ✓        |             | ✓                         |           |            |
| Social Influences (B)   |  |            |                 |          |          | ✓           | ✓                         |           | ✓          |
| Intentions (E/B)  | ✓  | ✓          | ✓               | ✓        |          |             |                           | ✓         |            |
| Memory, Attention and Decision Processes (E)  |  |            |                 |          | ✓        |             | ✓                         |           | ✓          |
| <b>Intervention Functions and comments around APEASE</b>  |  |            |                 |          |          |             |                           |           |            |
| <b>Education</b>  | Education is affordable and practical within existing roles and orientation processes. The HIRAID® program is supported by the executive, with support for instructor (train-the-trainer) education, with the capacity for short in-service education and eLearning to be completed in existing in-service time. Excessive educational focus may lead to neglect in other domains. Educational meetings alone are unlikely to effectively change behaviours. |            |                 |          |          |             |                           |           |            |
| <b>Persuasion</b><br><i>(Using communication to induce positive or negative feelings or stimulate action)</i>   | Using persuasive communication to motivate staff to use HIRAID® – senior staff, managers and peers. But need to consider the method of persuasion not to be construed as “pushy”. Communication must be delivered equitably – not single out individual staff. e.g. Encouragement through staff newsletters, ED memo communication   |            |                 |          |          |             |                           |           |            |
| <b>Incentivisation</b><br><i>(Creating an expectation of reward)</i>  | The provision of incentives is an essential characteristic to motivate staff to use the HIRAID® framework. This can be in the form of positive feedback from managers/ senior staff. The provision of a material incentive e.g. Emergency nursing text +/- voucher feasible within existing funding for the project. A material incentive must be equitable, with opportunity all for all staff to receive acknowledgement.                                  |            |                 |          |          |             |                           |           |            |
| <b>Coercion</b><br><i>(Creating and expectation of punishment or cost)</i>  | Applying punishment or cost to an individual for not applying the HIRAID® framework in practice would not be appropriate or ethical.   |            |                 |          |          |             |                           |           |            |
| <b>Training</b><br><i>(Imparting skills)</i>  | Imparting skills is affordable and practical within existing roles and orientation processes, but staff need motivation to use them.   |            |                 |          |          |             |                           |           |            |
| <b>Restriction</b><br><i>(Using rules to reduce the opportunity to increase the target behaviour by reducing the opportunity to engage in competing behaviours)</i> | Using rules to increase staff using HIRAID® is not possible within the environmental context; the template cannot be made mandatory, and staff can alter or not use the template if they choose to do so.  |            |                 |          |          |             |                           |           |            |
| <b>Environmental restructuring</b><br><i>(Changing the physical or social context)</i>  | Ensuring all staff have the HIRAID® documentation templates available for use involves no cost and is practical to complete. Once set up this is accessible to all staff when logged into the electronic medical record.   |            |                 |          |          |             |                           |           |            |
| <b>Modelling</b><br><i>(Providing an example for people aspire to)</i>  | Clinical Nurse Consultants and Clinical Champions will provide an example for people to aspire to or imitate by modelling is affordable, practical, effective, acceptable and equitable within existing roles and orientation processes.   |            |                 |          |          |             |                           |           |            |
| <b>Enablement</b><br><i>(increasing means/ reducing barriers to increase capability or opportunity)</i>   | Increasing the means and reducing barriers to increase staff to use of the HIRAID framework is possible with opportunity to use, in some capacity, for all ED presentations. Clinical Nurse Consultants and HIRAID champions will be able to support staff in use in the existing clinical roles in the ED. This is affordable, practical, effective, acceptable and equitable within existing roles and orientation processes.                              |            |                 |          |          |             |                           |           |            |

E = enabler; B = barrier.

employed in education roles as instructors, these staff have social influence and are respected by colleagues in the work environment. Engaging these nurses as instructors aligned with BCT 6.3 *Information about others’ approval* and 6.1 *Demonstration of the behaviour* by instructors in practice.

All nurses completing the instructor training were provided with a facilitator manual that included detailed guidance on the application of HIRAID®, the resource provided content to support instructors/ champions in delivering training across the LHD. In consultation with nursing experts, and local stakeholders, both the facilitator manual and in-service resources were tailored to suit the local context. To address identified barriers associated with nursing knowledge related to HIRAID® and resistance to change the education program provided an overview of the impact on both patients [14] and nursing staff [11,12] from a previous evaluation of HIRAID® in emergency departments. It also incorporated an overview of the local context, demonstrating areas where HIRAID® had the potential to improve practice. This was associated with two BCTs, 5.1 *Information about health consequences* and 5.3 *Information about social and environmental consequences*.

The instructor training for staff employed a train-the-trainer model to prepare clinicians across the LHD to deliver HIRAID® education, providing broader support for implementation. The model is not new to

healthcare [31], and has been demonstrated to improve capacity and reach for staff training [31,32]. This was an important aspect of the enablement intervention function, training local clinicians to deliver training and be clinical leads was part of BCT 12.2 *Restructure the social environment*. The same training model was used successfully in another LHD implementing HIRAID® [33], this approach would assist in addressing key barriers identified related to resources to implement, support for change and knowledge related to the intervention [21]. Nurses were concerned about inadequate support and availability of assistance when implementing, particularly at smaller sites [21] In SNSWLHD, there are not always onsite senior nursing roles that incorporate education/professional development functions like those of Clinical Nurse Consultant or Nurse Educator, this is not unlike other rural facilities and determined based on the size of the facility [5]. Using a train-the-trainer model aids in increasing capacity for training, through engaging senior nursing staff who are part of the core workforce. The train-the-trainer model was considered a key element with variability in senior staffing and support across the sites, and geographic spread of the 11 facilities.

The instructor course was intended to not only increase capacity for training, but also to prepare the nurses to model or “champion” the application of HIRAID® in practice. Individuals trained in the

**Table 3**  
Mapping Intervention Functions to Behaviour Change Techniques/ Mode of delivery.

| TDF Domain                               | Barriers/ Enablers  | Intervention Function <sup>1</sup>                   | Behaviour Change Technique and Mode of Delivery   |
|--|---|--|---|
| Knowledge                                | Lack of knowledge, or misunderstanding, about what HIRAID® is (B)   | Education  | <p>5.1 Information about health consequences</p> <p><b>Education Program</b></p> <ul style="list-style-type: none"> <li>– Instructors/ Facilitator/ Champion training to incorporate the details on the impact of HIRAID® implementation (face-to-face education and facilitator manual) e.g. decrease in adverse events associated with ED care.</li> <li>– Provider training (in-service) includes a summary of prior research related to HIRAID® and demonstrated outcomes (as covered in instructor training)</li> </ul> <p>5.3 Information about social and environmental consequences</p> <ul style="list-style-type: none"> <li>– The demonstrated benefits/outcomes of using HIRAID® from prior research to be incorporated into the <b>Education Programs</b> (face-to-face training) e.g. improved assessment and nurse confidence.</li> <li>– <b>Video-</b> local promotional video incorporates previous research outcomes and benefits of using HIRAID®.</li> </ul> <p>7.1 Prompts/Cues</p> <ul style="list-style-type: none"> <li>– Prompts within the <b>documentation templates</b> support staff education, with hints for each of the HIRAID® emergency nursing framework steps to aid understanding</li> </ul>   |
| Memory, Attention and Decision Processes | Nurse confidence in their capacity to learn and remember something new (E)  | Environmental Restructure                            | <p>12.5 Adding objects to the environment.</p> <ul style="list-style-type: none"> <li>– HIRAID® <b>Documentation templates</b> are accessible in eMR to maximise capacity to record HIRAID® assessment and recall.</li> </ul>   |
| Environmental context and resources      | Insufficient time for change (B)<br>Lack of staffing resources (B)  | Training<br>Environmental Restructure                | <p>6.1 Demonstration of the Behaviour</p> <ul style="list-style-type: none"> <li>– Behaviour demonstrated in the eLearning module video</li> <li>– Demonstration of the behaviour through application to a case study in face-to-face training (instructor/participant) assists in demonstrating how HIRAID® is similar to current work practices and time involved.</li> </ul> <p>7.1 Prompts/Cues</p> <ul style="list-style-type: none"> <li>– Integration of the <b>documentation templates</b> into eMR reduces cognitive load for recall HIRAID® emergency nursing framework and provides a framework that, when completed, will capture relevant clinical details from the initial assessment.</li> </ul>   |
| Social Influences                        | Unsupported by management (B)<br>Time not dedicated to education (B)  | Enablement<br>Modelling<br>Environmental Restructure | <p>3.2 Social Support (practical)</p> <ul style="list-style-type: none"> <li>– Provision of dedicated time for education by nurse managers</li> <li>– District CNCs schedule time to provide support to smaller sites during the initial implementation period.</li> <li>– Support from the research team- instructors will be able contact the team directly for support if required. Research team will make intermittent contact during implementation to offer support.</li> </ul> <p>6.2 Social Comparison</p> <ul style="list-style-type: none"> <li>– Demonstrate how it has been achieved at other sites, with flexibility in the approach.</li> </ul>  |
| Social /professional role and identity   | Current practice is inadequate (E)<br>Staff resistance to change (B)<br>Supportive, already using HIRAID® in practice (E) | Education<br>Persuasion<br>Modelling                 | <p>5.3 Info about social and environmental consequences</p> <ul style="list-style-type: none"> <li>– Provider training (face-to-face) is tailored to include data specific to the LHD to highlight areas for improvement. Based on previous findings demonstrate HIRAID has the potential to improve identified areas. (<b>Education program</b>)</li> <li>– <b>Communication-</b> related to expectations and processes when not being implemented to be communicated at local level.</li> </ul> <p>2.2 Feedback on behaviour</p> <p>Feedback uptake and performance will be both formal and informal</p> <ul style="list-style-type: none"> <li>– <b>Audit of HIRAID®</b> template use at 6 and 12-weeks will be disseminated via local processes.</li> <li>– <b>Communication-</b> Managers are encouraged to disseminate positive feedback, and address non-compliance where necessary.</li> </ul> <p>10.4 Social reward</p> <ul style="list-style-type: none"> <li>– HIRAID Champions/ Instructors are encouraged to provide positive <b>verbal feedback</b> to staff recognised to be applying HIRAID and documenting findings appropriately. e.g. during shift handover, direct.</li> </ul> <p>13.2 Framing/ reframing</p> <ul style="list-style-type: none"> <li>– <b>Education</b> for experienced staff demonstrates the parallel between HIRAID® and experienced clinical practice, the framework provides common terminology and process for all nurses.</li> </ul> <p>6.1 Demonstration of the behaviour</p> <ul style="list-style-type: none"> <li>– Engage <b>HIRAID Champions</b> who demonstrate the behaviour. Request commitment from all staff who complete instructor training to demonstrate use in practice.</li> </ul> <p>11.3 Conserving mental resources</p> <p>Provision of <b>Flip cards</b> provides easy to access prompt for the HIRAID® Framework to support all staff.</p> <p>12.2 Restructure the social environment</p> <ul style="list-style-type: none"> <li>– Recruitment of <b>HIRAID® Champions-</b> including clinical staff to complete the instructor training to enable them to support the application in clinical practice.</li> <li>– Recruit the CNCs / Educators to complete the HIRAID instructor (train-the-trainer) course. This is required to support initial implementation and ongoing use.</li> <li>– Managers and/or clinical staff from all sites to be invited to <b>Steering Committee</b> to support implementation.</li> </ul> |
| Belief about Capabilities                | Time constraints and workload hinder implementation (B)<br>Confidence in knowing what to do (E)                           | Enablement<br>Persuasion<br>Modelling<br>Education   |   |

(continued on next page)

Table 3 (continued)

| TDF Domain                | Barriers/ Enablers   | Intervention Function <sup>1</sup>                              | Behaviour Change Technique and Mode of Delivery   |
|---------------------------|--|---|---|
| Optimism                  | Nothing will change (B)  | <b>Persuasion</b><br>Modelling<br>Enablement                    | 6.3 Information about others approval<br><i>Demonstrate approval within the LHD</i><br>– <i>LHD leadership support demonstrated to staff e.g. through senior nurse leaders, and nurse manger, participation on the steering committee, providing time for education, local newsletter.</i><br>– <i>Video with senior clinicians demonstrating support for HIRAID®.</i><br>– <i>Instructors (senior nursing staff) using in practice reflecting endorsement of the framework in clinical practice</i>  |
| Belief about Consequences | HIRAID® will increase workload (B)<br>Will not change the way nurses care for patients (B)<br>Benefit to the use of the same structured approach (E) | <b>Persuasion</b><br>Education<br>Modelling                     | 9.1 Credible source<br>– <i>Instructor training is provided by experienced ED nurses who use HIRAID®</i><br><i>Framework in practice and can explain the application and benefits with practical examples and guidance. Project lead respected ED clinician.</i><br>– <i>Communication from district level nurse leaders/managers regarding expectations of HIRAID® use in clinical practice.</i><br>15.1 Verbal persuasion about capability<br>– <i>During instructor training participants work together to develop phrases that can be used to encourage staff use if required, for staff advocating for implementation and encounter resistance</i><br>13.1 Identification of self as role model<br>– <i>Self-nomination as champions to attend training is proposed recruitment, demonstrates support for the intervention.</i>  |
| Reinforcement             | Concern about lack of support when trying to use HIRAID®- primarily small EDs (B)  | <b>Training</b><br>Incentivisation<br>Environmental restructure | 4.1 Instruction on how to perform the behaviour<br><i>Staff will all be provided with the opportunity to complete an education program that provides instructions on the application HIRAID (written/ video/ simulated)</i><br>2.2 Feedback on behaviour<br>– <i>Simulated scenarios incorporated into instructor workshops provide an opportunity for feedback on the application of HIRAID in the clinical context.</i><br>– <i>Managers and senior clinicians will be encouraged to provide staff with feedback on behaviour in daily practice where relevant.</i><br>8.1 Behavioural/ practice rehearsal<br>– <i>Simulated training during the instructor course provides an opportunity to practice the application of the HIRAID® Framework and document patient assessment findings with the template.</i><br>– <i>HIRAID® Instructors/ Champions were requested to support staff, work through a patient assessment in the clinical setting to support use and give feedback.</i><br>8.3 Habit Formation<br>– <i>The HIRAID® education program to be incorporated into existing ED training programs and ED orientation, to support ongoing training and sustainability across the LHD.</i> |
| Intentions                | Unwilling to learn and adopt new practice- predominantly small ED (B)<br>Want to do what is best for patient care (E)                                | <b>Persuasion</b><br>Incentivisation<br>Education Modelling     | 6.3 Information about others approval<br>– <i>Support of other ED nurses outside the LHD to be included in the Education program e.g. feedback from nurses who use in practice.</i><br>10.2 Material reward <i>Provision of reward for use of HIRAID in practice. Reward to be determined with the stakeholders to ensure it is relevant and motivate staff to engage in practice. e.g. individual reward or collective group recognition of progress.</i>  |

<sup>1</sup> Bold intervention functions indicate those used to address the barrier or enhance the enabler.

application and modelling the behaviour in the clinical setting demonstrates one strategy associated with BCT 6.1 *Demonstration of the behaviour*. Champions are individuals who support an intervention and work to overcome resistance within the organisation [34]. Engaging clinicians who are supportive of implementing HIRAID®, and perceived as 'leaders' may be an advantageous use of identified enablers, potentially influencing intervention uptake [34]. The opportunity to be involved in change processes and understand why change is being implemented, has been demonstrated to influence the success of an intervention [35]. While the use of champions in healthcare has elicited positive results, the defined role has had considerable variability [36]. The champions role in this study aligns with 'Expert recommendation for implementing change' (ERIC), and is established as a strategy to implement change [34]. This mechanism will aid in addressing the barrier of inadequate support when implementing the HIRAID® emergency framework at smaller sites, as well as an opportunity for end user engagement in the process.

#### 4.2. Executive support

In addition to the multi-modal education program, support from the hospital executive and managers at all levels was considered necessary to deliver the proposed implementation strategy. While instructor

training increases local clinical capacity for HIRAID®, it does not address reported time or workload limitations that may impact implementation. To effectively deliver the education and support uptake, commitment from both hospital executives and local managers to provide logistical support for training is needed. This practical support is a strategy within BCT 3.2 *Social Support (practical)*, to overcome the barriers related to lack of support or perception that nothing will change. Managers can have a positive flow on effect down the chain for implementation, with staff willingness to engage in activities influenced by upper management [37]. Nurse unit managers are the key intermediary between upper management/hospital executives and staff. Therefore, their support for an intervention and involvement in the implementation planning can be critical to success [37]. Involvement of LHD management is an ongoing continuous process from initial planning and throughout the implementation process. This is achieved through a steering committee that has representation of executives/ managers at a district level as well as representation from the individual sites across the LHD. This committee is established to support the HIRAID® intervention delivery and assist with addressing any challenges within the emergency departments throughout the process. Visible support from the management is part of the strategies associated with BCT 6.3 *Information about others approval*.

#### 4.3. Environmental changes

Changing the physical environment is a mechanism recognised as a strategy to implement change for a select intervention [34], that was included. To support uptake of HIRAID® emergency nursing framework, the integration of documentation templates into the electronic medical record and distribution of cards attached to staff identification will potentially assist in reducing cognitive load for nurses, supporting recall of the required steps to apply HIRAID®. These are examples of strategies related to BCT 7.1 Prompts/ Cues and 11.3 Conserving mental resources. The templates, tailored to the local context, enable documentation of initial nursing assessment and actions guided by HIRAID®. Clinical documentation is integral to patient safety, with accurate and timely documentation in a patient's medical record necessary to support accurate clinical communication and decision-making for patient care [38]. Previous research has identified failures in communication in rural EDs as a leading human causal factor associated with patient deterioration [39]. This mechanism is an important aspect of delivering the intervention to improve patient care, demonstrated in previous research to improve both the quantity and quality of information documented relevant to the patient presentation [33].

#### 5. Study Limitations

This implementation strategy incorporates BCTs identified to address barriers specific to the study site, for application at another site would need to take into account barriers specific to the local context and suitable modifications. The data that established the barriers and enablers was from a survey of local emergency nurses, in which just over half of eligible nurses participated [21]. While all sites were represented and the response rates were higher than those reported in the literature [40], the potential exists that not all barriers and enablers were addressed through this implementation strategy.

#### 6. Conclusions

Changing practice is a complex process that requires many factors to be considered to ensure that effective and sustainable change is facilitated, especially in the rural / regional context. This implementation strategy consists of a variety of mechanisms, incorporating the behaviour change techniques through a range of modes that aim to mediate change in human behaviour to apply the HIRAID® emergency nursing framework in practice.

#### Ethical Statement

Ethical approval was obtained through the Greater Western Human Research Ethics Committee (2020/ETH02164).

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#### CRediT authorship contribution statement

Belinda Kennedy: Writing – review & editing, Writing – original draft, Project administration, Investigation, Formal analysis. Kate

Curtis: Writing – review & editing, Validation, Supervision, Project administration, Methodology, Funding acquisition, Formal analysis, Conceptualization. Sarah Kourouche: Writing – review & editing, Supervision, Methodology, Funding acquisition. Louise Casey: Writing – review & editing, Investigation. Dorothy Hughes: Writing – review & editing, Investigation. Andrea McCloughen: Writing – review & editing.

#### Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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#### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ienj.2024.101538>.

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### **5.1.3 Summary of Phase 1 Findings**

Study 1 involved a cross-sectional survey of emergency nurses in the Southern NSW LHD to identify the enablers and barriers of HIRAIID implementation. Two enablers and four barriers were identified and mapped to ten TDF domains. Guided by the BCW, these were linked the ten TDF domains to seven intervention functions according to the APEASE criteria. The intervention functions were subsequently mapped to 20 BCTs operationalised through 12 modes of delivery. Table 5.1 summarises the planned activities.

Table 5.1. Overview of the proposed 12 modes of delivery for the HIRAID implementation strategy

| Proposed intervention                  | Description   |
|--|---|
| Stakeholder engagement                 | Monthly meetings of a steering committee comprising representatives from all study sites; site visits conducted at the start of the project in September 2021   |
| Train-the-trainer course               | A 6-hour course, including PowerPoint presentations and simulations, for emergency nurses on the components of and rationale for the HIRAID framework. Attendees were identified through expressions of interest or by nurse managers, CNCs or nurse educators  |
| HIRAID e-learning module               | Available to Southern NSW LHD nurses via My Health Learning; based on an interactive design, adult learning principles and activities to reinforce teaching; develops nurses' skills and knowledge by teaching them about the components and benefits of HIRAID, demonstrating HIRAID use and enabling nurses to practice using the framework       |
| In-service training                    | A 45–60–minute workshop based on slides and interactive activities that teaches nurses about HIRAID and its benefits; delivered by emergency nurse educators and HIRAID champions who completed the train-the-trainer workshop  |
| Electronic medical records             | Replacement of previous documentation templates with HIRAID documentation templates in electronic medical records, which are available to all staff. The templates help with recall and provide prompts   |
| Video promotion                        | A brief YouTube video on the benefits of the HIRAID framework in clinical practice, the mechanisms to support its use HIRAID and how it can be incorporated into existing practice. The video features nursing, medical and executive staff promoting the use of HIRAID ( <a href="https://youtu.be/zbVvN6Qa05Q">https://youtu.be/zbVvN6Qa05Q</a> ) |
| Orientation                            | Incorporation of HIRAID into the ED orientation for new nurses, including e-learning, in-service training, role playing and instruction on the use of HIRAID templates to document patient assessment and management  |
| Short communications (posters, emails) | Communications related to staff expectations and use of the HIRAID framework at the executive and local levels prior to the live implementation and roll out of HIRAID  |
| Incentives                             | Material incentives, determined in consultation with emergency nurses, provided to staff at each site during HIRAID implementation  |
| Modelling                              | Modelling of HIRAID use in clinical practice by HIRAID champions, who will assist clinicians in skills development and encourage the use of HIRAID in practice. HIRAID champions to be provided with role instructions  |
| Resources/prompts                      | Flip cards outlining the HIRAID framework provided to all emergency staff to aid in recall and support use  |
| Reporting (meetings, data)             | Nurse managers, CNCs and HIRAID champions to monitor nurses' use of HIRAID and provide feedback. Documentation reviews to be conducted pre and post implementation to evaluate the implementation of HIRAID   |

*Note.* HIRAID: History, including Infection risk, Red flags, Assessment, Interventions, Diagnostics, reassessment and communication; CNC: clinical nurse consultant; NSW: New South Wales; LHD: local health district; ED: emergency department.

## 5.2 Phase 2: Evaluation of Implementation

This section presents the findings from each of the studies conducted in Phase 2 to evaluate the HIRAID implementation strategy (see Figure 5.2). It includes Publications 4 and 5. Publication 4 reports on the findings of Study 2, which involved an audit of emergency nurses' documentation before and after the implementation of HIRAID. Publication 5 reports on the findings of Study 5, a qualitative exploration of emergency nurses' experiences of HIRAID implementation. Chapter 6 integrates the findings of Phase 2, addressing Objective 3: to evaluate the implementation based on the RE-AIM framework to determine implementation fidelity and effectiveness.

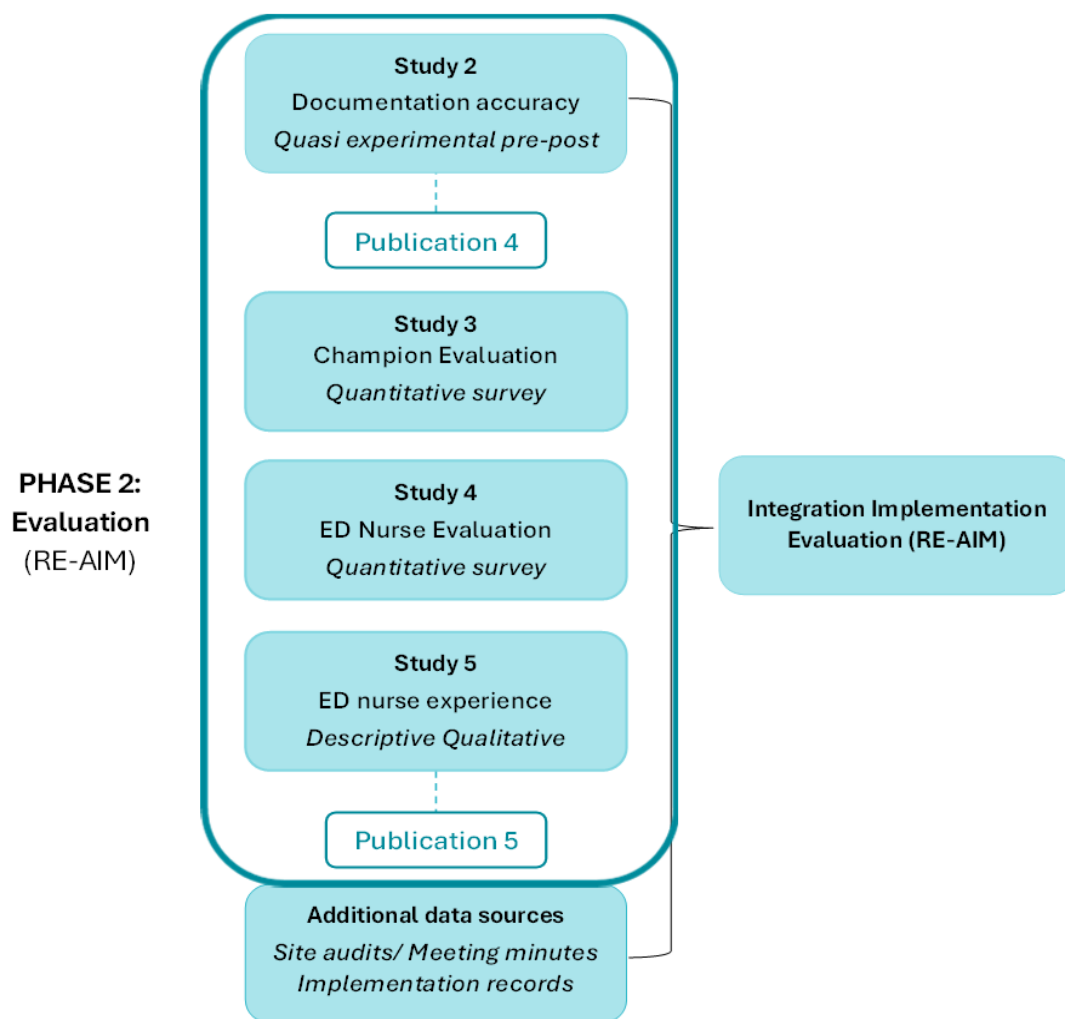


Figure 5.2. Overview of Phase 2 studies conducted to evaluate HIRAID implementation.

### **5.2.1 Study 2: Accuracy of Nursing Documentation (Publication 4)**

Study 2 is reported in Publication 4:

Kennedy, B., Lam, M., Kourouche, S., McCloughen, A., Casey, L., & Curtis, K. (2025). The impact of HIRAID implementation on the accuracy of emergency nurse documentation in Australian rural emergency departments: A multicenter quasi-experimental study. *Journal of Emergency Nursing*, *51*(3), 433–444. <https://doi.org/10.1016/j.jen.2024.12.004>

Supplementary files for Publication 4 can be found in Appendix 12 (Modified D-Catch data dictionary) and Appendix 21 (Documentation audit results).

# THE IMPACT OF HIRAID IMPLEMENTATION ON THE ACCURACY OF EMERGENCY NURSE DOCUMENTATION IN AUSTRALIAN RURAL EMERGENCY DEPARTMENTS: A MULTICENTER QUASI-EXPERIMENTAL STUDY



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## Contribution to Emergency Nursing Practice

- Accurate clinical documentation incorporating adequate detail related to the clinical presentation and nursing actions is essential to support continuity of care and communication through the patient journey.
- The implementation of HIRAID and the associated documentation template improved quality of nursing documentation in the emergency department. It also demonstrates relevance in diverse rural emergency settings.
- Establishing a template to guide documentation resulted in higher quality patient records of ED nursing care. Accurate, consistent written documentation supports verbal communication and transfer of care from the emergency department, which is essential for the patient's health care journey and patient safety.

## Abstract

**Introduction:** Documentation templates supported the implementation of HIRAID, a validated framework that supports nurses in assessing and managing patients in emergency

departments in rural Australia using a strategy informed by behavior change theory. The study aimed to determine whether the implementation of HIRAID improved the accuracy of nurses' documentation across a large rural health district.

**Methods:** A Quasi-experimental pre-post study design was conducted across 10 rural emergency departments between November 2020 and November 2021, with HIRAID implemented in February 2021. Retrospective audit of clinical documentation occurred 3 months pre-implementation and repeated at 6-months post. Based on power analysis and a sampling framework, records that met study inclusion were randomized for audit. Documentation accuracy was evaluated, using a modified D-catch instrument, assessing quality and quantity by an experienced research nurse. Data were analyzed with descriptive and inferential statistics.

**Results:** A review of 222 records (110 pre/112 post), demonstrated an improvement in initial ED nursing assessment documentation. Audit scores increased significantly for quantity of documentation across all areas, in particular history ( $P < .001$ ) and red flags ( $P < .001$ ), with a 27.1% increase in all red flags recorded. The quality of documentation also significantly improved across all areas, most notably in history ( $P < .001$ ) and assessment ( $P < .001$ ).

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**Discussion:** Implementation of HIRAID demonstrated a sustained improvement in the quantity and quality of emergency nurse documentation. Improved documentation accuracy is key to informing and evaluating ongoing care and supporting communication and continuity of care, and is essential to patient safety.

**Key words:** Emergency nursing; Rural nursing; Implementation science; Nursing assessment; Nursing documentation; Behavior change; Emergency; HIRAID

## Introduction

Communication failures contribute to adverse events in health care around the world.<sup>1</sup> Handover of care is a critical point of communication exchange, recognized as a high risk for patients due to the risk of miscommunication between health care providers.<sup>1</sup> Verbal handover without written records to support recall has the potential to result in communication errors, which can contribute to failures in the delivery of care and pose a risk to patient safety.<sup>2</sup> Accurate documentation is crucial to support the exchange of information between health professionals by providing a full account of events throughout the patient journey.<sup>2,4</sup>

Nursing documentation should be a contemporaneous, logical, and objective record of patient assessment and care delivery.<sup>1,5,6</sup> Higher quality documentation is achieved where it is consistent with the nursing process,<sup>6</sup> and it should cover all phases of nursing assessment and care to justify nursing interventions and actions.<sup>5,6</sup> Assessment of documentation accuracy requires the presence of qualitative and quantitative elements. That is, the record should be clear and unambiguous, using the correct terminology, and including the relevant details related to the purpose of admission, assessment findings, nursing interventions, and plan for ongoing care.<sup>7</sup>

Worldwide, clinical documentation in patient health care records by nurses is an established professional and legal responsibility.<sup>5,8,9</sup> Failure to accurately document, even if the care was provided, can lead to liability on the nurses' part due to the absence of written evidence of events and the plan of care.<sup>8</sup> Despite this, it is a common aspect of nursing care that is missed or incomplete,<sup>10-13</sup> of poor quality, or lacking accuracy.<sup>13,14</sup> Barriers to documentation include high workload and insufficient workplace resources and time.<sup>11,15</sup> The recognized barriers to documentation remain present with ever-increasing ED workload as a result of high patient acuity and volume of presentations. A small study of emergency nursing documentation post-implementation of the HIRAID emergency nursing framework, which included modifications to documentation processes, reported improvement in the quality of emergency nursing documentation for 3 common presentations.<sup>16</sup>

The HIRAID Framework, developed through a comprehensive review of the evidence and expert consensus, encompasses the emergency nursing process and guides assessment and care delivery post-triage.<sup>17</sup> HIRAID is History including Infection risk, Red Flags, Assessment, Interventions, Diagnostics, reassessment and communication (Figure 1). HIRAID has been tested in simulated and metropolitan settings,<sup>18</sup> demonstrating a positive impact on nurses and on patient and health service outcomes.<sup>19</sup> The framework has also been incorporated into the Residency Program delivered by the Emergency Nurses Association in the United States of America.<sup>20,21</sup> In rural emergency departments nurses may be the only clinician a patient will see, and at smaller sites with fewer resources and support, they are responsible for the majority of tasks to deliver effective care.<sup>12</sup> HIRAID has not previously been tested in a rural context.

## Aim

The aim of this study was to determine if the implementation of HIRAID, a structured framework for initial assessment and management post-triage, improved the accuracy of nurses' documentation across a large rural health district in Australia.

## Methods

Ethics approval was obtained through the Greater Western Human Research Ethics Committee (2020/ETH02164) before the commencement of the study. This report was prepared taking into consideration the strengthening reporting of observational studies in epidemiology (STROBE) checklist<sup>22</sup> (Supplementary File 1).

## STUDY DESIGN AND SETTING

The study was a quasi-experimental, pre-post design, conducted through retrospective review of randomized clinical records across 10 rural emergency departments from a single

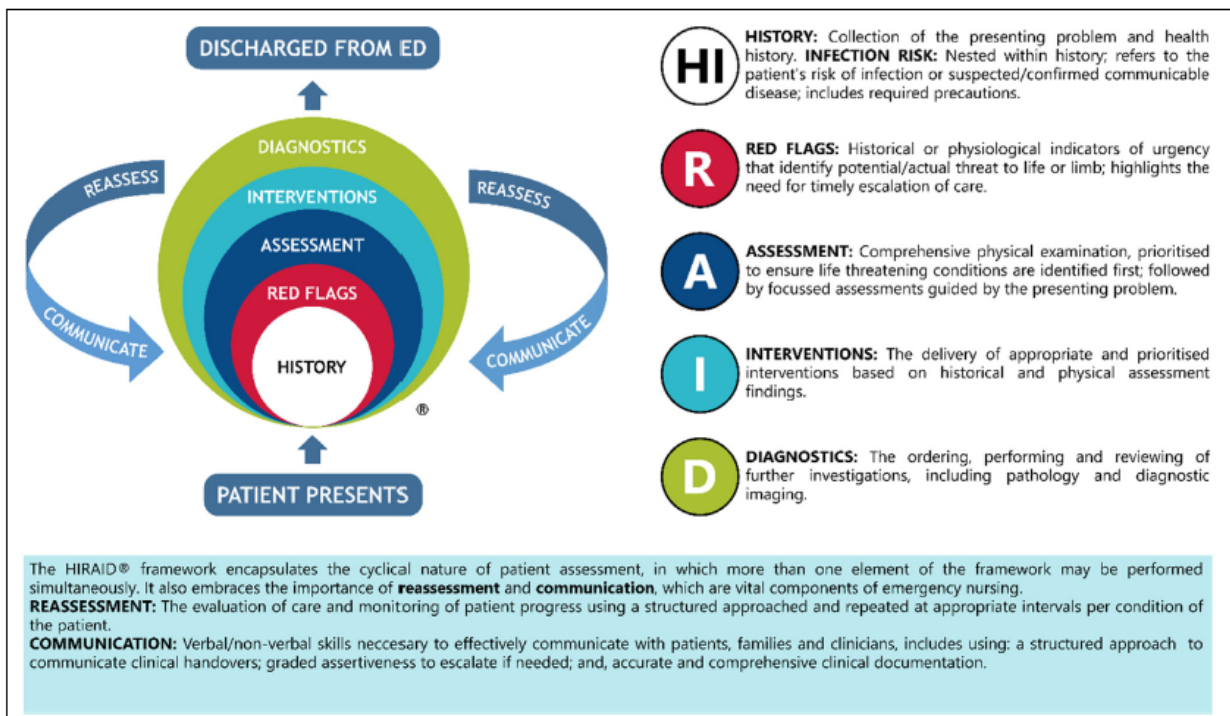


FIGURE 1  
HIRAID Emergency Nursing Framework.

health district in Southern New South Wales (NSW), Australia. The local health district (LHD) covers an area of 44,534 km<sup>2</sup>, and the 10 emergency departments had over 110,000 patient visits in 2020/21.<sup>23</sup> There are a mix of level 2 to 4 emergency departments within the LHD.<sup>24</sup> The level of emergency department corresponds to available onsite services, from 5 facilities with limited diagnostic and medical services onsite, often provided by a general practitioner or virtual care (level 2), to emergency departments with 24-hour onsite medical services, more physicians with specialist emergency training, and access to diagnostic clinical services, allied health, and administrative support (level 3/4).<sup>25</sup>

## STUDY PROCEDURE

### Implementation

The HIRAID emergency nursing framework was implemented as guided by a locally contextualized behavior change informed multi-modal strategy described elsewhere.<sup>26</sup> The framework was implemented using a train-the-trainer model, with staff from each site completing instructor training and then assisting in

delivering the education program and onsite support. The education program included an eLearning module and in-person training. A range of other strategies supported implementation, including documentation templates, audit and feedback, staff incentives, executive support, and district-wide communication.

Prior to HIRAID implementation, nurses completed free text clinical documentation or used individual or locally created templates. There was no evidence-based nursing framework taught nor standardized documentation templates used across the LHD. Documentation templates (Figure 2) were a key implementation strategy, designed to capture emergency nurse assessment findings and nursing actions. Based on senior clinician feedback, templates were modified to suit the local context, and instructor training included discussion related to appropriate application in the clinical setting. The templates required modification of the electronic medical record (eMR). Pre-formatted documentation templates were created as macros, making them available to all nurses to input free text documentation. The creation of macros is an eMR modification that is relatively straightforward, with minimal cost implications. HIRAID was implemented on February 22, 2021, following extensive pre-implementation consultation.

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**HIRAIID EMERGENCY NURSING ASSESSMENT (ADULT)**

**HISTORY** *(include historical red flags)*

**Presenting Problem**

*(Aggravating/relieving factors, related symptoms, severity, timing etc.)*

**Individual Health History**

*Pertinent Medications:*

*Pertinent medical/surgical:*

*Social history (who they live with, are they well?):*

*Habitual history (smoking/alcohol/drug use):*

**INFECTION RISK**

*Is patient at risk of infection or suspected/confirmed communicable disease? Precautions / PPE used*

**ASSESSMENT**

**Airway** *(patent/protected):*

**Breathing** *(RR/WOB/O2/air entry):*

**Circulation** *(HR/BP/rhythm/pulses/capillary refill/colour):*

**Disability** *(GCS/pain):*

**Exposure** *(temp/skin/access devices including if ambulance inserted):*

**Fluids** *(in):*

**Fluids** *(out):*

**Glucose** *(if indicated):*

**Relevant focused assessments** *(look/listen/feel):*

**INTERVENTIONS, DIAGNOSTICS**

*(What was done and what was the outcome?)*

**COMMUNICATIONS**

*(Who was contacted and when, including family/carers, referrals eg social work.*

*Escalation required? (Yes/No who to, why and when):*

**PLAN:**

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FIGURE 2  
HIRAIID Adult Documentation template.

POPULATION

Patient clinical records were reviewed for a 3-month period immediately before implementation, November 2020 to January 2021, and repeated from 6 months post-implementation, September to November 2021. The

timeframe for review following implementation was determined to ensure adequate time for HIRAIID and the associated documentation template to be established as part of routine practice and to assess sustainability. Criteria for inclusion were adult or pediatric presentations with either shortness of breath, fever, or abdominal/chest/

limb pain; an Australasian Triage Scale (ATS) 2, 3 or 4; admitted or transferred for ongoing care; and ED length of stay (LoS) greater than 1 hour. Any records meeting inclusion with no evidence of nursing care, ie, interventions such as medications or observations documented by nurses, were excluded.

Not all patients presenting to the emergency department will see the nurse post-triage; therefore, inclusion criteria were established to identify records for review where nurses would be required to document assessment and management. The 5 presenting problems were selected because they were among the most common problems presenting to emergency departments in NSW, Australia.<sup>27</sup> For patients presenting with these conditions, it was anticipated when a patient had an ED LoS greater than 1 hour and were admitted or transferred for ongoing care, nurses would be involved in care delivery for this patient group and required to complete and document a detailed assessment and relevant management. The ATS is used by Australian triage nurses to determine the urgency of the presentation based on a combination of the presenting problem in conjunction with physiological indicators, and the allocated category is associated with a recommended waiting time for treatment, ie, 1- immediate to 5- within 120 minutes.<sup>28</sup> For category 2-4 presentations, nurses are commonly involved post triage for assessment and commencement of treatment.

#### SAMPLE SIZE

Based on the 5 presenting problem types, it was determined that the minimum required sample was 110 records, 22 per presenting problem, to achieve 80% power at a significance level of 0.05, with an effect size of 0.3, and data analysis was conducted using 2 independent sample t-tests.

To identify patient records for audit, a report of all ED attendances during the study period was generated from the eMR system - FirstNet. Records were screened per the inclusion/exclusion criteria by the research nurse at the study site. Records were allocated a unique study ID and a study site ID. To ensure the sample was equitably distributed, a random sample of records based on the proportion of presentations according to established regions in the 12 months before commencing the study was generated using Statistical Package for Social Sciences (SPSS), version 2.<sup>29</sup> Randomization based on 3 established regions within the LHD was required; due to the small volume of presentations at some sites, it was not feasible to randomize per site.

#### DATA INSTRUMENT

The D-Catch instrument, developed through expert consensus and rigorous testing, has demonstrated validity and reliability in the assessment of nursing documentation in hospital settings.<sup>7</sup> A modified version of the D-Catch instrument, previously used by Munroe and colleagues,<sup>16</sup> was used to assess the accuracy of emergency nursing documentation. The tool captures the 7 essential elements of emergency nursing care, including history, red flags, assessment, interventions, diagnostics, reassessment, and communication.<sup>17</sup> The elements evaluated by the modified D-Catch are: (i) Structure of note, (ii) Patient history, (iii) Red flags, (iv) Assessment, (v) Interventions, and (vi) Ongoing plan for care; each is defined in Table 1. Quantity is evaluated for each item on a 4-point ordinal scale, from 1 (no relevant details) to 4 (all relevant details). Quality Items ii, iv-vi are also assessed for quality, scored on an ordinal scale of 1 (poor) to 4 (very good), detailed scoring criteria are available in Supplementary File 2. The identification of red flags relevant to the clinical presentation was guided by a predetermined selection of red flags associated with each presenting problem type as determined by clinical guidelines that were developed with emergency medicine, nursing, and pharmacy experts.<sup>30</sup>

#### Data Collection

The data collection tool was established in REDCap (Research Electronic Data Capture) (<https://catalyst.harvard.edu/services/redcap/>), a secure web-based application used for data collection and management<sup>31</sup> managed by The University of Sydney. The instrument provided prompts if data were missing.

Prior to use, the REDCap instrument was tested by 2 research nurses experienced in provision of emergency care, guided by a comprehensive data dictionary with scoring criteria (Supplementary File 2). This process tested the instrument for functionality, as well as training in the data collection. The reviewer was provided with an overview of the D-Catch instrument and was required to review the data dictionary and identify where the data elements were recorded within the health district records. Once this was established, data were collected on a sample of records, and reviewers met virtually to review the record content and scoring to identify discrepancies and ensure interpretation of the scoring criteria was consistent. Some minor changes in the original wording were made to the scoring criteria for greater clarity.

TABLE 1  
Definition of elements evaluated by the modified D-catch instrument

| Element         | Definition  |
|-----------------|---|
| Structure*      | Refers to the presence of a format that allows for meaningful and thorough description of all the essential elements of ED nursing care.  |
| Patient history | Is the reason for the patient attending the ED (presenting problem) and associated history of symptoms/ events, along with relevant medical/ surgical and social history.   |
| Red flags*      | Indicators of urgency identified through history or assessment, highlighting need for timely escalation of care due to actual or potential threat to life or limb.  |
| Assessment      | This refers to the physical assessment of the patient, including a general assessment and a focused assessment relevant to the presentation.  |
| Interventions   | This includes both interventions and diagnostics.<br>Interventions are actions taken to aid in managing acute deterioration or symptom control (e.g., pain relief), or to prevent complications and maintain functional status.<br>Diagnostics are investigations relevant to the presentation that will provide further information about the clinical condition, such as pathology, urinalysis, or imaging. |
| Plan            | Details the plan for ongoing care and follow up including communication with patient/family or medical staff as required. For example, noted abnormal assessment findings that require escalation.  |

ED, emergency department.

\* Assessed based on quantity only.

Records for the study were uploaded directly to REDCap by a research nurse employed by the LHD. They were then audited by an ED clinician experienced in clinical care and research, external to the study site. If any

clarification was required during the audit, a second auditor was consulted.

#### Data Analysis

Audit data were extracted from REDCap, imported to the secure Research Data Store managed by The University of Sydney, and then analyzed using SPSS, version 28.<sup>29</sup> Data were summarized using descriptive statistics, mean and SD or median and interquartile range (IQR), based on distribution for continuous data and frequencies and percentages for categorical variables. The modified D-catch scores were calculated as mean (SD). Differences pre- and post-intervention were assessed using a 2-sample *t*-test for continuous variables, and the association between phase of intervention for categorical variables was examined using Pearson's Chi-Square. The ordinal scale scores measuring the quantity and quality of documentation were calculated as mean scores. A *P*-value of <.05 was considered statistically significant.

#### Results

There were 56,595 presentations to the emergency department during the study period with 12,967 having a presenting problem included in the study eligibility criteria. After the removal of records based on exclusion criteria (triage category, LoS or not admitted/ transferred), 3248 records remained, from which 248 records were randomized and audited, and 110 pre and 112 posts were reviewed in full. A further 26 records were excluded as they did not meet study inclusion on full review (46.2%, *n* = 12); primarily, the presenting problem was not included in study, followed by those with no evidence of nursing documentation nor interventions performed by nursing staff beyond triage (34.6%, *n* = 9).

#### SAMPLE POPULATION

All sites were represented. Records of patients audited in the 3 months prior to HIRAID implementation were younger compared to the time period post, median (IQR) 61 (49-73) years and 70 (55-79) years (*U* = 6886, *P* = .03). There was no significant difference in sex, day/time of presentation, ED LoS, triage category, or time to initial

TABLE 2  
Sample characteristics of clinical records included in documentation audit analysis

| Characteristic                                       | Pre N = 110 | Post N = 112      | Test statistics/P value <sup>*†</sup> |
|--|-------------|-------------------|---------------------------------------|
| Age- median (IQR)                                    | 61 (49-73)  | 70 (55-78.5)      | U = 6886, P = .03                     |
| Sex  |             |                   | P = .90                               |
| Female   | 51 (46.4%)  | 51 (45.5%)        |                                       |
| Male   | 59 (53.6%)  | 61 (54.5%)        |                                       |
| Triage category                                      |             |                   | $\chi^2(2) = 1.39, P = .50$           |
| 2  | 42 (38.2%)  | 35 (31.3%)        |                                       |
| 3  | 48 (43.6%)  | 57 (50.9%)        |                                       |
| 4  | 20 (18.2%)  | 20 (17.9%)        |                                       |
| ED length of stay (hours) mean (SD)                  | 4.86 (3.67) | 5.17 (2.76)       | t(220) = 0.70, P = .48                |
| Time of presentation                                 |             |                   | $\chi^2(2) = 1.75, P = .42$           |
| Morning (8 AM - 3:59 PM h)                           | 43 (39.1%)  | 53 (47.3%)        |                                       |
| Afternoon (4 PM -11:59 PM h)                         | 48 (43.6%)  | 40 (35.7%)        |                                       |
| Night (12 AM -7:59 AM h)                             | 19 (17.3%)  | 19 (17%)          |                                       |
| Day of presentation                                  |             |                   | $\chi^2(2) = 5.86, P = .22$           |
| Monday   | 28 (25.5%)  | 16 (14.3%)        |                                       |
| Tuesday  | 13 (11.8%)  | 20 (17.9%)        |                                       |
| Wednesday  | 11 (10%)    | 13 (11.6%)        |                                       |
| Thursday   | 15 (13.6%)  | 19 (17%)          |                                       |
| Friday   | 12 (10.9%)  | 16 (14.3%)        |                                       |
| Saturday   | 14 (12.7%)  | 18 (16.1%)        |                                       |
| Sunday   | 17 (15.5%)  | 10 (8.9%)         |                                       |
| Time (min) documentation from arrival – median (IQR) | 67 (42-122) | 73.5 (37.5-121.5) | U = 6071, P = .87                     |
| Presentation   |             |                   | P = .59                               |
| Yes  | 8 (7.5%)    | 6 (5.5%)          |                                       |
| No   | 99 (92.5%)  | 103 (94.5%)       |                                       |
| Discharge disposition <sup>‡</sup>                   |             |                   | $\chi^2(2) = 1.27, P = .53$           |
| General Ward/ Short stay                             | 76 (69.1%)  | 84 (75%)          |                                       |
| Critical care  | 9 (8.2%)    | 8 (7.1%)          |                                       |
| Transfer   | 25 (22.7%)  | 19 (17%)          |                                       |

IQR, interquartile range.

\* Fisher exact test for 2 × 2 comparisons.

† P value rounded to 2 decimal places.

‡ One record post phase excluded from analysis discharged to operating theater.

documentation between the groups (Table 2). More than 80% of presentations were between 8 AM and 11 PM.

#### QUANTITY AND QUALITY OF NURSING DOCUMENTATION

Following the implementation of HIRAID there was a significant improvement in the accuracy of documented nursing assessment following triage. There was a significant increase

in the mean (SD) average score for quantity from 1.8 ( $\pm 0.6$ ) to 2.6 ( $\pm 0.7$ ),  $t(219) = 9.99, P < .001$ , and for quality from 1.6 ( $\pm 0.5$ ) to 2.2 ( $\pm 0.6$ ),  $t(219) = 8.45, P < .001$ .

#### STRUCTURE

The presence of structural elements (the elements required for meaningful and thorough emergency nursing documentation) was demonstrated with an increased mean

score (SD) from 1.6 ( $\pm$  0.9) to 3.3 ( $\pm$  1.1) ( $t$  (220) = 12.63,  $P < .01$ ). This is reflected with more than 75% of records scoring 3 or 4 post-implementation, ie, they were structured to allow the description of a minimum of 4 out of 6 elements considered relevant in ED documentation (Table 3). Before the implementation of HIRAID fewer than half of the records audited incorporated a structured format for documenting the initial nursing assessment post-triage (45.5% pre vs 83.9% post,  $P < .001$ ). Where a structure was used in the pre-group, the most common was an A-G format (72%), ie, airway, breathing, circulation, disability, fluids, glucose. Following implementation, when a structured format was noted, HIRAID was the most common (79%) (Supplementary File 3).

## HISTORY

Documentation of History, ie, the reason for attending emergency department and relevant health history, significantly improved post the implementation of HIRAID. More than 70% of records audited scored 3 or more for quantity compared to only 32% of records audited before implementation, equating to an increased mean score (SD) from 1.9 ( $\pm$  1.1) to 3 ( $\pm$  1.1) ( $t$ [220] = 7.06,  $P < .001$ ) (Table 3).

There was a significant improvement in documentation of "what" the presenting problem was ( $P < .001$ ), along with the onset of symptoms ( $P < .001$ ) and symptoms associated with the presenting problem ( $P < .001$ ). The areas of individual health history also improved with documentation

TABLE 3

Quantity and quality of initial emergency nursing documentation pre- and post-HIRAID implementation using modified D-catch tool

| Modified D-Catch element           | n   | Score*     |            |            |            | Mean (SD) | Test statistics†   |
|------------------------------------|-----|------------|------------|------------|------------|-----------|--------------------|
|                                    |     | 1          | 2          | 3          | 4          |           |                    |
| Quantity of documentation          |     |            |            |            |            |           |                    |
| Structure (pre)                    | 110 | 59 (53.6%) | 38 (34.5%) | 6 (5.5%)   | 7 (6.4%)   | 1.6 (0.9) | $t(220) = 12.63$ , |
| Structure (post)                   | 112 | 14 (12.5%) | 10 (8.9%)  | 18 (16.1%) | 70 (62.5%) | 3.3 (1.1) | $P < .001$         |
| History (pre)                      | 110 | 56 (50.9%) | 19 (17.3%) | 20 (18.2%) | 15 (13.6%) | 1.9 (1.1) | $t(220) = 7.06$    |
| History (post)                     | 112 | 15 (13.4%) | 18 (16.1%) | 34 (30.4%) | 45 (40.2%) | 3 (1.1)   | $P < .001$         |
| Red flags (pre)                    | 101 | 68 (67.3%) | 19 (18.8%) | 7 (6.9%)   | 7 (6.9%)   | 1.5 (0.9) | $t(202) = 5.00$    |
| Red flags (post)                   | 103 | 44 (42.7%) | 16 (15.5%) | 8 (7.8%)   | 35 (34.0%) | 2.3 (1.3) | $P < .001$         |
| Assessment (pre)                   | 110 | 46 (41.8%) | 41 (37.3%) | 23 (20.9%) | 0 (0%)     | 1.8 (0.8) | $t(220) = 5.45$    |
| Assessment (post)                  | 112 | 16 (14.3%) | 44 (39.3%) | 49 (43.8%) | 3 (2.7%)   | 2.3 (0.8) | $P < .001$         |
| Interventions & diagnostics (pre)  | 110 | 19 (17.3%) | 45 (40.9%) | 43 (39.1%) | 3 (2.7%)   | 2.3 (0.8) | $t(219) = 5.34$    |
| Interventions & diagnostics (post) | 112 | 9 (8.1%)   | 23 (20.7%) | 53 (47.7%) | 26 (23.4%) | 2.9 (0.9) | $P < .001$         |
| Plan (pre)                         | 110 | 62 (56.4%) | 41 (37.3%) | 6 (5.5%)   | 1 (0.9%)   | 1.5 (0.6) | $t(220) = 5.33$    |
| Plan (post)                        | 112 | 27 (24.1%) | 60 (53.6%) | 23 (20.5%) | 2 (1.8%)   | 2 (0.7)   | $P < .001$         |
| Quality of documentation           |     |            |            |            |            |           |                    |
| History (pre)                      | 110 | 62 (56.4%) | 43 (39.1%) | 5 (4.5%)   | 0 (0%)     | 1.5 (0.6) | $t(220) = 8.54$    |
| History (post)                     | 112 | 19 (17%)   | 47 (42%)   | 39 (34.8%) | 7 (6.3%)   | 2.3 (0.8) | $P < .001$         |
| Assessment (pre)                   | 110 | 60 (54.5%) | 37 (33.6%) | 13 (11.8%) | 0 (0%)     | 1.6 (0.7) | $t(220) = 6.98$    |
| Assessment (post)                  | 112 | 25 (22.3%) | 32 (28.6%) | 50 (44.6%) | 5 (4.5%)   | 2.3 (0.9) | $P < .001$         |
| Interventions & diagnostics (pre)  | 110 | 37 (33.6%) | 48 (43.6%) | 24 (21.8%) | 1 (0.9%)   | 1.9 (0.8) | $t(219) = 4.06$    |
| Interventions & diagnostics (post) | 112 | 16 (14.4%) | 49 (44.1%) | 40 (36%)   | 6 (5.4%)   | 2.3 (0.8) | $P < .001$         |
| Plan (pre)                         | 110 | 78 (70.9%) | 29 (26.4%) | 2 (1.8%)   | 1 (0.9%)   | 1.3 (0.6) | $t(220) = 4.95$    |
| Plan (post)                        | 112 | 45 (40.2%) | 50 (44.6%) | 17 (15.2%) | 0 (0%)     | 1.8 (0.7) | $P < .001$         |

\* Modified D-Catch Scoring Criteria Supplementary File 2.

†  $P$  value rounded to 3 decimal places.

of pertinent medical ( $P < .001$ ) and surgical history ( $P < .001$ ), as well as aspects related to social and habitual history in the initial assessment (Supplementary File 3).

The quality of patient history documentation also significantly improved post-intervention (mean [SD] 1.5 [ $\pm 0.6$ ] vs 2.3 [ $\pm 0.8$ ],  $t[220] = 8.54$ ,  $P < .001$ ). This change reflected improved documentation of the presenting problem and patient individual health history reported in adequate detail and with clarity, scoring  $\geq 3$  on the audit scale, increasing from 4.5% pre- to 41.1% of records audited post-implementation of HIRAID (Table 3).

#### RED FLAGS

Emergency nurses documented a greater number of the historical and/or clinical red flags identified in initial nursing assessment, with 41.8% documenting  $\geq 75\%$  of red flags noted by the auditor, compared with only 13.8% pre-implementation (mean [SD] 1.5 [ $\pm 0.9$ ] vs 2.3 [ $\pm 1.3$ ],  $t[202] = 5.00$ ,  $P < .001$ ) (Table 3). The mean (SD) percentage of red flags recorded by emergency nurses increased significantly from 27.5 (33.6) to 54.7 (40), ( $P < .001$ ) post-implementation. There was no change in the number of red flags identified in the clinical record by the reviewer pre/post (Supplementary File 3).

#### ASSESSMENT

The proportion of records with physical assessment findings documented improved from 58.2% to 85.8% of records audited in the post phase, reflected in a significant increase in mean (SD) from 1.8 ( $\pm 0.8$ ) to 2.3 ( $\pm 0.8$ ),  $t(220) = 5.45$ ,  $P < .001$ . (Table 3).

The quality of assessment had the second largest improvement in mean score (SD) after history, with only 11.8% of records scoring  $\geq 3$  before and 49.1% scoring  $\geq 3$  post-implementation (Table 3). Where observations were recorded in the observation chart and interpreted in the clinical documentation, there was a significant improvement in the accuracy for heart rate ( $P = .01$ ), blood pressure ( $P = .02$ ), oxygen saturation ( $P = .02$ ) and temperature ( $P = .002$ ). There was no change in documented pain score post-implementing HIRAID. Focused assessments for those with fever-related presentations significantly improved ( $P = .03$ ) but abdominal assessment remained poor. (Supplementary File 3).

#### INTERVENTIONS AND DIAGNOSTICS

The quantity of the required interventions and diagnostics documented with the initial nursing assessment post-triage, increased post the implementation of HIRAID (mean [SD] 2.3 [ $\pm 0.8$ ] vs 2.9 [ $\pm 0.9$ ],  $t[219] = 5.34$ ,  $P < .001$ ) (Table 3). There were more records where at least 50% of relevant nursing interventions were documented (42% pre vs 71% post). The frequency of interventions and diagnostics recorded in eMR was similar pre and post (Supplementary File 3). The quality of documentation for interventions also improved with an increase in mean (SD) 1.9 ( $\pm 0.8$ ) to 2.3 ( $\pm 0.8$ ),  $t(219) = 4.06$ ,  $P < .001$  (Table 3).

#### PLAN

The quantity and quality of the recorded plan significantly improved, 1.5 ( $\pm 0.6$ ) vs 2 ( $\pm 0.7$ ),  $t(220) = 5.33$ ,  $P < .001$  and 1.3 ( $\pm 0.6$ ) vs 1.8 ( $\pm 0.7$ ),  $t(220) = 4.95$ ,  $P < .001$ , respectively (Table 3). In the post-implementation phase a greater number of records documented consultation with the medical officer ( $P = .001$ ), a care plan ( $P < .001$ ) and communication with family ( $P = .01$ ) as part of the initial nursing documentation post triage. (Supplementary File 3).

#### Discussion

The implementation of HIRAID in a large rural health district resulted in a significant improvement in the accuracy (quality and quantity) of nursing documentation. This correlates with and builds on a smaller study conducted in a regional health setting.<sup>16</sup> Improvement was noted across all essential components of emergency nursing documentation: structure, history, assessment, red flags, interventions, and plan.

This significant increase in structure is important as it enables necessary information to be recorded in clinical documentation. Variable and inconsistent documentation practices have the potential for information to be omitted or miscommunicated, which poses a risk to patient safety.<sup>1,32</sup> The HIRAID framework encapsulates the emergency nursing process.<sup>33</sup> The documentation template, established during implementation, provided a consistent structure to capture the findings from HIRAID assessment that inform clinical decision-making, interventions, and plans for ongoing patient care and reassessment. The

template structure followed the emergency nursing process, and previous studies have shown documentation that aligns with the nursing process improves the quality of documentation.<sup>6</sup>

The study results reflected an improvement in the accuracy of history and assessment details that were documented. This accurate information is essential to provide a baseline for the patient's condition and inform ongoing patient care and assessment.<sup>33</sup> Although improvement was significant, there is scope for further improvement. For example, although the documentation of pain history, ie, location, radiation, and aggravating/relieving factors improved, it was still only present in fewer than half of the records audited, for presentations related to a painful condition. Collection of this information not only aids decision making, it provides justification for nursing actions taken and is also relevant in the transfer of care. Poor quality documentation is associated with increased adverse events following transfer of care, resulting from information not being accurately communicated throughout the patient journey.<sup>2,4</sup> Documentation of a complete history and assessment was associated with reduced adverse events in the 24 hours following the transfer of critically ill patients in 1 study.<sup>4</sup>

The early recognition and response to clinical deterioration is health service priority, to ensure appropriate management of deteriorating patients and minimize avoidable adverse events.<sup>34</sup> Nurses play an important role in the early recognition of deterioration, as they have more contact with the patient throughout their admission and are responsible for ongoing patient assessment.<sup>35</sup> There was an improvement in the documentation of red flags post HIRAID implementation. Red flags are actual or potential indicators of urgency associated with the patient presentation that are identified based on the history and/or assessment.<sup>33</sup> While not all red flags may require immediate escalation, they inform decision making around severity and ongoing assessment and management decisions. In this study there was a greater proportion of red flags documented in the clinical records. It is well established that accurate clinical records support the ongoing monitoring of patient progress, which is critical to the recognition of clinical deterioration.

While there is an overall improvement in documentation, based on the results of this study there is room for further improvement in the quality. The contributing factors to poor-quality documentation can be multifactorial. Workload, staff resources and a lack of time are all attributed to the inability to complete required nursing tasks, including documentation.<sup>10-12</sup> It has also been reported that greater priority is placed on practical nursing tasks and hence a barrier to documentation.<sup>36</sup> These challenges

are particularly heightened in rural areas because many nurses work on sites without 24-hour medical coverage and are required to fulfill a variety of clinical roles.<sup>12</sup> The initial work to inform the implementation of HIRAID raised similar concerns related to workload and resources at the study sites.<sup>37</sup> To further improve the accuracy of documentation, exploring the barriers to completion in the local context would be necessary.

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### Limitations

There are limitations to this study. It was conducted across 10 sites, with a relatively small sample size, which was not large enough to report results for individual sites. While there were more red flags recorded in the initial documented assessment, the actions taken by nurses based on these findings were not established. The documentation improved post HIRAID implementation, however, the impact on clinical practice and patient outcomes was not measured. Data related to the nursing staff profile across the sites were not collected, and therefore any change related to staff changes cannot be accounted for. The intervention training was embedded into local orientation processes to ensure all nurses commencing after initial implementation were trained. Data were collected by a single reviewer for this study, which may pose a risk to the validity of results; measures were taken to address using a reviewer external to the study site who was trained in data collection.

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### Implications for Emergency Nurses

Aligning the emergency nursing documentation with the nursing process in the emergency department improves the detail and quality of information recorded related to the patient presentation and treatment in the medical record. In an environment where emergency nurses frequently initiate treatment, improved documentation ensures that there is adequate detail to support clinical decisions. In addition, this has the potential to support transfer of care and continuity of care for the patient with improved communication.

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### Conclusion

The implementation of the HIRAID emergency nursing framework intervention, using an evidence-informed implementation strategy, resulted in significant improvement in the quality and quantity of initial emergency nursing documentation. There remains room for improvement and

further work is required to identify the relevant strategies to address barriers to accurate and complete documentation by emergency nurses.

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Conflicts of interest: none to report.

HIRAID is a registered trademark by The University of Sydney, and the associated education materials are copyrighted. The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

### Supplementary Data

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.jen.2024.12.004>.

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### 5.2.2 Study 3: Evaluation of Training and Implementation by HIRAID Champions

Study 3 captured the perspectives of HIRAID champions (emergency nurses who had attended a train-the-trainer course in February or April 2021) on the train-the-trainer course and implementation of HIRAID.

Thirty-four emergency nurses in the Southern NSW LHD were trained to be HIRAID champions. Most ( $n = 27, 79\%$ ) attended one of the three initial train-the-trainer courses in the week before the live implementation of HIRAID in February 2021. A further seven nurses (21%) attended the training in April 2021. After the initial training, ten of the 11 sites had at least one trained HIRAID champion. Following completion of training, the mean number of champions per site was 2.9 ( $SD = 1.6$ , range = 1–6). An additional two champions were employed in district roles. Table 5.2 shows the number and percentage of champions per site.

Table 5.2. HIRAID champions per study site

| Study site                        | Instructors $n$ (%) |
|-----------------------------------|---------------------|
| Batemans Bay District Hospital    | 3 (8.8)             |
| Bombala Multipurpose Service      | 2 (5.9)             |
| Braidwood Multipurpose Service    | 2 (5.9)             |
| Cooma Hospital and Health Service | 2 (5.9)             |
| Crookwell District Hospital       | 2 (5.9)             |
| Goulburn Base Hospital            | 6 (17.6)            |
| Moruya Hospital                   | 5 (14.7)            |
| Pambula Health Service            | 2 (5.9)             |
| Queanbeyan Hospital               | 5 (14.7)            |
| South East Regional Hospital      | 2 (5.9)             |
| Yass District Hospital            | 1 (2.9)             |
| District role                     | 2 (5.9)             |
| Total                             | 34                  |

#### 5.2.2.1 Survey 1: Instructor Course Evaluation

Twenty-four of the 34 emergency nurses who attended the instructor training completed the course evaluation, equating to a 71% response rate. Nineteen respondents included a free text response to one or both open-ended questions. Of these, eight included suggestions for improving the course and 18 provided general feedback. Overall, the

training was well received, as evidenced by the overall strong agreement with all six statements (see Table 5.3). Based on the Shapiro-Wilk test returning  $p < 0.001$  on all items, median and IQR are reported.

Table 5.3. HIRAID train-the-trainer course evaluation

| Item   | Median (IQR) |
|--|--------------|
| The e-learning module provided good foundation for course*     | 5 (4-5)      |
| Simulation gave greater understanding of application of HIRAID | 5 (4-5)      |
| Felt engaged in training                                       | 5 (5-5)      |
| Clear <i>how</i> to apply HIRAID in practice                   | 5 (5-5)      |
| Clear understanding of <i>my role</i> as HIRAID trainer*       | 5 (5-5)      |
| <i>Confident</i> in my ability to deliver HIRAID training      | 5 (4-5)      |

Note.  $N = 24$ ; \*23 participants responded to these statements. Answers rated on a five-point Likert scale.

Participants strongly agreed that the e-learning prepared them for the instructor training and that simulations facilitated their understanding of the application of HIRAID. Nevertheless, their main suggestions for improvement were related to having more time and space for simulations. For example, Participant 12 commented, “More time on simulation would help to process all the info and teach skills to teach others.”

Participants felt engaged with the training and had a good understanding of how to apply HIRAID in practice. For example, Participant 7 commented, “Great day. Great concept going forward. Let’s hope this becomes ‘the’ standard.”

Participants indicated that they understood their role as a HIRAID trainer and were confident in their ability to support implementation. For example, Participant 13 commented, “Great resources. Feel more confident to deliver and assist with implementation.”

5.2.2.2 Survey 2: HIRAID Champion Implementation Fidelity

Implementation fidelity measures the degree to which the implementation strategy was delivered as intended across the study sites. Twenty-five nurses who attended the instructor course completed the online survey (74% response rate). All 11 study sites were represented, with responses distributed between Level 2 ( $n = 11, 44%$ ) and Level 3/4 ( $n = 14, 66%$ ) facilities. Table 5.4 provides an overview of the HIRAID

implementation fidelity instructor survey results. Key findings along with exemplar quotes are presented below.

Most participants reported that there were HIRAID champions at the site during implementation ( $n = 23, 92\%$ ) and that they had been trained by the same instructors (i.e. the thesis author and a supervisor) ( $n = 21, 84\%$ ). While the original intention was that nurses would volunteer for the role of champion in consultation with their nurse manager, fewer than 50% of participants had done so (see Table 5.4).

Despite champions being present at all study sites, only 10 (43.5%) participants reported that they had 'often' or 'always' fulfilled the HIRAID responsibilities outlined in the training, indicating low fidelity. These responsibilities included activities such as tracking implementation activities, assisting in the delivery of training or following up with staff to conduct an assessment using HIRAID. Fulfilling these tasks was more challenging for nurses at Level 2 facilities compared with those at Level 3/4 facilities, with only 33% ( $n = 3$ ) and 50% ( $n = 7$ ), respectively, completing these tasks often or always. Respondents explained that their inability to complete the required tasks was related to staffing or workload challenges. For example, Participant 6 commented, "Short staffing levels impacted greatly on the implementation of HIRAID, at times no staff at all. At times if the staff were there, the unit will be so busy to even make a follow up." Others commented that colleagues who had also completed the training were not engaged: "There were 2 of us this for this site [sic]. I don't feel that the other champion did 50% of the work. She turned up for training and ate the chocolates" (Participant 3). Less than half of survey respondents had worked through a patient assessment with nurses, primarily because of workforce logistics or because they felt it was unnecessary. For example, Participant 14 explained, "After attending the in-service and going through the case scenario in that session, most staff understand the constructs of HIRAID related to patient assessment". Participant 12 commented,

It took quite a while to get to everyone, due to my role being 0.5 and thus not always coinciding with all staff [sic], also competing CNE [clinical nurse educator] priorities, annual leave and I then relieved nurse manger role for a few weeks 1 (ish) day/week specifically allocated to HIRAID implementation in the initial few weeks would have been fantastic [sic].

Just under half the respondents (48%) reported using the provided PowerPoint slides in the delivery of all sessions, indicating low fidelity in the delivery of this component of the implementation strategy. For those who did use the PowerPoint slides, seven (28%) indicated that they had made minor changes, removing one to four of the slides.

The delivery of face-to-face education to nurses varied and was hindered by the workload of the ward: “For myself, when time was limited I used the printed version of the presentation and did quick on the go education [sic]. This sometimes included starting and stopping the presentation to deal with the ward requirements” (Participant 24). Some respondents justified their failure to use the PowerPoint because of their work context: “Individual sessions only as there aren’t enough staff to justify running a PowerPoint [sic]. Relevant slides were used as decided by champions—depending on knowledge and experience of the learner” (Participant 3).

There was moderate fidelity to the distribution of flip cards and communications reinforcing the use of HIRAID. Most respondents ( $n = 18$ , 72%) reported distributing the ED flip cards, which provided nurses with a readily available prompt attached to their uniform. Most respondents ( $n = 18$ , 72%) also indicated that the nurse manager or educator had reinforced the use of HIRAID among staff.

When participants were asked about what they liked about HIRAID, their responses mainly related to consistency, supporting new nurses and the standard of documentation: “Commonality. Sets a high standard for documentation for all staff. We are all on the same page as staff members when it comes to our documentation” (Participant 25).

When asked about what they disliked about HIRAID, participants overwhelmingly referred to the documentation templates, with some suggesting improvements: “HIRAID should be improved as compared to the documentation on FirstNet which is user friendly [sic]. For example, you can add observations and results on the discharge summary unlike the HIRAID documentation [sic]” (Participant 6).

A few comments suggested that some nurses perceived HIRAID to be the use of the documentation templates used to support implementation. For example, Participant 24 stated, “There is not always a lot of time in ED to complete a full HIRAID, the subacute document was frequently used in high turnover beds.” Similarly, Participant 12 commented,

I think it is more suited to an ED with a separate triage and treating nurse. Much feedback included comments such as I'm just repeating my triage etc [sic]. Staff encouraged to use it in place of first progress note and not immediately [sic] and that seems to be working better. It is not appropriate for many of our T5's and some T4's —we have patients returning for dressings, ECG's wound review, eye r/v etc [sic] so we have not been using it for these people.

Table 5.4 provides an overview of the results of the HIRAID champion survey.

Table 5.4. Results of the HIRAID champion survey: overall and by emergency department level

| Survey item  |                                   | Overall ( <i>n</i> = 25) | Level 2 ( <i>n</i> = 11) | Level ED ( <i>n</i> = 14) | Fidelity |
|--|-----------------------------------|--------------------------|--------------------------|---------------------------|----------|
| <b>HIRAID champions</b>  |                                   |                          |                          |                           |          |
| Champions onsite during implementation                                   |                                   | 23 (92.0)                | 9 (81.8)                 | 14 (100.0)                | High     |
| Champions fulfilled tasks<br>( <i>n</i> = 23)                            | Often/always                      | 10 (43.5)                | 3 (33.3)                 | 7 (50.0)                  | Low      |
|  | Sometimes                         | 12 (52.2)                | 6 (66.7)                 | 6 (42.9)                  |          |
|  | Rarely/never                      | 1 (4.3)                  | -                        | 1 (7.1)                   |          |
| Champion recruitment   | All volunteered                   | 12 (48.0)                | 5 (45.5)                 | 7 (50.0)                  |          |
|  | Some volunteered, some were asked | 8 (32.0)                 | 3 (27.3)                 | 5 (35.7)                  |          |
|  | None volunteered, all were asked  | 5 (20.0)                 | 3 (27.3)                 | 2 (14.3)                  |          |
| Training for instructor/champion delivered by university representatives | All                               | 21 (84.0)                | 11 (100)                 | 10 (71.4)                 | High     |
|  | Most                              | 2 (8.0)                  | -                        | 2 (14.3)                  |          |
|  | Some/none <sup>a</sup>            | 2 (8.0)                  | -                        | 2 (14.3)                  |          |
| HIRAID assessment with staff   | Almost all staff                  | 10 (40.0)                | 3 (27.3)                 | 7 (50.0)                  | Low      |
|  | Most staff                        | 8 (32.0)                 | 4 (36.4)                 | 4 (28.6)                  |          |
|  | Occasionally /never <sup>a</sup>  | 7 (28.0)                 | 4 (36.4)                 | 3 (21.4)                  |          |
| Use of HIRAID documentation templates                                    | Often/always                      | 21 (84.0)                | 9 (81.8)                 | 12 (85.7)                 | High     |
|  | Sometimes                         | 2 (8.0)                  | -                        | 2 (18.2)                  |          |
|  | Rarely/never <sup>a</sup>         | 2 (8.0)                  | 2 (18.2)                 | -                         |          |
| Flip cards distributed   | Always                            | 19 (76.0)                | 8 (72.7)                 | 11 (78.6)                 | Moderate |
|  | Majority                          | 2 (8.0)                  | 1 (9.1)                  | 1 (7.1)                   |          |
|  | Some/never <sup>a</sup>           | 4 (16.0)                 | 2 (18.2)                 | 2 (14.3)                  |          |

| Survey item   |                                    | Overall (n = 25) | Level 2 (n = 11) | Level ED (n = 14) | Fidelity |
|---|------------------------------------|------------------|------------------|-------------------|----------|
| <b>HIRAID education</b>                             |                                    |                  |                  |                   |          |
| Education delivered by instructor trained in HIRAID | Always                             | 23 (92.0)        | 10 (90.9)        | 13 (92.9)         | High     |
|   | Most of the time                   | 1 (4.0)          | 1 (9.1)          | -                 |          |
|   | Hardly ever/never <sup>a</sup>     | 1 (4.0)          | -                | 1 (7.1)           |          |
| PowerPoints used in education sessions              | Always                             | 12 (48.0)        | 6 (54.5)         | 6 (42.9)          | Low      |
|   | Most of the time                   | 11 (44.0)        | 4 (36.4)         | 7 (50.0)          |          |
|   | Hardly ever/never <sup>a</sup>     | 2 (8.0)          | 1 (9.1)          | 1 (7.1)           |          |
| Adaptations made to presentation                    | Presentation delivered as provided | 18 (72.0)        | 8 (72.7)         | 10 (71.4)         | Moderate |
|   | 1-2 slides removed                 | 4 (16.0)         | 1 (9.1)          | 3 (21.4)          |          |
|   | > 2 slides removed                 | 3 (12.0)         | 2 (18.2)         | 1 (7.1)           |          |
| <b>HIRAID communication</b>                         |                                    |                  |                  |                   |          |
| Nurse manager/educator reinforced HIRAID use        | Often/always                       | 18 (72.0)        | 7 (63.6)         | 11 (78.6)         | Moderate |
|   | Sometimes                          | 4 (16.0)         | 1 (9.1)          | 3 (21.4)          |          |
|   | Rarely/never <sup>a</sup>          | 3 (12.0)         | 3 (27.3)         | -                 |          |
| Results from audits communicated                    | Often/ Always                      | 13 (52.0)        | 6 (54.5)         | 7 (50.0)          | Low      |
|   | Sometimes                          | 7 (28.0)         | 2 (18.2)         | 5 (35.7)          |          |
|   | Rarely/never <sup>a</sup>          | 5 (20.0)         | 3 (27.3)         | 2 (14.3)          |          |
| No. HIRAID posters displayed in the ED              | 0                                  | 11 (44.0)        | 7 (63.6)         | 4 (28.6)          | Low      |
|   | 1-2                                | 10 (40.0)        | 3 (27.3)         | 7 (50.0)          |          |
|   | 3-4                                | 3 (12.0)         | 1 (9.1)          | 2 (14.3)          |          |
|   | > 4                                | 1 (4.0)          | -                | 1 (7.1)           |          |

<sup>a</sup> Items rated 1 or 2 on the Likert scale were combined for tabulation.

### 5.2.3 Study 4: Emergency Nurse Evaluation of Implementation

In this section the results of Study 4 on emergency nurses' experience of HIRAID implementation are presented. This study informed the evaluation of three RE-AIM domains: effectiveness, implementation quality and maintenance. The study design and methods were presented in Section 4.10.

In total, 97 emergency nurses completed the online survey (51.6% response rate). Median duration of nursing experience and emergency nursing experience was 10 years (IQR = 5–24) and 5 years (IQR = 2–14), respectively. Years of emergency nursing experience was similar for all ED levels. However, emergency nurses at Level 2 facilities had been nursing for longer, with a median of 20 years' (IQR = 5–33) nursing experience compared with 8 years (IQR = 5–18) at Level 3/4 facilities ( $p = .02$ ) (see Table 5.5).

Over 80% of participants reported using a HIRAID documentation template most of the time or always. Most participants ( $n = 76, 78.5\%$ ) had watched the HIRAID video, which had been developed for the Southern NSW LHD to provide an overview and show the benefits of the framework. While two-thirds ( $n = 65, 67.0\%$ ) of the participants had been given a flip card (see Figure 5.3), less than 20% reported using it most of the time or always ( $n = 12, 18.5\%$ ). The use of flip cards was slightly higher at Level 2 EDs (see Table 5.6).

Participants' free text responses were generally positive. Overall, they believed that the education was comprehensive, detailed and easy to understand. For example, Participant 11 stated that it was “straight to the point, recognised what we needed to know—went through it with us and gave examples”. The education also helped participants understand the applicability of HIRAID to ED nursing: “It was clear and helpful to see the principles around why HIRAID is such an important tool for staff to use in the ED setting” (Participant 36).

Table 5.5. Demographics of emergency nurse participants overall and by emergency department level

| Item  | Overall<br>( <i>n</i> = 97) | ED Level 3/4<br>( <i>n</i> = 55) | ED Level 2<br>( <i>n</i> = 42) | Statistics                   |
|---|-----------------------------|----------------------------------|--------------------------------|------------------------------|
| <b>Position</b>                                   |                             |                                  |                                |                              |
| Registered nurse                                  | 70 (72.2)                   | 39 (70.9)                        | 31 (73.8)                      |                              |
| Leadership role                                   | 24 (24.7)                   | 15 (27.3)                        | 9 (21.4)                       |                              |
| Other (e.g. NP, EEN)                              | 3 (3.1)                     | 1 (1.8)                          | 3 (4.8)                        |                              |
| <b>Nursing experience (years)</b>                 |                             |                                  |                                |                              |
| Median (IQR)                                      | 10.0 (5.0–23.5)             | 8 (5–18)                         | 20.0 (5.0–33.3)                | U = 1,466<br><i>p</i> = .023 |
| <b>Emergency nursing experience (years)</b>       |                             |                                  |                                |                              |
| Median (IQR)                                      | 5 (2–14)                    | 5 (2–8)                          | 4.5 (1–18.5)                   | U = 1,189<br><i>p</i> = .804 |
| <b>Highest postgraduate nursing qualification</b> |                             |                                  |                                |                              |
| None  | 35 (36.1)                   | 16 (29.1)                        | 19 (45.2)                      |                              |
| Graduate certificate                              | 42 (43.3)                   | 27 (49.1)                        | 15 (35.7)                      |                              |
| Graduate diploma                                  | 13 (13.4)                   | 9 (16.4)                         | 4 (9.5)                        |                              |
| Master's degree                                   | 7 (7.2)                     | 3 (5.5)                          | 4 (9.5)                        |                              |
| <b>Areas worked</b>                               |                             |                                  |                                |                              |
| General acute area                                | 91 (93.8)                   | 53 (96.4)                        | 38 (90.5)                      |                              |
| Fast track  | 46 (47.4)                   | 35 (63.6)                        | 11 (26.2)                      |                              |
| Paediatrics                                       | 61 (62.9)                   | 41 (74.5)                        | 20 (47.6)                      |                              |
| Triage  | 70 (72.2)                   | 43 (78.2)                        | 27 (64.3)                      |                              |
| Resuscitation room                                | 70 (72.2)                   | 47 (85.5)                        | 23 (54.8)                      |                              |
| Clinical initiatives nurse                        | 13 (13.4)                   | 11 (20.0)                        | 2 (4.8)                        |                              |
| Emergency short stay unit                         | 28 (28.9)                   | 19 (34.5)                        | 9 (21.4)                       |                              |
| Other   | 7 (7.2)                     | 3 (5.5)                          | 4 (9.5)                        |                              |
| <b>Facility</b>                                   |                             |                                  |                                |                              |
| Batemans Bay District Hospital                    | 11 (11.3)                   |                                  |                                |                              |
| Bombala MPS                                       | 6 (6.2)                     |                                  |                                |                              |
| Braidwood MPS                                     | 11 (11.3)                   |                                  |                                |                              |
| Cooma Hospital and Health Service                 | 8 (8.2)                     |                                  |                                |                              |
| Crookwell District Hospital                       | 4 (4.1)                     |                                  |                                |                              |
| Goulburn Base Hospital                            | 15 (15.5)                   |                                  |                                |                              |
| Moruya Hospital                                   | 7 (7.2)                     |                                  |                                |                              |
| Pambula Health Service                            | 2 (2.1)                     |                                  |                                |                              |
| Queanbeyan Hospital                               | 20 (20.6)                   |                                  |                                |                              |
| South East Regional                               | 5 (5.2)                     |                                  |                                |                              |
| Yass District Hospital                            | 8 (8.2)                     |                                  |                                |                              |

*Note.* ED: emergency department; MPS: multipurpose service; NP: nurse practitioner; EEN: endorsed enrolled nurse. Statistical comparisons between categorical variables was not possible because of low counts.

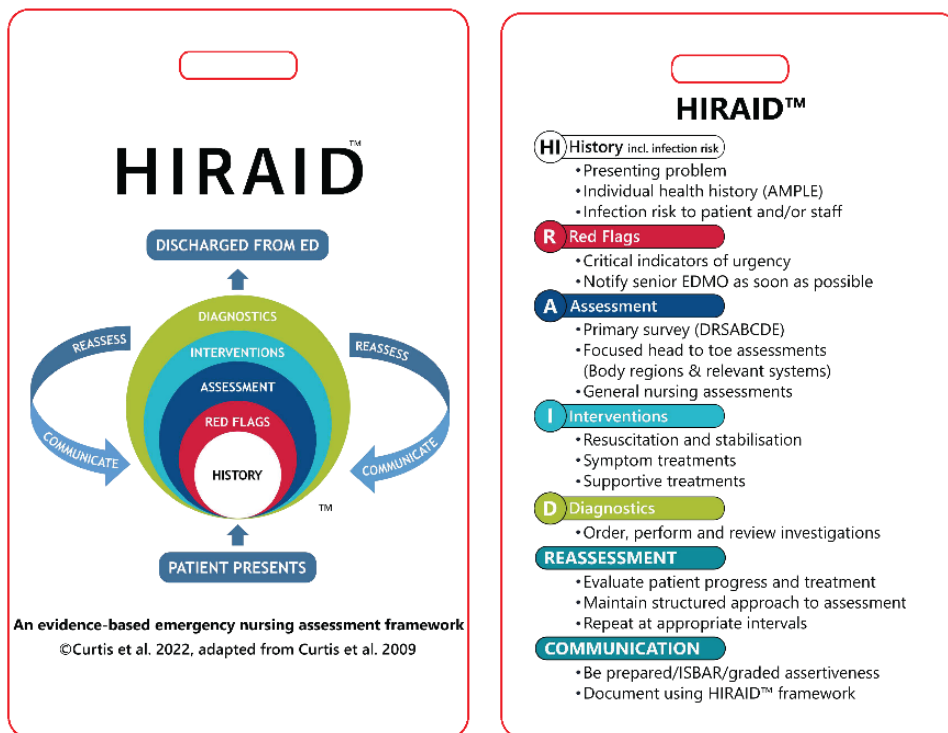


Figure 5.3. HIRAID flip card (front and back).

In terms of the use of HIRAID in clinical practice, over 75% of survey participants reported using the framework most of the time or always ( $n = 76, 78.3\%$ ) when conducting patient assessments. Similarly, 76.2% ( $n = 74$ ) reported that HIRAID most of the time or always assisted in their recall of what was required or what questions to ask when assessing a patient. However, this appeared to refer more to the use of the templates rather than the assessment itself. For example, Participant 72 wrote, “Helps guide me in asking pt questions [sic]. Ensure I have provided all relevant information in a concise format,” while Participant 67 commented, “It does prompt me to ask questions of the patient when I am documenting, especially when it is busy, or the patient is very complex, and I am documenting in retrospect.”

For respondents who indicated that HIRAID did not or only sometimes supported patient assessment, when asked about the reason for this, most stated that the documentation templates was ineffective (i.e. too cluttered or busy or took too long to use). Again, these respondents referred to HIRAID primarily as documentation rather than a framework to guide nursing practice. For example, Participant 110 stated, “I feel HIRAID creates a busy document and would prefer to not [sic] have the prompts on the screen. Clear concise

documentation means clear concise assessment [sic],” while Participant 99 wrote, “Can be long winded if you complete all sections—reducing time of face to face pt care [sic].”

Most participants ( $n = 86, 88.7\%$ ) reported that HIRAID was useful most or all of the time when teaching nurses who were new to emergency nursing, particularly because it provides a systematic approach to assessment. For example, Participant 82 commented, “I have found it very useful as I have been learning, gives [sic] me a systematic approach and prompts me to do tasks if I’m flustered,” and Participant 12 stated, “It’s a learning curve for them [sic] but at least they now have a formal structure to prompt them in their practice.”

Table 5.6. Emergency nurse survey, overall and by ED level

| Survey item                               | Overall (n = 97)                   | ED Level 3/4 (n = 55) | ED Level 2 (n = 42) | Statistics                    |   |
|---|------------------------------------|-----------------------|---------------------|-------------------------------|---|
| Viewed HIRAID video                       | 76 (78.5%)                         | 32 (76.2%)            | 44 (80.0%)          | $\chi^2 = .204 (1), p = .652$ |   |
| Flip card                                 |                                    |                       |                     |                               |   |
| Received                                  | 65 (67.0%)                         | 29 (69.0%)            | 36 (65.5%)          | $\chi^2 = .139 (1), p = .709$ |   |
| Attached to identification                | 57 (87.7)                          | 27 (93.1)             | 30 (83.3)           |                               |   |
|   | Always                             | 5 (7.7)               | 2 (6.9)             | 3 (8.3)                       | - |
|   | Most of the time                   | 7 (10.8)              | 7 (24.1)            | -                             |   |
| Used to recall HIRAID                     | Sometimes                          | 21 (32.3)             | 9 (31.0)            | 12 (33.3)                     | - |
|   | Seldom                             | 17 (26.2)             | 6 (20.7)            | 11 (30.6)                     |   |
|   | Never                              | 15 (23.1)             | 5 (17.2)            | 10 (27.8)                     |   |
| HIRAID education                          |                                    |                       |                     |                               |   |
|   | No                                 | 17 (17.5)             | 8 (19.0)            | 9 (16.4)                      | - |
| Attended face-to-face                     | Yes                                | 79 (81.4)             | 33 (78.6)           | 46 (83.6)                     |   |
|   | Cannot recall                      | 1 (1.0)               | 1 (2.4)             | -                             |   |
|   | In-service away from clinical area | 27 (34.2)             | 13 (39.4)           | 14 (30.4)                     |   |
|   | In-service in clinical area        | 20 (25.3)             | 9 (27.3)            | 11 (23.9)                     |   |
| Where delivered (for those who attended)  | 1:1 away from clinical area        | 12 (15.2)             | 4 (12.1)            | 8 (17.4)                      |   |
|   | 1:1 in clinical area               | 18 (22.8)             | 6 (18.2)            | 12 (26.1)                     |   |
|   | Other                              | 2 (2.5)               | 1 (3.0)             | 1 (2.2)                       |   |
| Use of the HIRAID documentation templates |                                    |                       |                     |                               |   |
|   | Always                             | 48 (49.5)             | 21 (50.0)           | 27 (49.1)                     |   |
|   | Most of the time                   | 32 (33.0)             | 10 (23.8)           | 22 (40.0)                     |   |
|   | Sometimes                          | 11 (11.3)             | 6 (14.3)            | 5 (9.1)                       |   |
|   | Seldom                             | 3 (3.1)               | 3 (7.1)             | -                             |   |
|   | Never                              | 3 (3.1)               | 2 (4.8)             | 1 (1.8)                       |   |

| Survey item   | Overall (n = 97) | ED Level 3/4 (n = 55) | ED Level 2 (n = 42) | Statistics |
|---|------------------|-----------------------|---------------------|------------|
| <b>Thinks about HIRAID during assessment</b>          |                  |                       |                     |            |
| Always  | 21 (21.6)        | 8 (19.0)              | 13 (23.6)           |            |
| Most of the time                                      | 55 (56.7)        | 24 (57.1)             | 31 (56.4)           |            |
| Sometimes   | 15 (15.5)        | 6 (14.3)              | 9 (16.4)            |            |
| Seldom  | 4 (4.1)          | 2 (4.8)               | 2 (3.6)             |            |
| Never   | 2 (2.1)          | 2 (4.8)               | -                   |            |
| <b>HIRAID helps recall of assessment requirements</b> |                  |                       |                     |            |
| Always  | 24 (24.7)        | 11 (26.2)             | 13 (23.6)           |            |
| Most of the time                                      | 50 (51.5)        | 21 (50.0)             | 29 (52.7)           |            |
| Sometimes   | 16 (16.5)        | 6 (14.3)              | 10 (18.2)           |            |
| Seldom  | 4 (4.1)          | 1 (2.4)               | 3 (5.5)             |            |
| Never   | 3 (3.1)          | 3 (7.1)               | -                   |            |
| <b>HIRAID supports teaching new ED nurses</b>         |                  |                       |                     |            |
| Always  | 41 (42.3)        | 21 (50.0)             | 20 (36.4)           |            |
| Most of the time                                      | 45 (46.4)        | 16 (38.1)             | 29 (52.7)           |            |
| Sometimes   | 11 (11.3)        | 5 (11.9)              | 6 (10.9)            |            |
| Seldom/never  | -                | -                     | -                   |            |

*Note.* ED: emergency department; HIRAID: History, including Infection risk, Red flags, Assessment, Interventions, Diagnostics, reassessment and communication.

## 5.2.4 Study 5: Emergency Nurses' Experiences of HIRAID (Publication 5)

The results of Study 5, a qualitative exploration of emergency nurses' experiences of HIRAID and its implementation, are reported in this section. The findings of this study informed the evaluations of two RE-AIM domains: effectiveness and implementation quality. The methods for this study were described in Section 4.11.

The results of this study are reported in Publication 5:

Kennedy, B., Curtis, K., Kourouche, S., Fry, M., & McCloughen, A. (2025). *Australian rural nurses' experiences of the implementation and impact of HIRAID® emergency nursing framework on nursing practice. A qualitative study* [Manuscript submitted for review on 8 April 2025].

Appendix 18 includes the interview guide.

### Title page

Australian rural nurses' experiences of the implementation and impact of HIRAID® emergency nursing framework on nursing practice. A qualitative study

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### **1. Conflict of Interest**

HIRAID® is a registered trademark by the University of Sydney, and the associated education materials are copyrighted.

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

### **2. Ethical Statement**

Ethical approval was obtained through the Greater Western Human Research Ethics Committee (2020/ETH02164).

### **3. Funding source**

The project is funded by a National Health and Medical Research Council (2021) NHMRC Partnership Projects (PRC1) GNT2005403, with partner agencies Thyne Reid Foundation, College Emergency Nursing Australasia, Australian College of Nursing, Agency for Clinical Innovation, Australian Commission for Quality and Safety in Health Care, Commonwealth Office of the Chief Nurse and Midwife, Southern NSW, Northern NSW, Western Sydney Local Health Districts, Eastern Health Victoria.

An Australian Government Research Training Program scholarship in Emergency Nursing Implementation Science supports the lead author.

### **4. Acknowledgements**

We wish to acknowledge Louise Casey and Dorothy Hughes who assisted with the study coordination in Southern NSW Local health District.

Highlights (for review)

### **Highlights**

- All nurses perceived there was a positive influence on nursing practice following HIRAID®
- HIRAID® was considered more beneficial to less experienced emergency nurses
- There were persistent barriers that influenced implementation effectiveness

1 **Australian rural nurses' experiences of the implementation and impact of**  
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3 **HIRAID emergency nursing framework on nursing practice. A qualitative study**  
4

5 **ABSTRACT**  
6

7 **Introduction**  
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11 Evaluation of implementation strategies by end users provides valuable insights into  
12 mechanisms of use and can identify areas for improvement. The HIRAID® emergency  
13 nursing framework was implemented in 10 sites across a predominantly rural health district  
14 in Australia. The aim of this study was to explore the emergency nurses' experiences of  
15 implementation and perceived impact on nursing practice.  
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23 **Methods**  
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25 A qualitative descriptive study was conducted using semi-structured interviews in October-  
26 December 2021. A convenience sample of emergency nurses were recruited from the health  
27 district during implementation. Interviews were conducted over the telephone, recorded and  
28 transcribed verbatim. Data were imported to NVivo, and an inductive approach, using an  
29 iterative conventional qualitative content analysis, was guided by Granheim and Lundman's  
30 method.  
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39 **Results**  
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41 Thirteen emergency nurses, with mean (SD) 9.4(8.1) years emergency experience,  
42 participated. Four overarching categories were identified. Two related to the impact of  
43 HIRAID® on practice, where participants believed that HIRAID® influenced communication  
44 and nursing practice and promoted critical thinking. The remaining categories related to  
45 organisational and individual factors that can influence implementation, and the educational  
46 program design and delivery for staff training.  
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56 **Conclusion**  
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Despite identified challenges in implementation in a rural context, participants all perceived some benefit to the HIRAID® intervention. At some sites, implementation could have been more effective had the recognised challenges been mitigated. The study highlights areas where modification should be considered from the perspective of the end user for future implementation activities.

## 1. Introduction

Emergency departments (ED) bear the burden of increased health service demands (1), in an environment exacerbated by nursing shortages (2, 3). In rural Australia, EDs are spread across large geographic distances, with reduced service availability (4). In some instances, facilities are staffed by emergency nurses with medical services provided through on-call general practitioners or telehealth arrangements (5). Emergency nurses are responsible for the initial and ongoing assessment and management of patients presenting to the ED and may be the only clinician patients will see (5). Historically, there was no standardised nursing framework to guide and support nurses in the delivery of emergency nursing care. The HIRAID® emergency nursing framework addressed this gap (6). Use of HIRAID® (History including Infection risk, Red flags, Assessment, Interventions, Diagnostics, assessment and communication) has demonstrated a positive impact on nurses, patients and health service outcomes (6-8) (Figure 1).

< Figure 1 HIRAID® emergency nursing framework >

### 1.1. Background

HIRAID® was implemented across a large, predominantly rural, local health district in Australia. Implementation was guided by a behaviour change-informed implementation strategy that included multiple components e.g. executive support, education and

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environmental changes and detailed elsewhere (9). The strategy incorporated a train-the-trainer model, using HIRAID® Instructors who received training, to deliver education to nurses and provide clinical support across the large geographic area during the initial implementation. Additionally, preformatted documentation templates were used to support recall of HIRAID® and provide a structure to guide documentation of relevant details in clinical records that would support and justify clinical decision-making and care delivery.

No previous studies have explored nurses' perspectives of HIRAID® implementation. Clinical outcomes, as a measure of success, are often the focus in evaluation of implementation efforts. However, evaluation of implementation processes is also important to promote ongoing uptake and sustainability of interventions (10, 11). Understanding participant experiences aids evaluation and can inform modifications to improve uptake of interventions and/ or strengthen sustainability of implementation efforts (10). This aim of this study was to understand emergency nurses' experience of implementation, in particular the strategies employed, and whether the HIRAID® emergency nursing framework had impacted nursing practice.

## 2. Methods

This qualitative descriptive study was conducted using semi-structured interviews, which were audio-recorded, transcribed and analysed using content analysis (12). A qualitative approach provides the opportunity to gain a more in-depth and nuanced understanding of participants' experiences of implementation and any perceived changes to nursing practice (13). Ethics approval for the study was received from Greater Western New South Wales Human Research Ethics Committee [REDACTED]. The consolidated criteria for reporting qualitative research were used to guide the reporting of this study. (14)

### 2.1 Setting

The study was conducted in a large local health district (LHD) in Southern New South Wales (NSW) Australia, which covers a geographical area of approximately 44,534km<sup>2</sup> (15),

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similar in size to Denmark. Ten EDs, with varying levels of service provision and onsite resources, participated in HIRAID® implementation. At the time of the study there were 188 emergency nurses employed.

### *2.2 Recruitment*

A convenience sample of emergency nurses working during the implementation of HIRAID® were recruited. An invitation for interview, with a participant information sheet (PIS), was provided to all ED nurses who completed a survey following implementation. An expression of interest could be submitted, separate to survey responses, in REDCap, a secure web-based application used for data collection and management (16). Additionally, an Emergency Clinical Nurse Consultant communicated the opportunity for interviews, via email, to capture nurses who had not completed the survey.

Nurses who expressed interest were contacted via email and invited to book an interview through Microsoft Bookings or by contacting the researcher directly, a PIS was again included with the email. Two follow-up emails were sent at two-week intervals if a booking had not been made. Participants who booked an interview received an email reminder the day prior and were compensated with a \$50 voucher in recognition of their time following the interview.

### *2.3 Data Collection*

Semi-structured interviews were conducted via phone by the lead author, during a six-week period in October-December 2021. Prolonged lockdowns secondary to COVID-19 in 2021 (17), limited researcher travel to sites for in-person interviews.

An interview schedule was used to guide interviews (Supplementary file 1). The schedule was developed in consultation with investigators and piloted to ensure clarity of the questions and cohesive flow of the interview. Interview training was provided by author MF, an expert clinician with extensive experience in qualitative data collection.

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The lead author (interviewer), a doctoral candidate, was not employed by the health district and had no direct working relationship with participants. However, some participants may have met the interviewer during initial implementation activities or site visits. Prior to commencing each interview, the voluntary nature of the study was reiterated, procedures for recording and maintaining confidentiality were explained, and consent was confirmed. Basic demographic details were collected prior to commencing interviews, e.g. age, time working as a nurse/ emergency nurse, primary employment location. Interviews were audio-recorded, transcribed verbatim, and deidentified prior to analysis.

#### *2.4 Data Analysis*

Data were managed using NVivo 14 (18). Analysis was guided by Granheim and Lundman's method (12), where transcribed interview data were analysed using conventional qualitative content analysis. Using an inductive approach to analysis, categories were derived from within the data by identifying similarities and differences. Data were sorted into broad areas related to participants' understanding of HIRAID®, potential influences on practice, and strategies used by participants during implementation of HIRAID®. The lead author developed meaning units based on the manifest content, which were condensed and coded. Coded text were sorted based on similar meanings and common characteristics to generate 14 subcategories, then further sorted through a process of comparing and contrasting into four overarching categories. Analysis was conducted using an iterative process, with codes and categories reviewed and discussed by co-authors at each stage of analysis to identify areas of disagreement and achieve consensus.

### **3. Results**

Thirty-four nurses expressed interest in the study, 14 agreed to participate, and 13 completed an interview. Eight of the 10 facilities where HIRAID® was implemented were represented by a relatively experienced group of emergency nurses, with a mean(SD) 9.4(8.1) years' experience in ED, and five (38.5%) held postgraduate qualifications. Interviews were 23- 48 minutes in duration (average 33 minutes).

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Four categories were developed. Categories 1 and 2 describe the perceived influence that HIRAID® had on nursing practice; firstly, through supporting communication and nursing assessment and secondly, by facilitating critical thinking and creating accountability in nursing practice. Categories 3 and 4 relate to organisational factors, in particular, the design and delivery of the HIRAID® education program to support implementation and the individual staff members' influence on implementation.

*1. The use of HIRAID® influenced communication and nursing practice*

Participants overwhelmingly expressed that using HIRAID® improved or supported written and verbal communication in the ED. It was evident that HIRAID® was an aid to support documentation. Participants felt that implementing HIRAID®, and using the standardised documentation templates, created consistency and prompted them to consider what information they should include in their clinical documentation, resulting in more comprehensive documentation of assessment and care. This improvement in documentation was reported to enhance verbal communication, particularly during handover:

*'But the way written documentation has improved is just outstanding. And I think because of that, the verbal handovers have also really escalated. They've become more detailed; they've become more focused and to the point, kind of thing, rather than waffle.'* (Participant 4)

For most nurses, using the documentation template ensured their initial assessment was recorded in adequate detail, which was perceived to assist with their clinical handover. For some, the recorded detail aligned well with existing frameworks for handover e.g. ISBAR. More experienced participants believed the templates served as a reminder to record necessary information, and the content documented did not change, the templates simply modified the structure of their written note.

While participants reported improved documentation, which was beneficial, some perceived that using HIRAID® had the potential to divert time from patient care. Some nurses reported

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that the clinical documentation took too long to complete using the HIRAID® template, and that nurses were viewed to prioritise documentation, which impacted on time for patient care.

Participants also perceived that HIRAID® supported them in escalating concerns for their patients. This was a result of HIRAID supporting a thorough assessment that identified clinical concerns, along with a fully documented assessment so relevant information was available and organised to facilitate communication.

HIRAID® was considered to support the practice of less experienced emergency nurses more than that of experienced nurses. This was due to the clear structure to guide clinical assessment and documentation requirements. The documentation templates were also an effective aid for inexperienced nurses.

*'Being able to keep consistent with my assessments too, make sure I'm not missing anything. And it's kind of quick and easy because you don't even realise you already know half of it by getting hand over, and just talking to patients a bit, and starting your assessment taking.....(HIRAID) helped with my learning a bit too, just a bit more confidence with my assessments.'* (Participant 1)

Participants were uncertain whether HIRAID® impacted the time to commence treatment for patients in the ED. Those from small sites reported there was currently good medical coverage, which meant there was minimal wait to be seen or well-established protocols for nurse-initiated care already existed, and HIRAID® had not changed that. However, the documentation related to nurse-initiated care improved.

*'I think, again, we've had a pretty high standard of interventions and assessment in our ED for a long time. But it's probably, on the documentation side we probably are documenting a lot... and myself included, a lot clearer about what interventions we have, or are going to do, because we've got that HIRAID template with the plan at the bottom.'* (Participant 8)

## 2. Use of HIRAID® supports critical thinking and accountability in practice

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Most participants found that the introduction of HIRAID® encouraged their critical thinking and conscious decision-making in the assessment and delivery of care, and accountability and consistency in practice. The process of documenting assessment using the HIRAID® framework led participants to reflect on their assessment findings and take a more considered and informed approach to their decisions about individual patient needs. This more reflective approach to decision-making was reported to have changed their practice. For example, nurses did not initiate some interventions, like inserting an intravenous cannula, which they would previously have done, because they recognised the intervention may not be required and could wait until further consultation occurred. Using HIRAID® also brought consideration of potential red flags, or indicators of urgency, to the fore and nurses more consciously thought about what might constitute a red flag based on the patient's presentation.

*'Prior to having a HIRAID template, everybody had a different idea of what they thought was important to capture in notes, specifically red flags. Whereas now, it is right in front of you. And I think it is at the forefront of your mind when you're doing your first assessment.'* (Participant 8)

Some participants believed that using HIRAID® made nurses more accountable. They considered the documentation template to record assessment findings and actions as contributing to this.

*'You've just written it down. You can't just leave that there. You have to go and do something about it because you've got a record of you knowing about it. Therefore, if you don't go and do something, you're risking your registration, not to mention the patient's safety.'* (Participant 11)

While some participants felt HIRAID® was no different to their usual nursing practice, most believed the implementation of HIRAID® created consistency in how care was delivered, and they considered this especially beneficial for nurses with limited experience in ED.

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3. *HIRAIID® implementation and uptake are influenced by organisational and individual characteristics.*

Organisational factors that created challenges for implementation were highlighted.

Concerns primarily related to time pressures, adequate staff resources or managerial support. These challenges impacted both HIRAIID® Instructors assisting with implementation and frontline nurses.

Participants reported the existing workload in ED exceeded the capacity of current staffing levels, and there was insufficient time to complete everything required. This made it difficult to use HIRAIID® or complete implementation activities, such as education or audits, that were expected of the HIRAIID® instructors. Some nurses viewed HIRAIID® as being solely a documentation template, rather than a framework to guide nursing assessment and management, and they reported that HIRAIID® implementation created an additional work burden because they did not have sufficient time to complete documentation using the template.

*'You could have a sepsis, you've got a COVID patient or something like that. And your resources are just really stretched. So, that's when it can be difficult to find the time to complete all the documentation.'* (Participant 10)

Implementing HIRAIID® was considered difficult in an environment where any practice change would be challenging due to inadequate resources to support delivery. While managers were considered supportive in principle of implementing HIRAIID®, participants believed the manager's ability to provide required support was hampered by competing demands of higher priority and events beyond their control, which limited in-person support or adequate staffing. Without the necessary operational support, implementation was less effective than participants felt it could have been.

Many participants reported making local modifications to improve acceptability and encourage or support HIRAIID® uptake. Changes mainly related to the documentation

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template structure or guidance for detailed HIRAID® assessment. For example, as the smaller rural sites do not see a large volume of high-acuity presentations, participants believed that clear guidance about expectations of completing HIRAID® assessment, would make the intervention more acceptable in the clinical context, meet expectations of staff, and increase receptivity. There was a shift in attitude toward HIRAID®, as described here:

*'That was probably the turning point for the staff really getting on board because I think initially they were like, "This is stupid, it doesn't make any sense for us," But once they could see that perhaps, we agree it doesn't make sense for some presentations, that was the point where they all said, "Okay, we'll give it a go really." (Participant 6)*

In addition to documentation templates, the other strategy participants commonly referred to were flip cards. The cards contained brief details related to the HIRAID framework and requirements, were easily accessible and were considered particularly beneficial for less experienced nurses to support recall. Flip, or reference, cards attached to staff identification tags was a common practice among nurses, which is why they liked them.

*'If I ever did get really stumped when I first started doing it and (sic) wasn't around, I'd either ask someone or have a quick look at the flips, because I had it on, what's it called, my tag. I just quickly flicked through that.'* (Participant 3)

Audit and feedback were other strategies discussed by participants. However, it was evident that the results of audits were not consistently provided across all sites, and those who recalled receiving feedback during implementation did not believe the information encouraged further staff uptake.

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4. *Face-to-face educational design and instructor qualities are important to end user experience*

Aspects of the education program were particularly important to the participant experience. Overwhelmingly, participants preferred face-to-face delivery of education as it permitted active participation and the opportunity to seek clarification throughout learning. Being able to work through concepts and ask questions during the training session was important because it enabled their learning to progress.

*'It's just that closed loop..... They tell you something, you say what you've received and they say yes, and you've got a question. When you leave you've understood what it is that's being told and or said. It's more of a closed loop. I feel like it's a bit more, I don't know. I just feel like I actually leave knowing things better.'* (Participant 13)

Conversely, some participants felt eLearning was problematic because there was a lack of protected time to complete modules. Modules were usually completed in the clinical environment during work time, with frequent interruptions, which detracted from the learning experience. While some participants perceived the eLearning modules as good preparation for face-to-face learning, there was also eLearning fatigue apparent among some participants where the work environment over-used online training.

*'When we're forced to sit and try and read, or try and listen to someone ... try listening to a prerecorded lecture, you get distracted and you're always doing other things. Because quite often, we are doing them (eLearning) at work when we're on shift, where they're always interrupted.'* (Participant 4)

Instructor characteristics were important to the delivery of education. Participants favoured instructors who were clinically reputable, and knowledgeable about the content, because they instilled confidence in the learner. Furthermore, their ability to provide real life clinical examples helped participants understand HIRAIID® application in the clinical context and was perceived to improve motivation.

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*'Our educator was incredibly knowledgeable, and she was really good. We could just ask questions. She had an example for every situation, and it was good to be able to bounce off her.'* (Participant 1)

#### 4. Discussion

In this study, the influence of the HIRAID® emergency nursing framework on nursing processes, knowledge and practice was highlighted. From the participant's perspective clinical credibility and characteristics of those delivering training, along with documentation templates, were important implementation strategies. However, there were also challenges to implementation across the large rural health district. The inherent complexity of implementation, with multiple interrelated elements, is evident. While participants experienced a variety of challenges during implementation and uptake, all participants believed there were some benefits to using HIRAID® in the ED.

##### Using HIRAID®

Benefits to HIRAID® implementation included improved quality of clinical documentation, support for clinical assessment, enhanced communication and decision-making, assisting to build a better safety climate. Clinical documentation is crucial to facilitating quality nursing care and supporting accurate communication throughout the patient healthcare journey, optimising patient safety (19).

Improvements to documentation are an important consideration in the context of professional and medico-legal requirements of nursing practice (20), where clinical documentation is frequently reported as poor (21). Improvements in documentation were attributed to the documentation templates that aligned with the HIRAID® framework, as they supported recall of the framework and documentation of relevant information related to presentation and treatment. This finding is supported by other studies that have evaluated initial nursing assessment documentation following HIRAID® implementation (8, 22). While some participants appeared to misunderstand that HIRAID® was a documentation template

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rather than the model to deliver nursing care, they still articulated the benefits. There is a paucity of literature that describes such misinterpretation of an implementation strategy as the intervention.

In addition to improved documentation, ED nurses considered HIRAID® improved handover and clinical assessment, especially for less experienced emergency nurses. Previous research has also demonstrated less experienced nurses had greater improvement in confidence when using HIRAID® (6, 7). ED is a complex, high-pressure clinical environment with an unpredictable and variable workload, which is stressful for experienced clinicians and negatively impacts recruitment and retention (23). For rural nurses, there is the added complexity of a broader scope of practice without onsite medical cover, a role nurses frequently feel unprepared for (24). HIRAID® is an intervention that can support novice to expert transition to ED, nurses who feel confident and adequately supported is key to successful transition and retention of junior ED nurses (23).

Participants believed using HIRAID® resulted in greater critical thinking, with increased critical reflection on assessment findings. Critical thinking is a complex skill fundamental to nursing that nurses require the opportunity to develop. More considered decisions better promote the delivery of safe and appropriate care (25) and can be influenced by factors such as education and experience (26, 27). All nurses, particularly those in rural settings without onsite medical services, need to have the confidence and ability to make informed decisions regarding diverse patient presentations. Critical thinking appears to be promoted through use of HIRAID®, which facilitates comprehensive assessment and organisation of information, assisting decision-making related to patient care. Further work would be required to investigate any relationship between HIRAID® and critical thinking.

#### **Implementing HIRAID®**

Implementation of practice change is a complex and dynamic process, and the challenge to implement and sustain evidence-based practice change is well documented (28). While

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clinical outcomes are often the focus, evaluation of the strategies that generate change is important to ensure uptake and sustainability moving forward (10, 11).

Implementation challenges reported in this study primarily related to reduced time and staff resources and limited direct line manager support. Managers are important drivers for implementation (29, 30), particularly in promoting and supporting implementation in conjunction with daily workplace activities (29). Senior clinicians and educational leaders were trained as instructors to deliver education and implementation activities (9) and required management support to facilitate delivery. Future implementation of HIRAID® requires greater engagement of direct line managers throughout all stages as they are essential to ensuring implementation processes are tailored to their context, and they have unique understanding and insights to ensure staff are adequately supported through the provision of time and material resources (29).

Activities that supported implementation included documentation templates, flip cards and a blended education program. Participants highlighted how the templates and flip cards aided recall in the clinical environment and supported nursing practice. Documentation template integration in the eMR, made them readily accessible in the busy ED environment. The templates enhanced recall of the HIRAID® Framework during initial implementation (9) which was viewed as particularly helpful, consistent with previous research (6). As such, it can be surmised that this implementation strategy in the rural setting was effective in supporting HIRAID® implementation.

The education design was considered integral to implementation, with face-to-face the preferred mode of learning. Face-to-face learning delivered in an environment away from the clinical space enables physical detachment from the practice area, which facilitates dedicated time for staff engagement. Participants expressed challenges associated with completing eLearning, primarily related to lack of dedicated time, interruptions and inability to focus on content, which supported in the literature (31). The growing delivery of education through eLearning has many benefits, particularly the capacity to provide training across a

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greater geographic area, as is the case in the rural setting (31). However, this shift has led to the onus being placed on individuals to undertake work-related learning in their personal time, which is burdensome to staff (31, 32). To address these barriers, and enhance staff engagement and motivation in learning activities, the provision of protected work time should be considered for future implementation activities (31).

## 5. Limitations

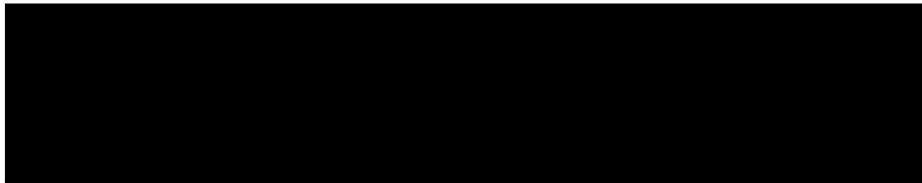
This study has several limitations. Interviews were conducted up to nine months after implementation had commenced, and the recall of implementation activities varied among participants and was open to responder bias. As end-users of HIRAID®, participants' perspectives related to implementation activities were limited to what they were exposed to and are based on self-report. The study is limited to a voluntary sample of nurses, and therefore, not all perspectives may have been captured.

## 6. Conclusion

The findings of this study highlighted that nurses' perceived nursing process, knowledge and safety benefits in using the HIRAID® Framework. The benefits of HIRAID® related to the nursing documentation templates which support a more considered approach to assessment and clinical actions. The implementation of HIRAID® was reported to strongly support less experienced emergency nurses in undertaking and reporting clinical assessments. Despite reported benefits, resource issues impacted the implementation of HIRAID® in practice. There are areas for adaptation in future implementation, including the opportunity for protected time for all learning and improved engagement with nurse managers to ensure adequate support in the clinical environment

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Conflict of Interest

**Conflict of Interest**

HIRAID® is a registered trademark by the University of Sydney, and the associated education materials are copyrighted.

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

### **5.3 Summary**

In Section 5.1 the findings of Phase 1 of this research were presented. This included a mixed methods survey of emergency nurses (Publication 2), the findings of which informed the development of the implementation strategy using the BCW (Publication 3).

Section 5.2 included the findings of Phase 2 of this research, which comprised four discrete studies. Findings demonstrated that HIRAID had a positive effect on emergency nursing practice, with improved clinical documentation of patient assessments (Publication 4). The survey of emergency nurses demonstrated a perceived benefit of HIRAID. However, there were some challenges related to the application and delivery of implementation activities.

Guided by the RE-AIM framework, in Chapter 6 the findings of Phase 2 of this research are integrated, providing a comprehensive evaluation of the implementation of HIRAID in the Southern NSW LHD.

# Chapter 6: RE-AIM Evaluation of Implementation

## 6.1 Introduction

The final part of Phase 2: the evaluation of HIRAID implementation in Southern NSW LHD (see Figure 6.1) is presented in this chapter. The findings of Studies 2–5, along with data from implementation records, are integrated in accordance with the five domains of the RE-AIM framework. Table 6.1 provides a brief definition of each RE-AIM domain and an overview of the relevant measures.

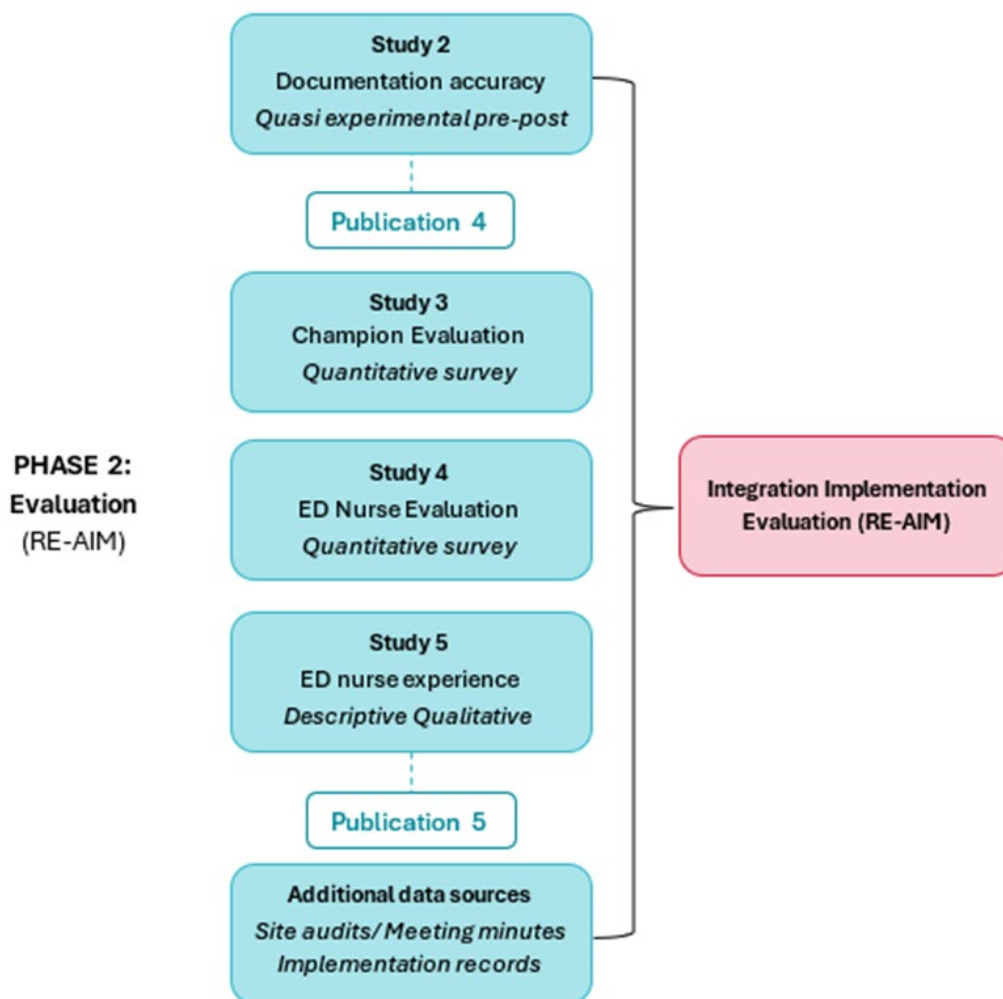


Figure 6.20. Phase 2: Evaluation of HIRAID implementation.

Table 6.1. RE-AIM domains as defined for HIRAID evaluation <sup>a</sup>

| RE-AIM domain          |                      | Definition  | Measure (target)   |
|------------------------|----------------------|---|--|
| Reach                  |                      | Proportion of eligible emergency nurses (target population) who completed HIRAID training                     | ≥ 80%  |
| Effectiveness          |                      | Effect of the intervention at the individual level  | HIRAID usefulness (≥ 80% of nurses)  |
|                        |                      | Effect of the intervention at the clinical level  | Improved clinical documentation (clinical outcome)                                       |
| Adoption               | Setting              | Proportion of sites that implement HIRAID   | 100%   |
|                        |                      | At least one HIRAID champion in each ED   | 100%   |
|                        | Individual           | Proportion of nurses who use the HIRAID document templates when indicated                                     | ≥ 80%  |
| Implementation quality | Dose                 | No. courses delivered, proportion of sites with a HIRAID champion and proportion of staff who used strategies | Range of measures from implementation records and emergency nurse surveys <sup>a</sup>   |
|                        | Fidelity             | Training and strategies delivered as intended   | Champion completion of implementation tasks (≥ 80%)<br>Documentation of adaptations made |
|                        | Quality              | Train-the-trainer course delivery   | Nurse satisfaction with course delivery  |
| Maintenance            | Organisational level |   | HIRAID embedded in health district   |
|                        | Individual level     |   | Ongoing use of HIRAID templates ≥ 6 months post implementation (≥ 80%)                   |

Note. <sup>a</sup> See Table 4.5 for a detailed overview of RE-AIM domains and measures.

### 6.1.1 Reach

At the commencement of HIRAID implementation, 188 emergency nurses were identified as eligible to receive HIRAID training, specifically those permanently employed in the ED. At the end of the 12-week implementation period, 170 of these emergency nurses had partially or fully completed the HIRAID education. This translates to a reach of 90.4% for the eligible population. However, only 122 (64.9%) of the eligible emergency nurses had completed all four education components at 12 weeks. Figure 6.2 provides an overview of education completion. Of those who partially completed the program ( $n = 66, 35.1\%$ ), 47.0% ( $n = 31$ ) completed only the face-to-face component.

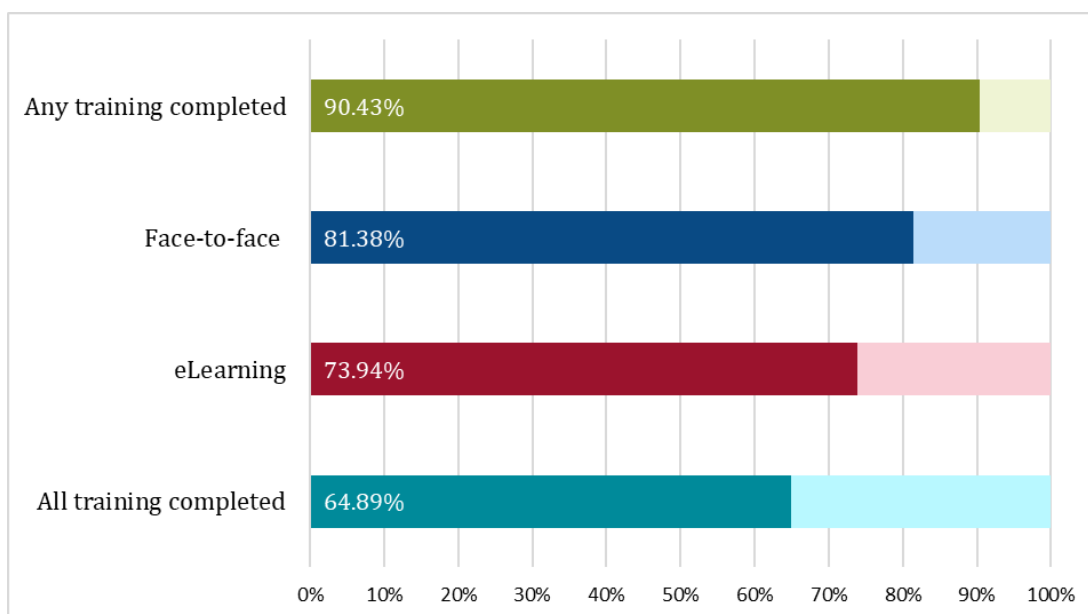


Figure 6.2. Completion of HIRAID education by emergency nurses at 12 weeks post implementation.

### 6.1.2 Effectiveness

The effectiveness of the HIRAID intervention was evaluated according to its effect at both the organisational and the individual levels. Organisational outcomes were evaluated based on the findings of Study 2, while individual outcomes were informed by the findings of Studies 4 and 5.

At the organisational level, HIRAID had a demonstrated positive effect. The review of patient (predominantly adult) presentations showed a significant improvement in the accuracy of emergency nursing documentation. As reported in Publication 3, there was a significant increase in the mean number of relevant assessment items from 1.8 ( $SD = 0.6$ ) to 2.6 ( $SD = 0.7$ ),  $t(219) = 9.99, p < .001$ , and an improvement in the quality of information

from 1.6 ( $SD = 0.5$ ) to 2.2 ( $SD = 0.6$ ),  $t(219) = 8.45$ ,  $p < .001$ . Improvements were observed in all areas measured (see Section 5.2.1 for full details).

On the individual level, most participants ( $n = 74$ , 76.3%) believed that HIRAID was useful for recalling the essential components of patient assessment. An even higher number ( $n = 86$ , 88.7%) believed that HIRAID was an effective aid for teaching nurses new to the ED. This finding is supported by the results of Study 5. The participants believed that HIRAID helped support clinical assessments, particularly for less experienced emergency nurses, because of its clear structure.

### **6.1.3 Adoption**

HIRAID adoption was measured at both the setting and individual levels. At the setting level, adoption was measured according to the site's implementation of HIRAID and the presence of at least one trained instructor. At the individual level, adoption was measured according to emergency nurses' use of the HIRAID documentation templates.

All 11 EDs that were eligible in February 2021 implemented the HIRAID framework. Thus, the 100% implementation target had been achieved by the end of the implementation period. At the commencement of implementation, a trained HIRAID champion was present at ten of the 11 sites, while two HIRAID champions provided district-level support. Following the fourth train-the-trainer course in early April 2021, each site had a minimum of one trained HIRAID champion. Thus, the target of 100% was achieved.

Individual-level adoption was measured according to champions' site audits of HIRAID use at 12 weeks post implementation. Data were received from eight of the 11 sites (73%), with none received from two Level 2 EDs and one Level 3 ED. Where audits were conducted, over half of the emergency nurses ( $n = 117$ , 62.2%) had worked during the audit period, thus had records available for audit. The HIRAID templates were used by 77.8% of the ED nurses audited, falling just short of the 80% target. Figure 6.3 shows the proportion of audited nurses who used the HIRAID templates and the proportion of those who completed the HIRAID education.

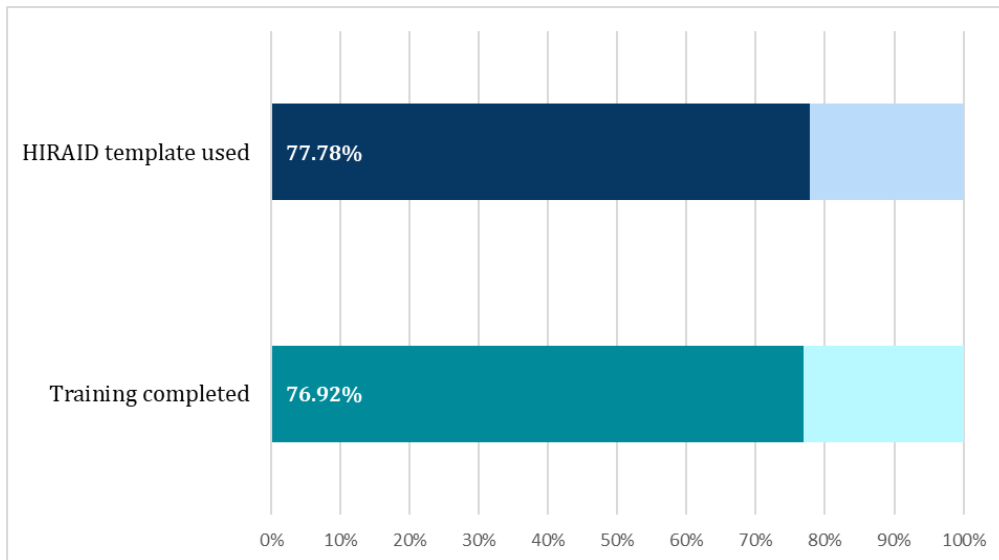


Figure 6.3. HIRAID template use and training completion among audited emergency nurses ( $n = 117$ ).

#### 6.1.4 Implementation Quality

The quality of implementation was measured according to dose, fidelity and quality. Dose was high, with four train-the-trainers courses ensuring at least one HIRAID champion per site, none of whom were employed in an education role. Only one site had a single champion. Training courses were completed across all 11 sites (see Table 6.2).

The findings of Study 3 show that, overall, fidelity to the activities in the implementation strategy was low to moderate. Only 43.5% ( $n = 10$ ) of the HIRAID champions indicated that they often or always fulfilled the implementation tasks (see Appendix 9). This finding is consistent with the fidelity of individual strategies in Study 3. The only activity that achieved high fidelity was the use of the HIRAID documentation templates, reflecting the role modelling by HIRAID champions (see Table 6.2).

Table 6.2. Measures of implementation quality

| Quality measure  | Outcome   | Benchmark                                     |
|--|-----------|---|
| <b>Dose</b>  |           |   |
| No. train-the-trainer courses (no. sites)                | 4 (3)     | 3   |
| No. champions trained                                    | 34        | -   |
| No. champions per site, mean (range)                     | 1.6 (1-6) | One per site (not part of the education team) |
| No. provider courses (no. sites)*                        | 48 (11)   | -   |
| Emergency nurse training ( <i>n</i> = 188 eligible)      |           |   |
| Completed face-to-face training                          | 81%       | 80%   |
| Completion e-learning                                    | 74%       | 80%   |
| Viewed HIRAID video                                      | 79%       | 80%   |
| Received flip cards                                      | 65%       | All   |
| Flip card use ( <i>n</i> = 65)                           |           |   |
| Attached to uniform                                      | 88%       |   |
| Used to recall HIRAID                                    | 19%       |   |
| <b>Fidelity (<i>n</i> = 25)</b>                          |           |   |
| Delivered education using PowerPoints                    | 48%       | 80%   |
| One-to-one instruction on HIRAID                         | 40%       | 80%   |
| Modelling of HIRAID templates                            | 84%       | 80%   |
| Flip card distribution                                   | 76%       | 80%   |
| Communication to reinforce training                      | 72%       | 80%   |
| Audit results communicated                               | 52%       | 80%   |
| <b>Quality (<i>n</i> = 24)</b>                           |           |   |
| Train-the-trainer course delivery, median ( <i>IQR</i> ) | 5 (5-5)   |   |

*Note.* \*Where no date was recorded for the provider course on site records, all indicated as 'yes' or ✓ were counted as a single course.

The frequency of steering committee meetings along with site representation and attendance was reviewed. In total, 11 meetings were held over a period of 13 months to September 2021, 6 months following HIRAID implementation. Representatives from each study site were invited in November 2020, prior to implementation, with nine meetings held from November 2020 to September 2021. Twenty attendees were employees of the Southern NSW LHD, while two were from the University of Sydney, including the thesis author. One steering committee member in a district position stepped down prior to implementation. Nine of the 11 sites were represented, with most attendees in managerial

or educational roles ( $n = 7$ ). Two clinical staff members did not receive supernumerary time to attend. Overall, the remaining 19 members attended an average of four of the nine meetings. Those in a district position attended three of the nine meetings, while staff employed at the study sites attended an average of only two of the nine meetings. These results reflect poor engagement with the steering committee meetings at all levels.

Fidelity was also measured according to any adaptations made to the HIRAID. This information was collected from site implementation logs, email correspondence and reported changes to education delivery (see Study 3, Section 5.2.2). The collection of information from implementation logs was challenging because only five of the 11 sites returned the parts of the logs that tracked modifications or challenges. In those returned, there was little information related to changes to implementation strategies. Only one site logged making a change to two of the documentation templates because staff believed they were not fit for purpose. However, the details of what was changed and the reasons for the change were not recorded. A review of the modified template revealed a change to structure rather than content.

As reported in Study 3, 92% of the HIRAID training was delivered by an individual who had completed a train-the-trainer course. Less than half (48%) of the HIRAID champions used the PowerPoint presentation in all sessions. When the presentation was used 28% of those champions reported changes were made to the presentation. Some champions stated that they did not use the learning resources because they had delivered one-on-one training. This is supported by the findings of Study 4, which showed that over a third (38%) of emergency nurses received one-to-one training. Participants indicated that they did not show the PowerPoint presentation because few nursing staff were available for training at the same time, and it was unfeasible to show the presentation in the clinical environment. The site records show that 48 face-to-face sessions were delivered across the 11 sites, equating to an average of four nurses at each training. This figure is likely to be overestimated because not all training dates were recorded; therefore, some sites appeared to have only a single session.

### **6.1.5 Maintenance**

The final domain is maintenance (or sustainability), which is the continued use of an implementation strategy or intervention.

Four months after commencing the HIRAID implementation, senior district nursing staff reported that HIRAID had been incorporated into the clinical learning pathway for new emergency nurses. Moreover, completing the e-learning and face-to-face training had become part of the standard health district orientation. The framework had also been incorporated into a range of district education programs, including the First Line Emergency Care course, the ED Clinical Emergency Response Business Rule and the Hip Fracture Pathway. Where appropriate, it had been integrated into site-specific ED business rules for trauma activation.

Study 4 explored the ongoing use of the HIRAID documentation templates. All eligible emergency nurses indicated that they had used the templates, although the frequency of use varied. An audit of all ED staff commencing the week of 15 November 2021 (9 months post implementation) revealed the ongoing use of the templates at all sites. Three consecutive records were available for auditing for 134 of the 208 (64%) staff rostered. Of the staff audited, 84% used the HIRAID documentation templates at least once in the three consecutive records. However, in all cases of relevant documentation post triage, the templates were only used 61% of the time. There was also a lack of compliance with using the correct template (see Figure 6.4). Similarly, the findings of Study 2, which evaluated emergency nurses’ post-triage assessment documentation, revealed that the HIRAID templates were used on only 70% of occasions. Although use of the templates was maintained, it was not being consistently applied to relevant presentations.

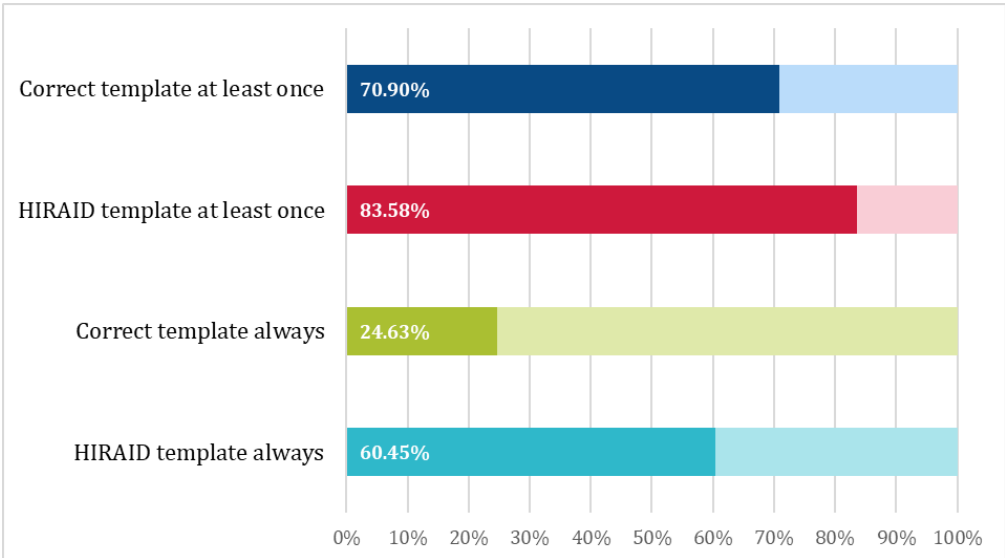


Figure 6.4. Audit of HIRAID documentation template use 9 months post implementation.

## **6.2 Summary**

Guided by the RE-AIM framework, the key findings from the four studies conducted in Phase 2 were integrated, along with data extracted from site implementation records, to comprehensively evaluate the implementation of HIRAID in Southern NSW LHD EDs. Overall, the implementation strategy achieved high reach, dose and quality. Despite the varied fidelity to the activities delivered by HIRAID champions, there was a significant improvement in the quality of nurses' post-triage assessment documentation.

In Chapter 7 the key findings and recommendations for the future implementation of practice change in rural areas are discussed.

## **Chapter 7: Key Findings and Recommendations**

### **7.1 Introduction**

The key findings from the implementation of HIRAID in a predominantly rural setting in southern NSW, Australia, are presented in this final chapter. The strengths and limitations of this research are discussed, followed by recommendations for future HIRAID implementation in rural EDs. Finally, the ongoing sustainability of HIRAID use in southern NSW and the outputs of this research are presented.

### **7.2 Summary of Key Research Findings**

The three objectives of this research were to:

1. identify the enablers of and barriers to HIRAID implementation based on the TDF
2. develop an evidence-based implementation strategy based on the BCW
3. evaluate the implementation, guided by the RE-AIM framework, to determine implementation fidelity and effectiveness.

The following subsections summarise the five key findings from this research.

#### **7.2.1 Key Finding 1: Lack of Evidence on Effective Strategies for Implementing Practice Change in the Emergency Department**

The use of an implementation framework and a variety of strategies supported effective and sustainable implementation of interventions where clinicians are required to change practice in the ED. However, there is a lack of robust evidence to unequivocally recommend specific strategies for implementing an intervention for sustainable practice change in the ED. These findings are presented in Chapter 2, Publication 1 (Kennedy, Kourouche, et al., 2025).

Twenty-two previous studies have focused on ED clinician behaviour change. The strategies used in these studies (e.g. educational meetings, email communications and consumer education) were mapped to ERIC strategies (Powell et al., 2015; Waltz et al., 2015). No strategy or combination of strategies was more effective in creating sustainable practice change. In some instances, mapping the strategies to ERIC was limited by the inadequate detail reported, which may also have influenced the results. Additionally, the lack of an observable relationship between the barriers and enablers and the chosen

strategies made it difficult to ascertain whether a particular strategy would be more suited to a specific situation.

### **7.2.2 Key Finding 2: Enablers and Barriers to HIRAID Implementation in Rural Emergency Departments**

The enablers of and barriers to HIRAID implementation differed according to the ED level. At the smaller sites, a higher proportion of nurses believed that HIRAID would not change the way in which they delivered care (beliefs about consequences) and that their workload would limit their ability to change their practice (beliefs about capabilities). These results illustrate the need to consider the specific context. Across the LHD, the greatest barriers were the lack of staff resources and time to dedicate to learning or implement a new practice (environmental context and resources). These findings are reported in Publication 2 (Kennedy, Curtis, Kourouche, Casey, Hughes, Chapman, & Fry, 2024) (see Section 5.1.1) and address Objective 1: to identify the enablers of and barriers to the implementation of HIRAID using the TDF.

### **7.2.3 Key Finding 3: Development of a Publicly Available Multifaceted Implementation Strategy Informed by the Behaviour Change Wheel**

This research involved the development of a HIRAID implementation strategy using the BCW to inform the BCTs required for effective implementation. The full implementation strategy and BCT mapping is presented in Publication 3 (Kennedy, Curtis, Kourouche, Casey, Hughes, & McCloughen, 2024) (see Section 5.1.2). This study addresses Objective 2: to develop an evidence-based implementation strategy using the BCW. Twenty BCTs were identified and operationalised through 12 modes of delivery, including a multimodal education program, documentation templates, district communications and feedback.

### **7.2.4 Key Finding 4: HIRAID Implementation Improves Clinical Documentation**

The introduction of HIRAID in the Southern NSW LHD led to a significant improvement in emergency nurses' post-triage patient assessment documentation. The mean quantity of relevant information increased from 1.8 ( $SD = 0.6$ ) to 2.6 ( $SD = 0.7$ ) ( $p < .001$ ), with the greatest improvement in the documentation of relevant patient history and red flags. Nevertheless, there is still room for further improvement. The findings of this study

informed the evaluation of clinical outcomes, contributing to Objective 3. These findings are reported in Publication 4 (Kennedy, Lam, et al., 2025) (see Section 5.3.1).

### **7.2.5 Key Finding 5: A Multifaceted, Evidence-based Implementation Strategy Resulted in High but Variable HIRAID Uptake**

The evaluation of HIRAID implementation, guided by the RE-AIM framework, identified high fidelity to the implementation overall. This finding was presented in Chapter 6 and addressed Objective 3: to evaluate the implementation, guided by the RE-AIM framework, to determine implementation fidelity and effectiveness.

The majority (90%) of emergency nurses completed at least one component of the education, indicating high *reach*. Emergency nurses believed that HIRAID was *effective*, particularly in supporting nurses new to the ED, and there was a significant improvement in the quality of documentation. The *adoption* of HIRAID was moderate to high, with all sites implementing HIRAID and having at least one trained HIRAID champion (setting level), and 78% of audited staff were using the HIRAID documentation templates (individual level). There was some variability in *implementation quality* in terms of dose, fidelity and quality of delivery.

All sites implemented HIRAID and had at least one champion who was not part of the education team (100% dose), with provider training delivered at all sites. More than 80% of emergency nurses completed face-to-face training; however, the dose of the remaining three elements was less than 80%. There was variability in the fidelity of delivery, with over 80% of champions modelling the behaviour, and the majority (92%) of education delivered by a nurse who had completed the HIRAID training. However, when delivering the face-to-face education, less than half (48%) of the HIRAID champions used the PowerPoint presentation every time, indicating lower fidelity. Champions reported not using the PowerPoint because of the small numbers of staff in each training session. The quality of the train-the-trainer course was rated high by those who completed it. The findings reveal that some emergency nurses considered the HIRAID intervention to be a documentation strategy only rather than the documentation being reflective of a comprehensive assessment. These findings are reported in Studies 4 and 5 (see Chapter 5).

The HIRAID implementation has been *maintained* across study sites. During this research, HIRAID was included in LHD policies and integrated into training programs and ED

orientation. There was ongoing use, with over 80% of audited emergency nurses using the HIRAID documentation templates 9 months post implementation. However, use of the templates varied, with only 61% of nurses using it for all relevant presentations. Senior clinicians in the Southern NSW LHD have reported the continued use of HIRAID more than 3 years since its implementation.

### **7.3 Strengths and Limitations**

This research has several strengths. First, to date, it is the only implementation science study of rural emergency nurses. Second, it demonstrates that the TDF, the BCW and implementation science principles can be used to inform an implementation strategy capable of delivering sustained change, providing a roadmap for future implementation in the rural context. Third, the research was conducted in 11 rural EDs, representing a diverse range of emergency nursing practice, medical staffing and site resources. This diversity enabled the testing of a behaviour change-informed multifaceted implementation strategy across a variety of emergency contexts. Fourth, the multimethod research design enabled a range of research methodologies to be applied to each phase of the study to inform implementation design and evaluation and meet the research objectives. This multimethod design allowed the exploration of separate yet interrelated concepts.

There are also several limitations to this research that should be considered when interpreting the results. First, the survey response rates were just over 50%. While these rates are above those reported in the literature for electronic surveys (Meyer et al., 2022), the views of non-responders may differ from those who chose to participate. Given that the surveys were de-identified, there is no way of comparing the characteristics of responders and non-responders. Second, delays in some data collection may have affected nurse recall, potentially influencing the findings. For example, the surveys on implementation fidelity were pushed back because of delays in implementation, with interviews being conducted up to 9 months following implementation. Third, many HIRAID champions failed to return their information tracking logs, and the few that were returned were delayed and had minimal detail on adaptations made to the delivery of HIRAID training. These delays affected the ability to provide feedback to all clinicians in a timely manner. The inability to adequately determine exactly what changes were made hindered the evaluation of fidelity. For example, the face-to-face training incorporated

seven BCTs related to content and how it was delivered, but the exact techniques used could not be quantified without detailed records of modifications made.

## **7.4 Recommendations for Future Implementation in the Rural Context**

This research has generated several recommendations for the future implementation of clinical interventions in rural EDs and EDs more broadly. These recommendations are discussed in the following subsections.

### **7.4.1 Embed Interventions into Policy and Practice**

Embedding an intervention into hospital policy and routine practice and targeting managers is essential to support its sustainability and increase individual engagement (Leeman et al., 2017). In this research, senior clinicians embedded the HIRAID framework into hospital orientation and clinical programs, requiring all staff to undergo HIRAID training. These actions align with the BCW policy categories ‘guidelines’ and ‘regulation’ (Michie et al., 2014), supporting the sustainability of the framework. In terms of regulation, incorporating HIRAID as part of the routine ED orientation supports ongoing education and training and establishes behavioural expectations (Michie et al., 2014). Guidelines support changes in the delivery of care, linking to multiple intervention functions (Michie et al., 2014) and maintaining demand for the intervention. Further, demand for the intervention can be created by engaging with external stakeholders such as policymakers, who could expect HIRAID assessment documentation to be completed as part of all ED clinical reviews (Powell et al., 2015), encouraging further uptake. The NSW Emergency Care Assessment and Treatment program, implemented in 2024, will continue to drive the demand for interventions that meet the protocols (Agency for Clinical Innovation, n.d), aligning with the HIRAID framework.

### **7.4.2 Provide a Dedicated Implementation Facilitator**

The implementation of an intervention at multiple sites across a large geographical area requires a dedicated implementation facilitator with clinical credibility. The effective implementation of an intervention in clinical practice requires time, leadership, coordination and support. Facilitation is defined as ‘a process of interactive problem solving and support that occurs in a context of a recognised need for improvement and a supportive interpersonal relationship’ Additional file 6, pp. 7 (Powell et al., 2015).

Clinical facilitators must have a range of interrelated skills, including the ability to communicate, develop meaningful relationships with stakeholders, take charge of implementation, assist with changes, deliver training and assess outcomes to monitor change (Ritchie et al., 2020). Therefore, this role would be ideally suited to a senior clinician who is familiar with the workplace and staff and with sufficient clinical credibility to facilitate effective implementation. Having a clinical facilitator dedicated to the implementation of an intervention and supporting clinicians through the process will ensure the activation of relevant intervention functions (Michie et al., 2014).

#### **7.4.3 Active Stakeholder Engagement at All Levels**

The meaningful and active engagement of all stakeholders is important for supporting implementation (O'Connell et al., 2024). Stakeholders are those responsible for delivering an intervention or affected by an intervention, and their engagement will influence the intervention's effectiveness (Petkovic et al., 2020). Direct line managers are essential for driving implementation (Birken et al., 2018; Meza et al., 2021) and providing the necessary support in line with regular workplace activities (Birken et al., 2018). Managers who provide leadership on implementation can contribute to the improved uptake of the intervention by clinicians (Williams et al., 2020).

During this study, there was low engagement from stakeholders at times, evidenced by their poor attendance at steering committee meetings in the planning and implementation of HIRAIID. As indicated in Study 5, engaging managers in the implementation was challenging, and nurses perceived inadequate support from managers. The implementation was led and driven by senior emergency nurses with senior management support.

Multilevel stakeholder engagement is necessary to ensure the development of a shared vision along with goal setting and problem-solving (Erlingsdottir et al., 2018). Steering committees should comprise a range of stakeholders, including senior LHD executives, facility managers, ED nurse managers, district emergency CNCs, ED and clinical nurse educators and ED nurses. Mandating attendance to ensure the necessary input from all stakeholders may be warranted.

#### 7.4.4 Nurses Need Dedicated Time for Education

Nurses require dedicated time for training on new clinical interventions. Learning about a new intervention necessitates a considerable time commitment, and ad hoc delivery may impede training, thus uptake. As demonstrated in Study 3 (see Section 5.2.2), time restrictions and the high number of staff requiring training were barriers to the delivery of the training as intended, with an average of four sessions per staff member during the 3-month implementation period. Low fidelity to training delivery may influence the uptake of an intervention because the potential barriers to the strategy may not be adequately addressed.

Training on interventions such as HIRAID should be undertaken onsite and during routine work hours (NSW Health, 2023). This requires the LHD to fund additional staff to cover for those attending training. This will support increased fidelity to the training and potentially improve the successful uptake of an intervention. For example, in the case of HIRAID, the LHD could recoup the cost of additional staff with the savings from delivering higher quality care. A study on the efficacy of HIRAID estimated a cost saving of \$1.9 million, with a payback period of less than 3 months (Curtis, Sivabalan, et al., 2021).

#### 7.5 Thesis Outputs

Throughout my PhD candidature, I have disseminated the findings of my research through publications, workshops and conference presentations. The five publications are embedded in Chapters 2 and 5 of this thesis. Three papers have been published, while the remaining two are awaiting the outcome of peer review. Workshop and conference presentations completed to date are as follows:

- Kennedy, B. (2022, 8 September). *Lessons learned from implementation in southern NSW* [HIRAID train-the-trainer workshop]. Westmead Hospital Emergency Department, Westmead, New South Wales, Australia.
- Curtis, K., Kennedy, B., Murphy, M., Considine, J., Fry, M., & Shaban, R. Z. (2022, 30 September). *HIRAID train-the-trainer* [HIRAID workshop]. Emergency Nursing 2022, Emergency Nurses Association, Denver, CO, United States.
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## 7.6 Conclusion

The research presented in this thesis is the first to evaluate an intervention to change emergency nursing practice in a predominantly rural context. It demonstrates the use of the TDF and BCW in the design of a context-specific HIRAID implementation strategy that addresses the enablers of and barriers to implementation and achieves a high reach, adoption and implementation quality at the setting level. The implementation strategy led to the sustained application of HIRAID at 9 months post implementation. HIRAID demonstrated clinical effectiveness, supporting emergency nursing practice and improving the quality of documentation. The use of HIRAID has become routine at all study sites, and it continues to be applied more than 3 years since completing the evaluation. This research identified key areas for improvement and recommendations for future implementation activities in rural EDs and EDs more broadly.

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# Appendices

## Appendix 1: Scoping review search strategy and PRISMA Extension for Scoping Reviews (PRISMA-ScR) reporting guideline

PRISMA Extension for Scoping Reviews (PRISMA-ScR) reporting guideline:  
Submitted with Publication 1

Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist

| SECTION   | ITEM | PRISMA-ScR CHECKLIST ITEM  | REPORTED ON PAGE #                                 |
|---|------|--|--|
| <b>TITLE</b>  |      |  |  |
| Title   | 1    | Identify the report as a scoping review.   | 1  |
| <b>ABSTRACT</b>                                       |      |  |  |
| Structured summary                                    | 2    | Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.  | page 1<br>Narrative abstract as per AEM guidelines |
| <b>INTRODUCTION</b>                                   |      |  |  |
| Rationale   | 3    | Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.   | 3-4  |
| Objectives  | 4    | Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.                                  | 4  |
| <b>METHODS</b>  |      |  |  |
| Protocol and registration                             | 5    | Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.   | 4  |
| Eligibility criteria                                  | 6    | Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.   | 5-6  |
| Information sources*                                  | 7    | Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.  | 6  |
| Search  | 8    | Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.  | Appendix 3   |
| Selection of sources of evidence†                     | 9    | State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.  | 7  |
| Data charting process‡                                | 10   | Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators. | 7-8  |
| Data items  | 11   | List and define all variables for which data were sought and any assumptions and simplifications made.   |  |
| Critical appraisal of individual sources of evidence§ | 12   | If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).  | N/A  |
| Synthesis of results                                  | 13   | Describe the methods of handling and summarizing the data that were charted.   | 9  |

| SECTION                                       | ITEM | PRISMA-ScR CHECKLIST ITEM   | REPORTED ON PAGE # |
|---|------|---|--------------------|
| <b>RESULTS</b>                                |      |   |                    |
| Selection of sources of evidence              | 14   | Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.                    | Figure 1 p.11      |
| Characteristics of sources of evidence        | 15   | For each source of evidence, present characteristics for which data were charted and provide the citations.   | 12                 |
| Critical appraisal within sources of evidence | 16   | If done, present data on critical appraisal of included sources of evidence (see item 12).  | N/A                |
| Results of individual sources of evidence     | 17   | For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.   | Table 2 p22-23     |
| Synthesis of results                          | 18   | Summarize and/or present the charting results as they relate to the review questions and objectives.  | 22-23              |
| <b>DISCUSSION</b>                             |      |   |                    |
| Summary of evidence                           | 19   | Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups. | 26-28              |
| Limitations                                   | 20   | Discuss the limitations of the scoping review process.  | 25-26              |
| Conclusions                                   | 21   | Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.                                       | 28                 |
| <b>FUNDING</b>                                |      |   |                    |
| Funding                                       | 22   | Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.                 | Title page         |

JBI = Joanna Briggs Institute; PRISMA-ScR = Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews.

\* Where sources of evidence (see second footnote) are compiled from, such as bibliographic databases, social media platforms, and Web sites.

† A more inclusive/heterogeneous term used to account for the different types of evidence or data sources (e.g., quantitative and/or qualitative research, expert opinion, and policy documents) that may be eligible in a scoping review as opposed to only studies. This is not to be confused with *information sources* (see first footnote).

‡ The frameworks by Arksey and O'Malley (8) and Levac and colleagues (7) and the JBI guidance (4, 5) refer to the process of data extraction in a scoping review as data charting.

§ The process of systematically examining research evidence to assess its validity, results, and relevance before using it to inform a decision. This term is used for items 12 and 19 instead of "risk of bias" (which is more applicable to systematic reviews of interventions) to include and acknowledge the various sources of evidence that may be used in a scoping review (e.g., quantitative and/or qualitative research, expert opinion, and policy document).

From: Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. *Ann Intern Med.* 2018;169:467-473. doi:10.7326/M18-0850.

## Supplementary File 1 from Publication 1: Scoping review strategy

| <b>SCOPING REVIEW: <i>Implementation strategies for successful, and sustainable, practice change in the emergency department: a scoping review</i></b>   |  |
|--|--|
| <b>LITERATURE SEARCH STRATEGY</b>  |  |
| <b>Version 6</b>   |  |
| <b>OVERVIEW</b>  |  |
| <p>Delivery of evidence-based care has the potential to improve both delivery of patient care and patient outcomes. Translating evidence into the clinical environment to ensure consistent evidence-based practice requires implementation strategies to address the complexity of the environment, including both individual and organisational and factors. The challenges of translating evidence into practice are not new. Implementation science has led to the development of frameworks and methods to guide practice change. Guided by these frameworks and theories provides a structured approach and assists to identify practice gaps, as well as both the organisation and individual changes required to promote effective uptake and use of an intervention<sup>1,2</sup>. With adequate assessment, planning and support through the process it is more likely to deliver successful implementation and sustainable practice change over time<sup>4,3</sup>.</p> <p>Research frequently evaluates the outcomes associated with the intervention but the evaluation of the process of implementation is frequently overlooked. Implementation outcomes are the planned activities, or actions, to introduce new practices<sup>4</sup>. Implementation is costly to organisations<sup>3</sup>, therefore the ability to deliver change with processes known to be effective will not only support the necessary practice change, but also likely to deliver cost savings to the organisation.</p> <p>The emergency department is unique setting with an unpredictable, constantly changing, clinical environment. Little is known about implementation processes and / or strategies that have been established to deliver effective and sustainable practice change within emergency departments.</p> |  |
| <b>AIM &amp; QUESTIONS</b>   | <p><b>Aim:</b> 1. To describe implementation strategies shown to be effective in introducing sustainable practice change in the emergency department</p> <p><b>Qs:</b></p> <ol style="list-style-type: none"> <li>1. What theories/models/ frameworks have been used to implement practice change in the emergency department?</li> <li>2. What implementation strategies have been used and/ or evaluated in the emergency environment?</li> <li>3. What implementation strategies are successful in sustained clinical practice change in the ED?</li> </ol> |
| <b>KEY CONCEPTS</b>  |  |
| 1. Implementation  | <p>'Implementation strategy' OR 'Implementation fidelity' OR 'Process evaluation' OR 'Behaviour change' OR 'practice change' OR 'Implementation methods' OR 'knowledge translation'</p> <p>MeSH: 'Implementation science' OR 'Quality improvement' OR 'Evidence- based practice' OR 'Translational Medical Research'</p>   |
| 2. Emergency Departments   | 'Emergency Department' OR 'Accident & Emergency' OR 'A&E' OR 'emergency room' OR 'ER' OR 'Emergency ward'  |

|  |                     |             |
|--|---------------------|-------------|
| MeSH: 'Emergency service, Hospital' OR 'Emergency Nursing' OR 'Emergency Medicine' |                     |             |
| DATABASES  |                     |             |
| 1. Medline   | 3. EBSCO (CINAHL)   | 5. PsycINFO |
| 2. Scopus  | 4. ProQuest central |             |

| INCLUDE   | EXCLUDE   |
|---|---|
| <b>Population:</b><br>Emergency department/ staff behaviour change;   | <ul style="list-style-type: none"> <li>Mixed population- i.e. staff external to ED (non-ED based)</li> <li>Target intervention patients</li> </ul>  |
| <b>Intervention/ Exposure</b> <ul style="list-style-type: none"> <li>New intervention (program, policy, practice, pill, process, product or guideline); AND</li> <li>Describes strategies, informed by theory or evidence*, for implementation/ practice change; OR</li> <li>Evaluates implementation strategies based on implementation theory and clinical outcomes; OR</li> <li>Single strategy (e.g. Education, checklist, simulation, audit) development informed by implementation theory; AND</li> <li>Reports outcomes</li> </ul> | <ul style="list-style-type: none"> <li>Single strategy (e.g. Education, check list, simulation, audit) where development not described; OR</li> <li>Investigate other aspects of implementation eg barriers or readiness to change; OR</li> <li>Evaluation of staff perceptions.</li> </ul> |
| <b>Comparator/ Context</b>  | Intervention implemented across multiple context not solely ED  |
| <b>Outcome</b><br>Evaluates outcomes of intervention; AND<br>Evaluation > 6 months from implementation <u>start</u> , or from the commencement of last QI cycle.  | Evaluation less than or equal to 6 months from implementation or from the commencement of the last QI cycle.  |
| <b>Study Characteristics</b><br>Original research   | <ul style="list-style-type: none"> <li>Literature reviews; No full text</li> <li>Opinion pieces.</li> <li>Grey literature.</li> <li>Systematic review (screen for papers)</li> <li>Not English.</li> </ul>  |

\*Evidence informed: work undertaken to determine what needs to change and/ or strategies informed based on prior evidence generated in literature (meeting

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4. Proctor E, Silmere H, Raghavan R, Hovmand P, Aarons G, Bunger A, et al. Outcomes for implementation research: conceptual distinctions, measurement challenges, and research agenda. *Administration and policy in mental health and mental health services research*. 2011;38(2):65-76.
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## Data extraction template Covidence

| General information  |  |
|--|--|
| Study ID   | First Author, year published   |
| Title  | Title of paper / abstract / report that data are extracted from  |
| Country in which the study conducted   | <ul style="list-style-type: none"> <li>• United States</li> <li>• UK</li> <li>• Canada</li> <li>• Australia</li> <li>• Other (free Text)</li> </ul>  |
| Methods  |  |
| What was the intervention being implemented?   |  |
| Brief description of the intervention.   |  |
| Aim of study   |  |
| Study design   | <ul style="list-style-type: none"> <li>• Randomised controlled trial</li> <li>• Non-randomised experimental</li> <li>• Cohort</li> <li>• Cross sectional</li> <li>• Case Control</li> <li>• Qualitative research</li> <li>• Other (free text)</li> </ul> |
| Start date   |  |
| End date   |  |
| ED staff population<br>(staff groups involved in practice change)  | <ul style="list-style-type: none"> <li>• Nursing</li> <li>• Medical</li> <li>• Allied Health</li> <li>• Support staff (e.g. orderly)</li> </ul> Other (free text)  |
| Implementation Strategy  |  |
| Was a framework/ theory used?  | <ul style="list-style-type: none"> <li>• Yes</li> <li>• No</li> </ul>  |
| Further details where no framework used<br>i.e quality improvement   |  |
| If yes, which Framework/ theories were used<br>(select multiple, document any quality improvement framework) | <ul style="list-style-type: none"> <li>• CFIR</li> <li>• COM-B</li> <li>• Behaviour Change Wheel</li> <li>• Evidence-based Practice Implementation Scale</li> <li>• Knowledge to Action Framework</li> <li>• PARIHS</li> </ul>                           |

|   |  |
|---|--|
|   | <ul style="list-style-type: none"> <li>• Quality Implementation Framework</li> <li>• Normalisation Process Theory</li> <li>• RE-AIM</li> <li>• Theoretical Domains Framework</li> <li>• Other</li> </ul>   |
| <p>What evidence informed strategy development?</p> <p><i>i.e work undertaken to determine what needs to change and/ or strategies informed based on prior evidence generated in literature</i></p> | <ul style="list-style-type: none"> <li>• Literature review</li> <li>• Informal assessment</li> <li>• Formal Assessment (e.g. survey, interviews)</li> <li>• Assessment guided by framework or theory</li> <li>• Other</li> </ul>                                     |
| Further detail if required:   |  |
| Were barriers/ enablers assessed? -   | <ul style="list-style-type: none"> <li>• Yes</li> <li>• No</li> </ul>  |
| Were barriers/ enablers documented?   | <ul style="list-style-type: none"> <li>• Yes</li> <li>• No</li> </ul>  |
| <p>Implementation strategies or activities?<br/>e.g education, policy<br/><i>(enter detail activities used/ described)</i></p>  | <p>Table – 10 lines<br/>Description (from paper) / Timing</p> <p>Intervention: describe intervention and how delivered.<br/>Timing- the stage during implementation when it was rolled out.<br/>Barriers/ Facilitators inform intervention choice (if available)</p> |
| Additional interventions if required, not described above   |  |
| Was the fidelity of the intervention reported?  | Yes/ No  |
| Outcomes Measured   |  |
| Time of evaluation from implementation start  | <ul style="list-style-type: none"> <li>• 6-9 months</li> <li>• &gt;9-12 months</li> <li>• &gt;12- 18 months</li> <li>• &gt; 18 months</li> </ul>   |
| PRE: Number Records/ cases reviewed   |  |
| POST: Number of records/ cases reviewed   |  |

| <p><b>Study outcomes</b></p> <p>(Outcome measure/ Baseline/ Post intervention/ Stats)</p> | <table border="1"> <thead> <tr> <th colspan="4">Study Outcomes</th> </tr> <tr> <th></th> <th>Outcome measure</th> <th>Baseline</th> <th>Post intervention</th> </tr> </thead> <tbody> <tr> <td>Outcome 1</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Outcome 2</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Outcome 3</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Outcome 4</td> <td></td> <td></td> <td></td> </tr> </tbody> </table> | Study Outcomes |                   |  |  |  | Outcome measure | Baseline | Post intervention | Outcome 1 |  |  |  | Outcome 2 |  |  |  | Outcome 3 |  |  |  | Outcome 4 |  |  |  |
|---|---|----------------|-------------------|--|--|--|-----------------|----------|-------------------|-----------|--|--|--|-----------|--|--|--|-----------|--|--|--|-----------|--|--|--|
| Study Outcomes  |   |                |                   |  |  |  |                 |          |                   |           |  |  |  |           |  |  |  |           |  |  |  |           |  |  |  |
|   | Outcome measure   | Baseline       | Post intervention |  |  |  |                 |          |                   |           |  |  |  |           |  |  |  |           |  |  |  |           |  |  |  |
| Outcome 1   |   |                |                   |  |  |  |                 |          |                   |           |  |  |  |           |  |  |  |           |  |  |  |           |  |  |  |
| Outcome 2   |   |                |                   |  |  |  |                 |          |                   |           |  |  |  |           |  |  |  |           |  |  |  |           |  |  |  |
| Outcome 3   |   |                |                   |  |  |  |                 |          |                   |           |  |  |  |           |  |  |  |           |  |  |  |           |  |  |  |
| Outcome 4   |   |                |                   |  |  |  |                 |          |                   |           |  |  |  |           |  |  |  |           |  |  |  |           |  |  |  |
| <p>Further details on study outcomes if required</p>                                      | <p><i>Free text</i></p>   |                |                   |  |  |  |                 |          |                   |           |  |  |  |           |  |  |  |           |  |  |  |           |  |  |  |
| <p>NHMRC Level of evidence</p>  | <p>level I<br/> Level II<br/> Level III-1<br/> Level III-2<br/> Level III-3<br/> Level IV</p>   |                |                   |  |  |  |                 |          |                   |           |  |  |  |           |  |  |  |           |  |  |  |           |  |  |  |

## Supplementary File 2 from Publication 1

### MEDLINE

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| #  | Query   |
|----|---|
| 1  | Evidence-Based Practice/ed, mt [Education, Methods]   |
| 2  | Implementation Science/   |
| 3  | Quality Improvement/  |
| 4  | implementation strateg*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] |
| 5  | implementation fidelity.mp.   |
| 6  | implementation method*.mp.  |
| 7  | practice change.mp.   |
| 8  | Behavior?r change.mp.   |
| 9  | process evaluation.mp.  |
| 10 | Emergency Service, Hospital/  |
| 11 | Emergency Medicine/ or Emergency Nursing/   |
| 12 | emergency department.mp.  |
| 13 | Emergency room.mp.  |
| 14 | emergency ward.mp.  |
| 15 | accident & emergency.mp.  |
| 16 | A&E.mp.   |
| 17 | ER.mp.  |
| 18 | 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17  |
| 19 | knowledge translation.mp.   |
| 20 | Translational Medical Research/mt [Methods]   |
| 21 | Implementation evaluation.mp.   |
| 22 | 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 19 or 20 or 21   |
| 23 | 18 and 22   |
| 24 | limit 23 to english language  |

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## CINAHL

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Implementation

“implementation fidelity” OR “implementation method\*” OR “implementation strateg\*” OR “practice change” OR

“process evaluation” OR “behavior change” OR “knowledge translation” OR “implementation evaluation”

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MESH

(MH “Nursing Practice, Evidence-Based/MT/EV”) OR (MH “Medical Practice, Evidence-Based/EV/MT”) OR (MH “Implementation Science”) OR (MH “Quality Improvement+/EV/MT”) OR (MH “Translational Medical Research”)

---

TOTAL Implementation (OR)

---

Emergency

“emergency department” OR “emergency ward” OR “accident & emergency” OR “Emergency room” OR “A&E”

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MESH

(MH “Emergency Service”)

(MH “Physicians, Emergency”) OR (MH “Emergency Nursing”)

---

TOTAL Emergency (OR)

---

Combine concepts: Implementation (AND) Emergency

Limit to English

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## APA PsycInfo

MESH- behavior change definition in OVID does not fit with meaning for search i.e. Detectable changes in behavior due to psychotherapeutic, behavioral, or other intervention, or spontaneous occurrence. Therefore, behaviour change, searched as Keyword only.

Translation medical research not available as MESH term in PsychINFO, Knowledge Transfer used. No scope provided for term in database.

| #  | Query   |
|----|---|
| 1  | implementation strateg*.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh] |
| 2  | implementation fidelity.mp.   |
| 3  | implementation method*.mp.  |
| 4  | practice change.mp.   |
| 5  | process evaluation.mp.  |
| 6  | behavio#r change.mp.  |
| 7  | Evidence Based Practice/  |
| 8  | Implementation Science.mp.  |
| 9  | Quality Improvement.mp.   |
| 10 | Emergency Medicine/   |
| 11 | Emergency Nursing.mp.   |
| 12 | Emergency Services/   |
| 13 | emergency department.mp.  |
| 14 | accident & emergency.mp.  |
| 15 | emergency ward.mp.  |
| 16 | Emergency room.mp.  |
| 17 | A&E.mp.   |
| 18 | knowledge translation.mp.   |
| 19 | 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17  |
| 20 | Knowledge Transfer/   |
| 21 | Implementation evaluation.mp.   |
| 22 | 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 18 or 20 or 21   |
| 23 | 19 and 22   |

## Proquest

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### Implementation

(su(implementation NEAR/1 evaluation) OR ab(implementation NEAR/1 evaluation)) OR ((su(knowledge NEAR/1 translation) OR ab(knowledge NEAR/1 translation)) OR ((su(implementation fidelity) OR ab(implementation fidelity)) OR (su(Implementation NEAR/1 method\*) OR ab(Implementation NEAR/1 method\*)) OR (su(implementation NEAR/1 strateg\*) OR ab(implementation NEAR/1 strateg\*)) OR (su(behavior\*r NEAR/1 change) OR ab(behavior\*r NEAR/1 change)) OR (su(practice NEAR/1 change) OR ab(practice NEAR/1 change)) OR (su(process NEAR/1 evaluation) OR ab(process NEAR/1 evaluation))))

---

(MAINSUBJECT.EXACT("Evidence-based practice") OR MESH.EXACT("Implementation Science") OR MESH.EXACT("Quality Improvement")) OR MAINSUBJECT.EXACT("Translational Medical Research")

---

TOTAL Implementation (OR)

---

### Emergency

(su(emergency NEAR/0 department) OR ab(emergency NEAR/0 department) ) OR (su(emergency NEAR/0 ward) OR ab(emergency NEAR/0 ward) ) OR (su(accident NEAR/1 emergency) OR ab(accident NEAR/1 emergency)) OR (su(Emergency NEAR/0 room) OR ab(Emergency NEAR/0 room) )

---

(MAINSUBJECT.EXACT("Emergency services") AND MAINSUBJECT.EXACT("Hospitals")) OR (MESH.EXACT("Emergency Service, Hospital") OR MESH.EXACT("Emergency Nursing") OR MESH.EXACT("Emergency Medicine"))

---

TOTAL Emergency (OR)

---

Combine (AND)

---

Limit scholarly journal; theses; conference papers & proceedings; other sources; working papers

---

Limit English

---

## Scopus

---

### Implementation

(( TITLE-ABS-KEY ( "implementation fidelity" ) ) OR ( TITLE-ABS-KEY ( "implementation method\*" ) ) OR ( TITLE-ABS-KEY ( "implementation strateg\*" ) ) OR ( TITLE-ABS-KEY ( "behavior change" ) ) OR ( TITLE-ABS-KEY ( "process evaluation" ) ) OR ( TITLE-ABS-KEY ( {evidence-based practice} ) ) OR ( TITLE-ABS-KEY ( {translational medical research} ) ) OR ( TITLE-ABS-KEY ( quality AND improvement W/2 method\* ) ) OR ( TITLE-ABS-KEY ( {implementation science} ) ) OR ( TITLE-ABS-KEY ( "knowledge translation" ) ) ) ) OR ( TITLE-ABS-KEY ( "implementation evaluation" ) ) )

---

### Emergency

( TITLE-ABS-KEY ( "emergency medicine" ) OR TITLE-ABS-KEY ( "emergency nurs\*" ) OR TITLE-ABS-KEY ( {accident and emergency} ) OR TITLE-ABS-KEY ( {emergency ward} ) OR TITLE-ABS-KEY ( {emergency room} ) OR TITLE-ABS-KEY ( {emergency department} ) OR TITLE-ABS-KEY ( {a&e} ) )

---

### Combined

(( TITLE-ABS-KEY ( "emergency medicine" ) OR TITLE-ABS-KEY ( "emergency nurs\*" ) OR TITLE-ABS-KEY ( {accident and emergency} ) OR TITLE-ABS-KEY ( {emergency ward} ) OR TITLE-ABS-KEY ( {emergency room} ) OR TITLE-ABS-KEY ( {emergency department} ) OR TITLE-ABS-KEY ( {a&e} ) ) ) AND ( (( TITLE-ABS-KEY ( "implementation fidelity" ) ) OR ( TITLE-ABS-KEY ( "implementation method\*" ) ) OR ( TITLE-ABS-KEY ( "implementation strateg\*" ) ) OR ( TITLE-ABS-KEY ( "behavior change" ) ) OR ( TITLE-ABS-KEY ( "process evaluation" ) ) OR ( TITLE-ABS-KEY ( {evidence-based practice} ) ) OR ( TITLE-ABS-KEY ( {translational medical research} ) ) OR ( TITLE-ABS-KEY ( quality AND improvement W/2 method\* ) ) OR ( TITLE-ABS-KEY ( {implementation science} ) ) OR ( TITLE-ABS-KEY ( "knowledge translation" ) ) ) ) OR ( TITLE-ABS-KEY ( "implementation evaluation" ) ) ) )

---

(( TITLE-ABS-KEY ( "emergency medicine" ) OR TITLE-ABS-KEY ( "emergency nurs\*" ) OR TITLE-ABS-KEY ( {accident and emergency} ) OR TITLE-ABS-KEY ( {emergency ward} ) OR TITLE-ABS-KEY ( {emergency room} ) OR TITLE-ABS-KEY ( {emergency department} ) OR TITLE-ABS-KEY ( {a&e} ) ) ) AND ( (( TITLE-ABS-KEY ( "implementation fidelity" ) ) OR ( TITLE-ABS-KEY ( "implementation method\*" ) ) OR ( TITLE-ABS-KEY ( "implementation strateg\*" ) ) OR ( TITLE-ABS-KEY ( "behavior change" ) ) OR ( TITLE-ABS-KEY ( "process evaluation" ) ) OR ( TITLE-ABS-KEY ( {evidence-based practice} ) ) OR ( TITLE-ABS-KEY ( {translational medical research} ) ) OR ( TITLE-ABS-KEY ( quality AND improvement W/2 method\* ) ) OR ( TITLE-ABS-KEY ( {implementation science} ) ) OR ( TITLE-ABS-KEY ( "knowledge translation" ) ) ) ) OR ( TITLE-ABS-KEY ( "implementation evaluation" ) ) ) ) AND ( LIMIT-TO ( SUBJAREA, "MEDI" ) OR LIMIT-TO ( SUBJAREA, "NURS" ) OR LIMIT-TO ( SUBJAREA, "SOCI" ) OR LIMIT-TO ( SUBJAREA, "HEAL" ) OR LIMIT-TO ( SUBJAREA, "PSYC" ) ) AND ( LIMIT-TO ( LANGUAGE, "English" ) ) )

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## Appendix 3: Sample of excluded papers and rationale

### Supplementary File 3 from Publication 1

| Author (year)           | Exclusion reason         | Exclusion description   |
|-------------------------|--------------------------|---|
| Barlow 2007             | Wrong (mixed) population | Intervention targeted at ED and Medical admission unit (MAU).                             |
| Bean et al. (2021)      | Wrong outcomes           | Investigated barriers and facilitators and potential strategies to implement.             |
| Burns, et al. (2024)    | Outcomes ≤ 6 months      | Evaluated for four months post final implementation strategy.                             |
| Farbman et al (2017)    | Wrong intervention       | Evidence for guideline development. No theory/ evidence to inform the implementation plan |
| Moeller, D (2017)       | Wrong intervention       | No new practice, improvement current practice.  |
| Plambech et al (2012)   | Wrong intervention       | Evidence to inform implementation strategy not described.                                 |
| Siarkowski et al (2020) | Wrong study design       | Systematic review   |
| Wright et al (2008)     | Wrong Population         | Targeted at general medical wards   |

Full citations:

Barlow, G., Nathwani, D., Williams, F., Ogston, S., Winter, J., Jones, M., Slane, P., Myers, E., Sullivan, F., Stevens, N., Duffey, R., Lowden, K. & Davey, P. (2007). Reducing door-to-antibiotic time in community-acquired pneumonia: controlled before-and-after evaluation and cost-effectiveness analysis. *Thorax*, 62(1), 67-74. <https://doi.org/10.1136/thx.2005.056689>

Bean, G., Krishnan, U., Stone, J. R., Khan, M., & Silva, A. (2021). Utilization of chest pain decision aids in a community hospital emergency department: a mixed-methods implementation study. *Critical Pathways in Cardiology*, 20(4), 192-207. <https://doi.org/10.1097/hpc.000000000000269>

Burns, B. S., Nouboussi, N., DeVane, K., Andrews, W., Selden, N. R., Lin, A., Petterson, D., Jafri, M. & Sheridan, D. (2024). Increasing Use of Rapid Magnetic Resonance Imaging for Children with Blunt Head Injury. *The Journal of Pediatrics*, 272, 114099. <https://doi.org/10.1016/j.jpeds.2024.114099>

Farbman, K. S., Michelson, K. A., Neuman, M. I., Dribin, T. E., Schneider, L. C., & Stack, A. M. (2017). Reducing hospitalization rates for children with anaphylaxis. *Pediatrics*, 139(6). <https://doi.org/10.1542/peds.2016-4114>

Moeller, D. (2017). Eliminating blood culture false positives: harnessing the power of nursing shared governance. *Journal of Emergency Nursing*, 43(2), 126-132. <https://doi.org/10.1016/j.jen.2016.07.001>

Plambech, M. Z., Lurie, A. I., & Ipsen, H. L. (2012). Initial, successful implementation of sepsis guidelines in an emergency department. *Dan Med J*, 59(12), A4545.

Siarkowski, M., Lin, K., Li, S. S., Al Sultan, A., Ganshorn, H., Kamal, N., Hill, M. & Lang, E. (2020). Meta-analysis of interventions to reduce door to needle times in acute ischaemic stroke patients. *BMJ open quality*, 9(3). <https://doi.org/10.1136/bmjoq-2020-000915>

Wright, A. A., Ranmuthugala, G., Jones, J., Maydom, B., & Disler, P. (2008). Rural organisation of acute stroke teams project. *Internal Medicine Journal*, 38(1), 32-37. <https://doi.org/10.1111/j.1445-5994.2007.01399.x>

## Appendix 4: ERIC strategy frequency and mapping to activities detailed in studies

### Supplementary File 4 from Publication 1

**Table 1: Frequency of ERIC strategy use for 22 studies**

| ERIC strategy   | Overall<br>use<br>n=22 | Successful<br>n=18 | Unsuccessful<br>n=4 |
|---|------------------------|--------------------|---------------------|
|   | n(%)                   | n(%)               | n(%)                |
| <b>Evaluative Iterative Strategies</b> (strategies/ studies)        | <b>42/18</b>           | <b>33/15</b>       | <b>9/3</b>          |
| Assess for readiness and identify barriers and facilitators         | 14 (63.6)              | 11 (61.1)          | 3 (75.0)            |
| Audit and provide feedback  | 11 (50.0)              | 9 (50.0)           | 2 (50.0)            |
| Purposely reexamine the implementation                              | 6 (27.3)               | 5 (27.8)           | 1 (25.0)            |
| Develop and implement tools for quality monitoring                  | 2 (9.1)                | 1 (5.6)            | 1 (25.0)            |
| Develop and organize quality monitoring systems                     | 1 (4.5)                | 1 (5.6)            | -                   |
| Develop a formal implementation blueprint                           | 2 (9.1)                | 1 (5.6)            | 1 (25.0)            |
| Conduct local needs assessment                                      | 3 (13.6)               | 2 (11.1)           | 1 (25.0)            |
| Stage implementation scale up                                       | 1 (4.5)                | 1 (5.6)            | -                   |
| Obtain and use patients/consumers and family feedback               | 1 (4.5)                | 1 (5.6)            | -                   |
| Conduct cyclical small tests of change                              | 1 (4.5)                | 1 (5.6)            | -                   |
| <b>Interactive assistance</b> (no. of studies)                      | <b>1</b>               |                    |                     |
| Facilitation  | 1 (4.5)                | 1 (5.6)            | -                   |
| <b>Adapt and Tailor to context</b> (strategies/studies)             | <b>8/8</b>             |                    |                     |
| Tailor strategies   | 5 (22.7)               | 3 (16.7)           |                     |
| Promote adaptability  | 3 (13.6)               | 2 (11.1)           |                     |
| <b>Develop Stakeholder interrelationships</b> (strategies/ studies) | <b>44/20</b>           | <b>36/17</b>       | <b>4/3</b>          |
| Identify and prepare champions                                      | 9 (40.9)               | 9 (50.0)           |                     |
| Organize clinician implementation team meetings                     | 1 (4.5)                | 1 (5.6)            |                     |
| Recruit, designate, and train for leadership                        | 1 (4.5)                | -                  | 1 (25.0)            |
| Inform local opinion leaders  | 7 (31.8)               | 6 (33.3)           | 1 (25.0)            |
| Build a coalition   | 5 (22.7)               | 4 (22.2)           | 1 (25.0)            |
| Identify early adopters   | 2 (9.1)                | 2 (11.1)           | -                   |
| Conduct local consensus discussions                                 | 1 (4.5)                | -                  | 1 (25.0)            |
| Capture and share local knowledge                                   | 1 (4.5)                | 1 (5.6)            |                     |
| Use advisory boards and workgroups                                  | 6 (27.3)               | 5 (27.8)           |                     |
| Use an implementation advisor                                       | 7 (31.8)               | 5 (27.8)           |                     |
| Involve executive boards  | 2 (9.1)                | 2 (11.1)           |                     |
| Develop academic partnerships                                       | 2 (9.1)                | 1 (5.6)            |                     |
| <b>Train and educate stakeholders</b> (strategies/ studies)         | <b>66/22</b>           | <b>52/18</b>       | <b>10/ 4</b>        |

| <b>ERIC strategy</b>                                 | <b>Overall use<br/>n=22</b> | <b>Successful<br/>n=18</b> | <b>Unsuccessful<br/>n=4</b> |
|--|-----------------------------|----------------------------|-----------------------------|
| Conduct ongoing training                             | 6 (27.3)                    | 5 (27.8)                   | 1 (25.0)                    |
| Develop educational materials                        | 6 (27.3)                    | 5 (27.8)                   | 1 (25.0)                    |
| Make training dynamic                                | 10 (45.5)                   | 10 (55.6)                  | -                           |
| Distribute educational materials                     | 16 (72.7)                   | 12 (66.7)                  | 4 (100)                     |
| Use train-the-trainer strategies                     | 3 (13.6)                    | 3 (16.7)                   | -                           |
| Conduct educational meetings                         | 20 (90.9)                   | 16 (88.9)                  | 4 (100)                     |
| Conduct educational outreach visits                  | 1 (4.5)                     | 1 (5.6)                    | -                           |
| <b>Support clinicians</b> (strategies/ studies)      | <b>25/19</b>                | <b>20/15</b>               | <b>5/4</b>                  |
| Facilitate relay of clinical data to providers       | 2 (9.1)                     | 2 (11.1)                   | -                           |
| Remind clinicians                                    | 17 (77.3)                   | 13 (72.2)                  | 4 (100)                     |
| Revise professional roles                            | 4 (18.2)                    | 3 (16.7)                   | 1 (25.0)                    |
| Create new clinical teams                            | 2 (9.1)                     | 2 (11.1)                   | -                           |
| <b>Engage Consumers</b> (strategies/ studies)        | <b>14/11</b>                | <b>11/ 9</b>               | <b>3/2</b>                  |
| Involve patients/consumers and family members        | 6 (27.3)                    | 4 (22.2)                   | 2 (50.0)                    |
| Prepare patients/consumers to be active participants | 3 (13.6)                    | 2 (11.1)                   | 1 (25.0)                    |
| Increase demand                                      | 1 (4.5)                     | 1 (5.6)                    | -                           |
| Use mass media                                       | 4 (18.2)                    | 4 (22.2)                   | -                           |
| <b>Utilize financial strategies</b> (no. of studies) | <b>2</b>                    |                            |                             |
| Alter incentive/allowance structures (60)            | 2 (4.5)                     | 2 (11.1)                   | -                           |
| <b>Change infrastructure</b> (strategies/ studies)   | <b>20/15</b>                | <b>18/13</b>               | <b>2/2</b>                  |
| Mandate change                                       | 2 (9.1)                     | 2 (11.1)                   |                             |
| Change record systems                                | 13 (59.1)                   | 12 (66.7)                  | 1 (25.0)                    |
| Change physical structure and equipment              | 5 (22.7)                    | 4 (22.2)                   | 1 (25.0)                    |

**Table 2: Mapping Implementation activities to ERIC strategies**

| First Author (Year)       | Intervention                                  | Implementation strategies  | ERIC Strategy   |
|---------------------------|---|--|---|
| Abaya et al. (2019)       | Asthma Clinical Pathway                       | <p>Multidisciplinary implementation team, including Quality improvement staff, met regularly during planning and implementation, assess progress and make modifications.</p> <p>Process review to identify drivers</p> <p>Piloted in small area of ED that dealt with respiratory presentations</p> <p>Guidelines- modified asthma pathway, to metered dose inhaler for all mild-moderate patients</p> <p>EHR modification (weight-based doses x 3 repeat), that could be discontinued by respiratory therapist when mild score reached - minor modification during implementation</p> <p>Education via division conferences, electronic mail, and computer screensavers throughout the department</p> | <p>Use advisory boards and workgroups</p> <p>Implementation advisor (29)</p> <p>Conduct cyclical small tests of change (10)</p> <p>Assess for readiness and identify barriers and facilitators</p> <p>Stage implementation scale up (8)</p> <p>Develop educational materials</p> <p>Change record systems</p> <p>Revise professional roles</p> <p>Purposely reexamine the implementation</p> <p>Conduct educational meetings</p> <p>Distribute educational materials</p> <p>Make training dynamic</p> |
| Basu and Ratcliffe (2014) | Independent Domestic Violence Advocate (IDVA) | <p>Multidisciplinary research team, included relevant community partners to engage community members</p> <p>A standardised form - rapid assessment tool to determine a risk status for the patient. Included instructions for required actions.</p> <p>Training for all senior nursing and medical staff was provided by the IDVAs on a rolling basis, embedded as mandatory part ongoing professional development.</p> <p>Two IDVAs in the department that case-managed referrals from ED staff</p>   | <p>Build a coalition</p> <p>Involve patients/consumers and family members</p> <p>Change physical structure and equipment</p> <p>Develop educational materials</p> <p>Conduct educational meetings</p> <p>Conduct ongoing training</p> <p>Create new clinical teams</p>  |

| First Author (Year)   | Intervention  | Implementation strategies  | ERIC Strategy   |
|-----------------------|---|--|---|
|                       |   | <p>An electronic coding system implemented to alert staff to previous DV presentations to ED.</p> <p>Private interview room allocated for assessment if required</p>   | <p>Facilitate relay of clinical data to providers</p> <p>Change physical structure and equipment</p>  |
| Cabilan et al. (2023) | Queensland Occupational Violence Patient Risk Assessment Tool (QOVPRAO) | <p>Engaged organisational leaders feedback and approval to embed the QOVPRAO in the EHR</p> <p>To foster engagement, named and disseminated through media releases to generate interest and promote a sense of ownership within the health service</p> <p>Consultation regarding the design and workflow of the digital QOVPRAO in the ED</p> <p>Screening tool embedded in electronic record and made mandatory assessment field which triggered a pop up and visual flag for high risk patients.</p> <p>Education (eLearning) designed two short modules to reduce time commitment. Completion core requirement contract staff and new staff. Reminders regarding eLearning emailed to staff.</p> <p>Develop suite of interventions to complement screening tool to enhance value and advantage over current practice. Interactive design eLearning and gamified activities to increase awareness of appropriate interventions for de-escalation.</p> <p>Nurses deployed in ED to drive implementation through encouraging screening, advocating benefits and reinforcing goal to reduce violence, relieved staff to complete eLearning (role discontinued early due to COVID)</p> <p>Staff reminded to complete QOVPRAO by CNC every shift huddle and prompt agency staff to complete, who did not do eLearning</p> | <p>Involve executive boards</p> <p>Use mass media</p> <p>Use advisory boards and workgroups</p> <p>Mandate change</p> <p>Change record systems</p> <p>Develop educational materials</p> <p>Conduct ongoing training</p> <p>Distribute educational materials (40)</p> <p>Develop educational materials (38)</p> <p>Make training dynamic (39)</p> <p>Identify and prepare champions</p> <p>Remind clinicians</p> |

| First Author (Year)  | Intervention   | Implementation strategies  | ERIC Strategy  |
|----------------------|--|--|--|
|                      |  | <p>Staff emailed monthly e-newsletters to communicate impacts of the QOVPRAO, e.g. screening adherence, OV incidents, and e-learning adherence</p> <p>Activities for sustainment - collaboration to extend beyond study site.<br/>Evaluation of effectiveness and education transferable</p>   | <p>Facilitate relay of clinical data to providers</p> <p>Capture and share local knowledge</p>   |
| Coombs et al. (2021) | NSW Agency for Clinical Innovation model of care for acute low back pain | <p>Working group to oversee implementation at each ED</p> <p>Approval of administration heads and clinical leads of all EDS, and formalised partnership between academic institutions and the health district.</p> <p>Identified sites for participation through presentation baseline data on practice, site included where local clinicians considered active implementation would benefit quality improvement.</p> <p>Map the workflow to identify practices that require modification or change for the implementation, identify barriers.</p> <p>Design intervention adapted to the local model of care in consultation with local stakeholders to address barriers and facilitate adoption of the new model</p> <p>Education seminars -a mini-lecture and interactive group discussions lasting for 30 to 60 minutes, during four-week implementation phase.</p> <p>Educational materials included hard copy of the model of care; imaging guidelines; posters highlight key messages ACI model of care, website incorporating all materials</p> <p>Emergency quick reference sheet for staff lanyards</p> <p>Patient handout- to educate patients (six languages)</p> <p>Provision of non-opioid pain management strategies, staff instructed to inform patients treatment in line with model of care</p> | <p>Recruit, designate, and train for leadership</p> <p>Build a coalition<br/>Develop academic partnerships</p> <p>Conduct local consensus discussions</p> <p>Assess for readiness and identify barriers and facilitators</p> <p>Promote adaptability</p> <p>Conduct educational meetings</p> <p>Develop educational materials<br/>Distribute educational materials</p> <p>Remind clinicians</p> <p>Prepare patients/consumers to be active participants</p> <p>Change physical structure and equipment<br/>Involve patients/consumers and family members</p> |

| First Author (Year)       | Intervention                       | Implementation strategies  | ERIC Strategy   |
|---------------------------|------------------------------------|--|---|
|                           |                                    | <p>Fast-track referral to outpatient services- clinics agreed to prioritise follow-up. Staff educated on referral process as part of education.</p> <p>Audit and Feedback on outcomes presented during seminars and monthly email newsletters</p> <p>Develop dashboard to audit health outcomes with data extracted from electronic health record</p>  | <p>Develop stakeholder interrelationships*</p> <p>Audit and provide feedback</p> <p>Develop and implement tools for quality monitoring</p>  |
| Kate Curtis et al. (2021) | Consolidated Checklist             | <p>Stakeholder engagement- in design and testing</p> <p>Implemented - adapted -reimplemented</p> <p>Face to face education, bedside and classroom</p> <p>Clinical champions- trained to model</p> <p>Combination of instruments into single tool in electronic record</p> <p>Visual cue completion a "stethoscope" icon displayed on the ED tracking screen</p>  | <p>Build a coalition</p> <p>Purposely reexamine the implementation</p> <p>Conduct educational meetings</p> <p>Identify and prepare champions</p> <p>Change record systems</p> <p>Remind clinicians</p>  |
| K. Curtis et al. (2021)   | HIRAID Emergency Nursing Framework | <p>Identified barriers and enablers to intervention</p> <p>Training - train the trainer model</p> <p>Education - development and completion eLearning (compulsory); half day face-to-face workshop. Integrated into orientation and ED training programs</p> <p>Workplace cues: Posters and reference cards</p> <p>Mandated quarterly documentation audits as part of hospital governance</p> <p>HIRAID video – inform about the framework and include senior leadership</p> | <p>Assess for readiness and identify barriers and facilitators</p> <p>Use train-the-trainer strategies</p> <p>Develop educational materials</p> <p>Conduct educational meetings</p> <p>Conduct ongoing training</p> <p>Make training dynamic</p> <p>Remind clinicians</p> <p>Develop and organize quality monitoring systems</p> <p>Develop educational materials</p> |

| First Author (Year)      | Intervention            | Implementation strategies  | ERIC Strategy   |
|--------------------------|-------------------------|--|---|
|                          |                         | HIRAID documentation templates, mandated use   | Inform local opinion leaders<br>Change record systems<br>Mandate change   |
| Doherty and Jones (2006) | Asthma clinical pathway | Identify evidence practice gap and areas of guideline to address- i.e where practice deviated from evidence-based recommendations<br><br>Identify barriers to change at individual level (doctor, nurse, patient), ED team or organisation<br><br>Create guideline in usable format, with check box for completion. Variations to guideline could be recommended based on the local context<br><br>Guideline placed in medical record as reminder<br><br>Site visits to each study hospital to talk to nursing staff and medical staff and Senior nurses at each site were encouraged to remind staff to use- communicated with lead author to support implementation<br><br>Education medical and nursing staff - focusing on barriers to change, evidence for asthma management and the guideline itself<br><br>Prewritten material for medical staff two draft papers related to evidence-based medicine<br><br>Audit and feedback- low frequency due to low presentation | Conduct local needs assessment<br><br>Assess for readiness and identify barriers and facilitators<br><br>Distribute educational materials<br>Promote adaptability<br>Remind clinicians<br><br>Remind clinicians<br><br>Conduct educational meetings<br><br>Distribute educational materials<br><br>Audit and provide feedback |
| Doherty et al. (2007)    | Asthma clinical pathway | An Implementation team.<br><br>Use Local opinion leaders<br><br>Identify barriers to change at individual level (doctor, nurse, patient), ED team or organisation<br><br>Reformat of the National Asthma Council (NAC) guidelines into a simple, usable format- added to medical record at triage  | Develop stakeholder interrelationships*<br><br>Inform local opinion leaders<br><br>Assess for readiness and identify barriers and facilitators<br><br>Develop educational materials   |

| First Author (Year)    | Intervention                       | Implementation strategies   | ERIC Strategy   |
|------------------------|------------------------------------|---|---|
|                        |                                    | <p>Reminders by placing guideline in notes, during the education sessions and senior staff encourage use, notices in the ED</p> <p>Audit and feedback - aggregate data, monthly report left for staff in tearoom</p> <p>Education sessions, coincide with routine department teaching, informal updates. Nursing education, each weekday afternoon during handover prior to implementation.</p>   | <p>Remind clinicians</p> <p>Audit and provide feedback</p> <p>Conduct educational meetings</p>  |
| Hoffmann et al. (2023) | Agitation Care Pathway             | <p>Multidisciplinary QI team- map current process; establish aims and identify barriers. Review of current evidence to inform intervention for implementation</p> <p>Agitation Care Pathway: Printed version placed with restraints and electronic version included with care pathways for easy access</p> <p>Agitation Order Set - updated to include medication for agitation and restraints</p> <p>All medication included in the pathway made available in ED, accessible without pharmacy approval.</p> <p>Education - medical/ nursing in meetings and via email to inform agitation care pathway and order set</p> <p>Pathway updated during implementation to include child life activity carts and recommend consulting child life to provide coping strategies to prevent agitation</p> <p>Inclusion of psychiatry team instead of social worker as intermediary</p> <p>Personalized de-escalation plans with patient specific triggers, involved family. ED staff difficult to access, therefore, adaptation to embed in EHR improved access- modifiable by ED</p> | <p>Build a coalition</p> <p>Conduct local needs assessment</p> <p>Assess for readiness and identify barriers and facilitators</p> <p>Distribute educational materials</p> <p>Change record systems</p> <p>Change physical structure and equipment</p> <p>Conduct educational meetings</p> <p>Distribute educational material</p> <p>Tailor strategies</p> <p>Change physical structure and equipment</p> <p>Provide local technical assistance</p> <p>Involve patients/consumers and family members</p> <p>Change record systems_</p> |
| Kennedy et al. (2025)  | HIRAID emergency nursing framework | <p>Train-the-trainer - staff from facilities trained as instructors assisted in education delivery and onsite support</p> <p>Education program, eLearning and face to face education</p>  | <p>Use train-the-trainer strategies</p> <p>Identify and prepare champions</p> <p>Conduct educational meetings</p> <p>Make training dynamic</p>  |

| First Author (Year)   | Intervention                            | Implementation strategies  | ERIC Strategy  |
|-----------------------|---|--|--|
|                       |   | <p>Documentation template -- preformatted templates in the electronic health record aligned with nursing framework, enable free text input from nurses</p> <p>Audit and feedback</p> <p>Staff incentives</p> <p>Executive support</p> <p>Communication district-wide</p>   | <p>Change record systems</p> <p>Audit and provide feedback</p> <p>Alter incentive/allowance structures</p> <p>Develop stakeholder interrelationships*</p> <p>Use mass media</p>  |
| Kinsman et al. (2012) | Clinical Pathway STEMI                  | <p>Engaging clinicians- discussion to identify barriers</p> <p>Clinical pathway based on National Heart Foundation Guidelines developed in consultation with clinicians, hospital-specific based on NHFA guidelines</p> <p>Education session during implementation related to evidence underpinning clinical pathway</p> <p>Reminded of the intervention through site visits by study investigator, and research assistant ongoing reminder to medical and nursing staff about clinical pathway.</p> <p>Performance audited with results communicated to ED clinicians once during project</p> | <p>Assess for readiness and identify barriers and facilitators</p> <p>Distribute educational materials#</p> <p>Tailor strategies</p> <p>Conduct educational meetings</p> <p>Remind clinicians</p> <p>Audit and provide feedback</p>  |
| Kramer et al. (2024)  | Nurse initiated dexamethasone in asthma | <p>Multidisciplinary quality improvement team (physicians/nurses/respiratory therapists/informaticists/pharmacists)</p> <p>ED QI team identified key drivers and causes of delays. Periodically updated throughout the project</p> <p>Modification existing order set for nurses to integrated dexamethasone for nurses to order. Established to make dose orders easier to administer</p> <p>Electronic medical record modification to prompt asthma scoring and usage of order set for relevant chief complaints.</p>  | <p>Build a coalition</p> <p>Use an implementation advisor</p> <p>Assess for readiness and identify barriers and facilitators</p> <p>Purposely reexamine the implementation</p> <p>Revise professional roles</p> <p>Change record systems#</p> <p>Change record systems#</p> <p>Remind clinicians</p> |

| First Author (Year)    | Intervention                    | Implementation strategies  | ERIC Strategy  |
|------------------------|---------------------------------|--|--|
|                        |                                 | <p>Education to nurses via staff meetings, posters illustrate dexamethasone priority. Lead physician attended meetings to encourage use and feedback.</p> <p>ED physicians educated on the project</p> <p>Appropriate drug strength made available along with necessary supplies to administer</p>   | <p>Conduct educational meetings</p> <p>Distribute educational materials</p> <p>Remind clinicians</p> <p>Inform local opinion leaders</p> <p>Change physical structure and equipment</p>  |
| Lawrence et al. (2024) | Brøset Violence Checklist (BVC) | <p>Develop implementation team- nurses all facilities and behavioural health units, collaboration with necessary disciplines e.g. security, informatics, QI.</p> <p>Implementation team members all previously completed implementation science training. QI expert assisted with process mapping.</p> <p>Survey ED nurses to assess determinants using the Tailored Implementation for Chronic Diseases (TCID) Framework</p> <p>BVC with automatic scoring, with list interventions for nurses, integrated into EHR</p> <p>Nurses previously used BVC encouraged others to serve as leaders, promote the intervention and assist with education, and provide feedback to the implementation science team from frontline</p> <p>Educational program: five-minute brief introduction for unit-based meetings, video montage from ED colleagues affected by workplace violence, one page resource distributed, online BVC training module for ED nurses. All new employees trained</p> <p>Develop guideline for BVC use, including roles and responsibilities. Added to hospital guidelines.</p> <p>Champions recruited from ED clinical staff to train and coach to ED staff, share updates during huddles, and act as a resource for implementation in ED.</p> | <p>Organize clinician implementation team meetings</p> <p>Use an implementation advisor</p> <p>Assess for readiness and identify barriers and facilitators</p> <p>Change record systems#</p> <p>Identify early adopters</p> <p>Develop educational materials</p> <p>Distribute educational materials</p> <p>Conduct ongoing training</p> <p>Make training dynamic</p> <p>Distribute educational materials#</p> <p>Identify and prepare champions</p> |

| First Author (Year)  | Intervention                       | Implementation strategies   | ERIC Strategy   |
|----------------------|------------------------------------|---|---|
|                      |                                    | <p>ED unit councils attended by implementation team members before and after implementation, to educate, answer questions, receive feedback. Collaborated with range of committees to support implementation.</p> <p>Monitor BVC usage including completion rates and timeliness of use feedback to staff. Built in HER for automated reports after commencing.</p>   | <p>Use advisory boards and workgroups</p> <p>Audit and provide feedback</p>   |
| Munroe et al. (2022) | HIRAID emergency nursing framework | <p>Implementation plan guided by BCW</p> <p>Structured electronic documentation template</p> <p>Education workshops using train the trainer model and eLearning module</p> <p>Documentation audit and feedback</p> <p>Posters and reference cards</p> <p>Video demonstrating key-stakeholder engagement and clinical champions</p>  | <p>Develop a formal implementation blueprint</p> <p>Change record systems</p> <p>Use train-the-trainer strategies</p> <p>Conduct educational meetings</p> <p>Make training dynamic</p> <p>Audit and provide feedback</p> <p>Remind clinicians</p> <p>Identify and prepare champions</p> <p>Inform local opinion leaders</p> |
| Peters et al. (2022) | Lower Back Pain (LBP) Protocol     | <p>Multidisciplinary spine working group - physical medicine, rehabilitation, neurosurgeon, orthopaedic surgeon, physiotherapist, care delivery manager.</p> <p>Adjustments made to implementation based on evaluation.</p> <p>Multidisciplinary group identified barriers and facilitators to implementing protocol.</p> <p>Protocol placed on intranet for easy access</p> <p>Face to face interactive educational sessions to physicians and ED nurses. Delivered 2012-2014 and repeat 2018.</p> | <p>Use advisory boards and workgroups</p> <p>Purposely reexamine the implementation</p> <p>Assess for readiness and identify barriers and facilitators</p> <p>Distribute educational materials#</p> <p>Develop educational materials</p> <p>Conduct educational meetings</p> <p>Conduct ongoing training</p>                |

| First Author (Year)             | Intervention    | Implementation strategies   | ERIC Strategy  |
|---------------------------------|-----------------|---|--|
|                                 |                 | <p>eLearning replaced face to face, short presentation with an overview of the intervention and rationale- compulsory prerequisite for ED rotation</p> <p>Poster describing intervention targeting medical staff.</p> <p>Variety of patient information brochures to explain management, lower back pain and radicular pain.</p> <p>GP symposium to present the protocol and rationale, information also mailed</p> <p>Template referral to GPs for patients with</p> <p>Ongoing monitoring and evaluation with x-ray and CT indicators auto report- Feedback to ED via Multidisciplinary Spine Working Group committee.</p> <p>Direct individual feedback early in implementation where deviation from protocol identified in audit of records.</p>  | <p>Remind clinicians</p> <p>Prepare patients/consumers to be active participants</p> <p>Involve patients/consumers and family members#</p> <p>Distribute educational materials</p> <p>Change record systems</p> <p>Audit and provide feedback</p>  |
| Puchalski Ritchie et al. (2022) | Sepsis Protocol | <p>Multidisciplinary group (leadership and frontline clinicians) throughout development, usability testing and implementation.</p> <p>Met to address implementation challenges with team external to study site. Adjustments made to implementation.</p> <p>Practice gap identified and barriers and facilitators to practice (previous study), informed implementation plan development</p> <p>Adaptation of evidence-based sepsis protocol to meet local context needs, including adaption based on local antibiotic availability and resistance.</p> <p>Regular educational sessions delivered during physician and nursing meetings, included a didactic session about the project, followed by an opportunity for questions and discussion (4 weeks)</p> <p>A short power-point presentation was developed and presented at regular orientation sessions, due to high staff turnover</p> | <p>Use an implementation advisor</p> <p>Use advisory boards and workgroups</p> <p>Purposely reexamine the implementation</p> <p>Conduct local needs assessment</p> <p>Assess for readiness and identify barriers and facilitators</p> <p>Develop a formal implementation blueprint</p> <p>Distribute educational materials#</p> <p>Tailor strategies</p> <p>Conduct educational meetings</p> <p>Conduct ongoing training</p> |

| First Author (Year)       | Intervention               | Implementation strategies  | ERIC Strategy   |
|---------------------------|----------------------------|--|---|
|                           |                            | <p>ED and opinion leaders involvement in education and ad hoc meetings to encourage use</p> <p>Hard copy reminder tools three types, to address poor internet. Include different posters at triage and resuscitation/ acute area, and laminated pocket cards.</p> <p>Triage trigger to identify patients, flag placed on note at triage, modified during implementation to have nurse take directly to physician</p>   | <p>Inform local opinion leaders</p> <p>Remind clinicians</p> <p>Revise professional roles</p>   |
| <p>Southerland (2023)</p> | <p>Geriatric screening</p> | <p>Implementation support from geriatric ED team: physicians, nurse manager, nurse educator, ED resident, champions, physio.</p> <p>Initial barriers and additional throughout implementation using CFIR</p> <p>Assessments built into hospital record systems – digital dashboard</p> <p>Digital dashboard provided visibility on completeness of assessments</p> <p>Geriatric screening results pulled into ED physician notes- prompt request if not completed</p> <p>Education initial formal nursing session part or onboarding and annual training, emails with tips from end users. Medical education through various face-to-face and email. Adapted to outreach with regular on shift rapid education</p> <p>Staff champions identified – nurses across different shifts</p> <p>Staff completing assessment recognised via email and tips shared with others.</p> <p>Implementation strategies assessed and adaptation made, focus on underperforming areas that manage older adults</p> <p>Individual reports to nurses/ physicians initially, adaptation to aggregate feedback on performance. Changed again when workforce demand reduced.</p> <p>Nurses chose their prices, incentives, and stretch goals</p> | <p>Use advisory boards and workgroups</p> <p>Assess for readiness and identify barriers and facilitators</p> <p>Change record systems#</p> <p>Remind clinicians</p> <p>Increase demand</p> <p>Conduct educational meetings</p> <p>Conduct educational outreach visits</p> <p>Make training dynamic</p> <p>Identify and prepare champions</p> <p>Identify early adopters</p> <p>Purposely reexamine the implementation</p> <p>Promote adaptability</p> <p>Audit and provide feedback</p> <p>Alter incentive/allowance structures</p> |

| First Author (Year)  | Intervention          | Implementation strategies  | ERIC Strategy  |
|----------------------|-----------------------|--|--|
|                      |                       | <p>Local assessment to identify needs to complete screening- additional equipment needs identified and supplied</p> <p>Engage senior staff – understand the alignment of practice with standards</p> <p>Senior staff and management involvement in shift huddles to promote practice</p> <p>National guard unit to assist with COVID workload- not responsible for completing screening</p> <p>Pause implementation due to workload, support clinicians</p>                        | <p>Change physical structure and equipment</p> <p>Inform local opinion leaders</p> <p>Involve executive boards</p> <p>Create new clinical teams</p> <p>Support clinicians*</p>   |
| Stiell et al. (2009) | Canadian C-spine rule | <p>Consultation with experts on knowledge transfer</p> <p>Policy for c-spine imaging consulted with ED physicians, who agreed to order per policy to be implemented</p> <p>Variety of educational initiatives: 1 hr teaching session, published evidence distributed, pocket cards with rule, poster depictions of the rule</p> <p>Mandatory reminder of rule at the point of imaging requisition, doctor required to check rule criteria or document the reason for deviation</p> | <p>Use an implementation advisor</p> <p>Involve patients/consumers and family members#</p> <p>Distribute educational materials#</p> <p>Conduct educational meetings</p> <p>Remind clinicians</p> <p>Change record systems#</p> |
| Stiell et al. (2010) | Canadian CT Head Rule | <p>Consultation with experts on knowledge transfer</p> <p>Physician groups in ED discussed the goal of the rule and agreed to order CT according to the decision rule</p> <p>Education strategies: papers CT Head rule and validation results circulated, one hour teaching session, pocket cards and posters</p>  | <p>Use an implementation advisor</p> <p>Involve patients/consumers and family members#</p> <p>Distribute educational materials</p> <p>Conduct educational meetings</p>   |

| First Author (Year)  | Intervention   | Implementation strategies   | ERIC Strategy  |
|----------------------|--|---|--|
|                      |  | Real time reminder of the rule at the point of requisition for CT scans   | Remind clinicians<br>Change record systems#  |
| Stiell et al. (2021) | CAEP Acute Atrial Fibrillation and flutter Best Practices Checklist.       | <p>Assistance from knowledge implementation experts to inform implementation strategy. Identify behaviour change techniques and strategies suited to barriers and enablers identified through interviews.</p> <p>Physician champions from ED and cardiology, also used to remind clinicians</p> <p>Engage local physician groups to discuss study aims and potential barriers/enablers</p> <p>Education provided to physicians and nurses about the CAEP Checklist via presentations at rounds and staff meetings, e-mails, online video, and web-based teaching resources.</p> <p>Local action plans for sites- address local barriers</p> <p>Smartphone application in English and French- decision support tool and CAEP checklist</p> <p>Site compliance provided (frequency not specified)</p> | <p>Use an implementation advisor<br/>Assess for readiness and identify barriers and facilitators</p> <p>Identify and prepare champions<br/>Remind clinicians</p> <p>Develop stakeholder interrelationships*</p> <p>Conduct educational meetings<br/>Make training dynamic</p> <p>Tailor strategies<br/>Distribute educational materials#</p> <p>Audit and provide feedback</p> |
| Stiell et al. (2024) | CAEP Acute Atrial Fibrillation and Atrial Flutter Best Practices Checklist | <p>Surveys to identify barriers and enablers to plan strategy</p> <p>Physician champions from ED and cardiology</p> <p>Discussion of the goals of the study with the local physician groups</p> <p>Action plan to address local barriers to implementation</p>  | <p>Assess for readiness and identify barriers and facilitators</p> <p>Identify and prepare champions</p> <p>Develop stakeholder interrelationships*</p> <p>Tailor strategies</p>   |

| First Author (Year)    | Intervention            | Implementation strategies  | ERIC Strategy  |
|------------------------|-------------------------|--|--|
|                        |                         | <p>Introduction of the CAEP checklist to physicians and nurses through presentations at staff meetings, emails, and online video</p> <p>Communicating about referral process via email, social media, face -to-face interaction</p> <p>Smartphone application with guideline</p> <p>Regular reminders</p>  | <p>Conduct educational meetings</p> <p>Make training dynamic</p> <p>Use mass media</p> <p>Distribute educational materials (b)</p> <p>Remind clinicians</p>  |
| Williams et al. (2025) | Kids pain collaborative | <p>Multilevel facilitation model, external facilitators, experience facilitator (embedded researcher), internal facilitators (ED clinicians funded role), Champions (ED clinicians in substantive role)</p> <p>Communication to reach all clinicians about the pain care through wide range point of care opportunities and existing forums (orientation, clinical workshops), impromptu face to face sessions.</p> <p>Electronic and printed communication including ED newsletter, community announcement board, hard copy flyers, personal emails and large posters in staff and patient areas.</p> <p>Family engagement with posters that encourage families notify staff when a child had pain</p> <p>Policy governing nurse-initiated analgesia to facilitate autonomous practice and approval for nurse practice embedded in the nurse education pathway.</p> <p>Evidence based guideline to support decision making on analgesia type</p> <p>Purpose built dashboard provide immediate feedback analgesia administration times, nurse-initiated analgesia and pain assessment.</p> <p>Pain indicator performance data shared with clinicians enable reflection on practice and acknowledge success</p> | <p>Facilitation</p> <p>Develop academic partnerships</p> <p>Identify and prepare champions</p> <p>Conduct educational meetings</p> <p>Use mass media</p> <p>Prepare patients/consumers to be active participants</p> <p>Distribute educational materials#</p> <p>Revise professional roles</p> <p>Distribute educational materials#</p> <p>Develop and implement tools for quality monitoring</p> <p>Remind Clinicians</p> <p>Audit and provide feedback</p> |

| First Author (Year) | Intervention | Implementation strategies   | ERIC Strategy  |
|---------------------|--------------|---|--|
|                     |              | <p>Acknowledge clinicians doing well, share successful experiences/ strategies to involve families</p> <p>Workshops examining family engagement, incorporate videos of ED staff reading experience expressed by parents of child pain management.</p> <p>Further workshops to wider clinician group, facilitated by attendees of initial workshop.</p> <p>Presentation to ED senior medical staff for engagement and support of NIA</p> | <p>Capture and share local knowledge</p> <p>Conduct educational meetings</p> <p>Make training dynamic</p> <p>Obtain and use patients/consumers and family feedback</p> <p>Inform local opinion leaders</p> |

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## Appendix 5: Ethics and Governance Approval

### Ethics Approval

**Subject:** 2020/ETH02164: Application HREA - Approved  
**Date:** Tuesday, 20 October 2020 8:43:34 AM

---

Date of Decision Notification: 20 Oct 2020

  
Thank you for submitting the following Human Research Ethics Application (HREA) for HREC review;

2020/ETH02164: Evaluation of an evidence-informed emergency nursing framework (HIRAID) in Southern NSW Local Health District

This Application was reviewed as a Greater than low risk review pathway and was initially considered by the Greater Western Human Research Ethics Committee at its meeting held on 2 September 2020

The project was determined to meet the requirements of the National Statement on Ethical Conduct in Human Research (2007) and was APPROVED.

This email constitutes ethical and scientific approval only.

This project cannot proceed at any site until separate research governance authorisation has been obtained from the Institution at which the research will take place.

- This project has been Approved to be conducted at the following site:
- Southern NSW Local Health District

The following documentation was reviewed and is included in this approval:

- Application Attachment, HIRAID\_NSW Ministry Health Privacy Questions.pdf
- Other, Please specify, Ethics cover letter-1-16-Oct-2020
- Other, Please specify, Appendix 9\_ Interview script patient\_carer-1-12-Aug-2020
- Questionnaire, Appendix 8\_ Patient\_carer experience-1-12-Aug-2020
- Questionnaire, Appendix 7\_ Rapid response review-1-17-Aug-2020
- Questionnaire, Appendix 6\_ Documentaion template-2-25-Sep-2020
- Other, Please specify, Appendix 5: eMR\_Firstnet variables-1-15-Aug-2020
- Other, Please specify, Appendix 4: Implementation log-1-10-Aug-2020
- Questionnaire, Appendix 3: Implementation Fidelity-1-10-Aug-2020
- Application Attachment, Partner Letter APP2005403\_SNSWLHD
- Other, Please specify, Appendix 2\_ HIRAID documentation template-1-10-Aug-2020
- Participant Information Sheet, Appendix 15\_Implementation participant information-1-30-Jul-2020
- Participant Information Sheet, Appendix 14\_Medical staff participant information-2-25-Sep-2020

- o Participant Information Sheet, Appendix 13\_Nursing staff participant information-2-25-Sep-2020
- o Participant Information Sheet/s, Appendix 12\_Patient\_carer participant information and consent-2-25-Sep-2020
- o Questionnaire, Appendix 11\_ Medical staff survey-1-14-Aug-2020
- o Questionnaire, Appendix 10\_ Nursing staff survey-2-25-Sep-2020
- o Application Attachment, Appendix 1: Behaviour change principle
- o Other, Please specify, Appendix 1 Behaviour change principles implementation -1-12-Aug-2020
- o Study Protocol, 1. Protocol\_HIRAIID\_SNSWLHD\_v2\_16Oct20.pdf
- o Other, Please specify, Appendix 16\_ Privacy and Confidentiality agreement-1-26-Jul-2020
- o Study Protocol, Study protocol\_tracked-2-16-Oct-2020

[Application Documents](#) - (link will only be active for 14 days from the decision date. The approved documents are also available to download from forms section of this project in REGIS)

The Human Research Ethics Application reviewed by the HREC was:

Version: 1.02

Date: 19 Oct 2020

The approval is for a period of 5 years from the date of this e-mail (20 Oct 2020)

The Coordinating Principal Investigator will:

- provide the HREC with an annual report and the final report when the project is completed at all sites. This will be through the submission of a milestone in REGIS.
- immediately report anything that might warrant review of ethical approval of the project.
- submit proposed amendments to the research protocol, including; the general conduct of the research, changes to CPI or site PI, an extension to HREC approval, or the addition of sites to the HREC before those changes can take effect. This will be through a notification of an amendment in REGIS
- will notify the HREC if the project is discontinued at a participating site before the expected completion date, with reasons provided.

Submission of annual progress/final reports (milestone), amendments and safety reports should be done through the forms provided in REGIS. Guidance on these processes can be found on the [REGIS website](#).

It is noted that the Greater Western Human Research Ethics Committee is constituted in accordance with the National Statement on Human Conduct in Research, 2007 (NHMRC).

Please contact us if you would like to discuss any aspects of this process further, as per the contact details below. We look forward to managing this study with you throughout the project lifecycle.

Regards,



Manager, Research Ethics and Governance | Allied Health and Innovation  
Research Governance Officer

## Governance Approval

**Subject:** 2020/STE03695: SSA - Authorised  
**Date:** Tuesday, 3 November 2020 2:28:30 PM

---

Date of Decision Notification: 03 Nov 2020  
Greater than low risk review pathway

  
Thank you for submitting the following Site Specific Assessment (SSA) for governance review;

2020/STE03695: Evaluation of an evidence-informed emergency nursing framework (HIRAID) in Southern NSW Local Health District

The Application has been reviewed by the Chief Executive/Delegate who has determined the application has been **AUTHORISED** to begin at this site:  
Southern New South Wales Local Health District - site

The following documentation is included in this authorisation:

- Ethics application (HREA or other), 2020/ETH02164
- Participant Information Sheet, Appendix 12\_clean-2-25-SEP-2020
- Participant Information Sheet, Appendix 12\_tracked-2-25-SEP-2020
- Participant Information Sheet, Appendix 13\_clean-2-25-SEP-2020
- Participant Information Sheet, Appendix 13\_tracked-2-25-SEP-2020
- Participant Information Sheet, Appendix 14\_clean-1-10-AUG-2020
- Participant Information Sheet, Appendix 14\_tracked-1-10-AUG-2020
- Other, Please specify, Appendix 9\_clean-1-12-AUG-2020
- Other, Please specify, Appendix 9\_tracked-1-12-AUG-2020
- More Information Required, More Information Required
- More Information Required, More Information Required
- Budget - Site Study, Partnership letter-1-07-JUL-2020
- Application, SSA

[Application Documents](#) (Please note : Due to security reasons, this link will only be active for 14 days. The approved documents are also available to download from forms section of this project in REGIS)

The Site Specific Assessment reviewed/authorised is:

Version: 1.00

Date: 21 Oct 2020

Site authorisation with cease on the date of HREA expiry 19/10/2025.

The Principal Investigator will:

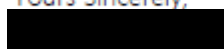
- Proposed amendments to the research protocol or conduct of the research which may affect the ethical acceptability of the project, and which are submitted to the lead HREC for review, are provided to the office through REGIS.

- Proposed amendments to the research protocol or conduct of the research which may affect the ongoing site acceptability of the project, are to be submitted to this office, via REGIS.
- The appropriate documentation must be submitted for authorisation before any external researcher is authorised to conduct research procedures at this site.

We wish you all the best with the study and remind you that any changes to the application and safety reports will need to be submitted via REGIS and acknowledged prior to implementation.

Please contact us if you would like to discuss any aspects of this process further, as per the contact details below.

Yours Sincerely,



Nurse Manager & Research Governance Officer |  
Nursing and Midwifery Directorate and Clinical Governance Unit  
Southern NSW LHD

# Appendix 6: Nursing Participant Information Sheet



Susan Wakil School of Nursing and Midwifery  
Faculty of Medicine and Health



ABN 15 211 513 464

Kate Curtis  
*Professor of Trauma and Emergency Nursing*

Room A5.19, MO2  
The University of Sydney  
NSW 2006 AUSTRALIA  
Telephone: +61 2 9351 0604  
Email: [kate.curtis@sydney.edu.au](mailto:kate.curtis@sydney.edu.au)  
Web: <http://www.sydney.edu.au/>

Implementation and evaluation of an evidence-informed emergency nursing framework in  
clinical practice (HIRAID) in Southern NSW Local Health District

## NURSING STAFF PARTICIPANT INFORMATION STATEMENT

### (1) What is this study about?

You are invited to take part in a research study evaluating the implementation of the HIRAID (History, Identify Red flags, Assessment, Interventions, Diagnostics, communication and reassessment) nursing assessment framework. HIRAID is the only validated framework designed to teach emergency nurses how to systematically assess and manage emergency patients after the triage process.

You have been invited to participate in this study because you are permanently employed registered Nurse working within the Emergency Department/ Multipurpose Facility in Southern NSW LHD. This Participant Information Statement tells you about the research study. Knowing what is involved will help you decide if you want to take part in the research. Please read this sheet carefully and ask questions about anything that you don't understand or want to know more about.

Participation in this research study is voluntary.

By giving your consent to take part in this study you are telling us that you:

- ✓ Understand what you have read.
- ✓ Agree to take part in the research study as outlined below.
- ✓ Agree to the use of your personal information as described.

You will be given a copy of this Participant Information Statement to keep.

### (2) Who is running the study?

The study is being carried out by the following researchers: Professor Kate Curtis<sup>1,2</sup>, Ms Louise Casey<sup>3</sup>, Ms Joanne Dungey<sup>3</sup>, Ms Vivienne Chapman<sup>3</sup>, Dr Mary Lam<sup>1</sup>, Ms Belinda Kennedy<sup>1</sup>.

<sup>1</sup>Susan Wakil School of Nursing and Midwifery, University of Sydney, <sup>2</sup>Illawarra Shoalhaven Local Health District, <sup>3</sup>Southern NSW Local Health District

This study is being funded by Southern NSW Local Health District and the Thyne Reid Foundation.

### (3) What will the study involve for me?

The study involves you completing an online survey prior to the implementation of the HIRAID framework and/or post implementation. Online surveys will be completed in REDCap (Research Electronic Data Capture) (<https://catalyst.harvard.edu/services/redcap/>), a secure web-based application for data management and survey tool managed by The University of Sydney. Surveys can be completed at a time convenient to you, with the survey link available for a period of three weeks from the time it is received.

The survey will have a number of components that you will be asked to complete, including individual characteristics, satisfaction with communication, self- efficacy, the practice environment and data related to the barriers and facilitators of HIRAID implementation.

- **Participant Characteristics:** we will collect details from you related to your age, place of work and level of experience.
- **Satisfaction with communication:** you will be asked to complete 13 items, with eight answered on an 11-point Likert scale, from not at all satisfied to completely satisfied, and the remaining a yes/no response, related to the quality of information received during clinical handover.
- **Self-efficacy in patient assessment:** you will be asked to complete 15 items on an 11 point Likert scale, from no confidence to complete confidence, to assess your self-efficacy (confidence), in assessment and management of patients presenting to the emergency department or multipurpose facility. For example, *"I am confident that I am able to identify and perform appropriate nursing interventions"*.
- **Work environment:** you are asked to complete the Practice Environment Scale of Nursing Workforce Index (PES-NWI). This survey will look at the work environment in which you practice and asks you to rate each of the 28 items on a 4-point Likert scale, from strongly disagree to strongly agree. The survey includes items such as, *"Doctors and nurses have good working relationships"* or *"Administration listens and responds to nursing concerns"*.
- **Behavioural diagnostics:** this survey will only be completed as part of the first survey prior to implementation of HIRAID. There are five short questions for you to select responses for a select group of answers. This will seek your opinion on different components that are recognised to hinder the implementation of new practice in your workplace. Your responses will inform the strategies used to implement HIRAID in your workplace.

You will be asked to create your own unique identifier, this will mean your survey responses cannot be identified by the research team. The identifier you create will be used for the purposes of linking survey responses pre and post implementation of HIRAID, this will enable researchers to evaluate whether the implementation of HIRAID results in change for those using the framework.

You will be required to acknowledge that you have read and understood the participant information prior to commencing the first survey. Completion of the survey will be deemed to be consent to participate. If you agree to participate in the study, you can access an electronic survey via the link sent to you via email with the study information.

### (4) How much of my time will the study take?

You will be invited to participate in two surveys. It is anticipated the surveys will take approximately 15 minutes of your time.

**(5) Who can take part in the study?**

All nursing staff permanently employed in the EDs/ MPS across SNSW LHD, pre and post implementation, will be invited to participate.

**(6) Do I have to be in the study? Can I withdraw from the study once I've started?**

Being in this study is completely voluntary and you do not have to take part. Your decision whether to participate will not affect your current or future relationship with the researchers or anyone else at the University of Sydney, your employment in the Southern NSW Local Health District, your relationship with your managers or other members of staff within your team. Given the study is anonymous, no one will know whether you choose to participate.

Submitting your completed questionnaire is an indication of your consent to participate in the study. You can withdraw your responses any time before you have submitted the questionnaire. If you decide to withdraw from the study, after completing the first survey you can do this by contacting Belinda Kennedy, [Belinda.kennedy@sydney.edu.au](mailto:Belinda.kennedy@sydney.edu.au). In order to withdraw you will need to provide the researchers with the identifier you created at the time of completing the survey. Your response cannot be withdrawn if you are not able to provide these details as researchers cannot identify individual responses.

**(7) Are there any risks or costs associated with being in the study?**

Aside from giving up your time, we do not expect that there will be any risks or costs associated with taking part in this study.

**(8) Are there any benefits associated with being in the study?**

As recognition for your time to complete the survey you will be provided with a \$20 gift voucher. On completion of the survey, you will have the opportunity to provide your details so the voucher can be sent to you.

Aside from the above recognition of your time there will be no personal benefit to you. However, we hope the evaluation of the HIRAID framework will improve the experience for nursing and medical staff, as well as patients/ carers in the emergency department.

**(9) Will taking part in this study cost me anything? Will I be paid?**

There will be no cost to you, aside from your time. As recognition for your time to complete the survey you will be provided with a \$20 gift voucher. On completion of the survey, the nurse researcher will ask you for to provide your details so a voucher can be sent to you.

**(10) What will happen to information about me that is collected during the study?**

By providing your consent, you are agreeing to us collecting the information as stated for the purposes of this research study. Your information will only be used for the purposes outlined in this Participant Information Statement.

No personal identifying information will be collected. The data collected for the project is intended to inform the implementation and evaluation of HIRAID in Southern NSW Local Health District.

Only the chief investigator, project manager and statistician will have access to the data collected. Study data will be stored securely at The University of Sydney for a minimum of 5 years, after which they will be destroyed.

## Appendix 7: Phase 1: Nursing Survey Instrument: Enablers and Barriers

*Survey created in REDCap*

### Survey instructions

Thank you for giving your perspective on nursing assessment when caring for patient presenting to the emergency department or multipurpose service.

All nursing staff permanently employed in the ED are invited to participate. If you are still working in the ED in 8 months' time, we will send you a follow up survey.

This survey should take no longer than 15 minutes. There are five sections.\*\*

On completion of the survey, you will have the opportunity to provide your contact details to receive a \$20 gift voucher, as acknowledgement for your time. The details you provide will not be linked to your survey. Your responses remain confidential, and you cannot be identified.

If you have any questions related to this research study, please contact one of the investigators below prior to proceeding.

[site investigator details removed]

*\*\*Two sections relevant to this research, other sections related to broader program of research.*

| #            | Field label  | Variable name    | Field attributes                                 |
|--------------|--|------------------|--|
| 1            | If you have not read the participant information, a copy can be accessed below.          | desc1            | Participant information embedded                 |
| 2            | Please confirm you have read and understood the participant information provided to you. | Consent*         | 1. I have read the participant information sheet |
|              | Thank you. Please continue to the survey.  | desc3            | descriptive                                      |
| Demographics |  |                  |  |
| 3            | Current position   | current_position | 1. RN  |

| # | Field label  | Variable name           | Field attributes   |
|---|--|-------------------------|--|
|   | <i>Select one</i>  |                         | 2. EEN<br>3. Leadership role - NUM / CNC / CNS / CNE<br>4. Other   |
|   | Other<br>Show the field ONLY if: [current_position] = '4'                | current_position_other* | Free text  |
| 4 | How many years have you worked as a nurse?                               | Years*                  | Text (integer, Min: 0, Max: 50), Required  |
| 5 | How many years have you worked as a nurse in the emergency department?   | years_ed*               | Text (integer, Min: 0, Max: 50), Required  |
| 6 | Please tick your highest level of post-graduate nursing qualification.   | Qualification*          | 1. None<br>2. Graduate certificate<br>3. Graduate Diploma<br>4. Masters<br>5. Other  |
|   | Other<br>Show the field ONLY if: [qualification] = '5'                   | qualification_other*    | Free text  |
| 7 | What areas of the ED do you work?<br><i>Select all applicable</i>        | areas_worked*           | 1. General Acute area<br>2. Fast Track<br>3. Paediatrics<br>4. Triage<br>5. Resuscitation room<br>6. Clinical Initiatives Nurse<br>7. Emergency short stay area/unit<br>8. Other |
|   | Other<br>Show the field ONLY if: [areas_worked(8)] = '1'                 | areas_worked_other*     | Text, Required   |
| 8 | Please select the Southern NSW facility that you currently work at most. | Site*                   | 1., Batemans Bay Hospital<br>2. Bega District Hospital<br>3. Bombala Hospital  |

| #                                    | Field label  | Variable name  | Field attributes   |
|--------------------------------------|--|----------------|--|
|                                      |  |                | 4. Braidwood (MPS)<br>5. Cooma Health Service<br>6. Crookwell Hospital<br>8. Goulburn Hospital<br>9. Moruya Hospital<br>10. Pambula District Hospital<br>11. Queanbeyan Health Service<br>12. Yass Health Service                  |
| <b>How do you feel about change?</b> |  |                |  |
| 9                                    | What are the best ways for you to learn about how to do something new?<br><i>Select all that apply</i> | behaq1*        | 1. Face to face education<br>2. Opportunity to ask questions<br>3. Feedback from my manager or educator about how I was performing<br>4. Online learning<br>5. Hands on practice<br>6. Other                                       |
|                                      | Other<br>Show the field ONLY if: [behaq1(6)] = '1'   | behaq1_other*  | Text   |
| 10                                   | Do you think using the same structured approach to assess patients would be beneficial in your ED?     | behaq2*        | 0. No<br>1. Yes<br>2. Unsure   |
| 10a                                  | Why?<br><i>Select all that apply</i><br>Show the field ONLY if: [behaq2] = '0'                         | behaq2b*       | 1. There is no benefit to a standardised process<br>2. A single method will not suit all situation in the ED<br>3. Current practice is adequate<br>4. We all work differently, a single method doesn't suit all nurses<br>5. Other |
|                                      | Other<br>Show the field ONLY if: [behaq2b(5)] = '1'  | behaq1b_other* | Free text  |

| #  | Field label   | Variable name  | Field attributes             |
|----|---|----------------|------------------------------|
| 11 | Southern NSW is planning to implement a structured emergency nursing framework (HIRAID). This means learning and using a new, evidence based way to initially assess and manage your patients. Are you willing to learn and adopt something new? (Don't worry, we can't link your answers with you, so be totally honest) | behaq3*        | 0. No<br>1. Yes<br>2. Unsure |
| 12 | Please indicate if you agree or disagree with the following statements about why you would or wouldn't want to learn and use HIRAID   |                |                              |
|    | Not enough time to change the way of working  | beha3b1*       | 1. Agree<br>2. Disagree      |
|    | I don't have the headspace to learn something new   | beha3b2*       |                              |
|    | Too hard to remember anything new   | beha3b3*       |                              |
|    | It will not change the way I care for my patient  | beha3b4*       |                              |
|    | Unsupported by management   | beha3b5*       |                              |
|    | Nothing with change   | beha3b6*       |                              |
|    | I don't want to learn something new   | beha3b7*       |                              |
|    | The way we do things is fine, no need to changes anything   | beha3b8*       |                              |
|    | I want to do what is best for patient care  | beha3b9*       |                              |
|    | I am worried I won't know what to do  | beha3b10*      |                              |
|    | I don't understand what HIRAID is   | beha3b11*      |                              |
|    | I am worried no one will help me with questions when I try and use it   | beha3b12*      |                              |
| 13 | Please provide any additional reasons not provided above related to why you WOULD be willing to learn something new   | behaq3b_other1 | Free text                    |

| #  | Field label   | Variable name  | Field attributes  |
|----|---|----------------|---|
| 14 | Please provide any additional reasons not provided above related to why you would NOT be willing to learn something new                               | behaq3b_other2 | Free text   |
| 15 | If you had to use HIRAID in your ED, is there anything that would help ensure it is implemented properly so it works?<br><i>Select all that apply</i> | behaq3c*       | <ol style="list-style-type: none"> <li>1. Support in the clinical environment to adjust (people around to answer questions I might have)</li> <li>2. Visual prompts to remind me (posters)</li> <li>3. Opportunity to ask questions</li> <li>4. Feedback from my manager or educator about how I was performing</li> <li>5. A policy</li> <li>6. Knowing that there are consequences if I don't change</li> <li>7. Knowing that change is being monitored</li> <li>8. Knowing that it will improve care for my patients</li> <li>9. Opportunity to be part of the process of change</li> <li>10. Other</li> </ol> |
|    | Other<br>Show the field ONLY if: [behaq3c(10)] = '1'  | behaq5_other*  | Free text   |

\*Responses required to complete the survey

### Survey completion

Thank you for finishing the survey!

The next page will take you to a separate form where you can choose which place would you like your \$20 voucher for. Your responses to this survey are NOT linked to the voucher form. This means your responses will remain confidential and cannot be identified.

If you would like to proceed to claim your \$20 voucher, please click on this link: [link]

If you do not want to receive a \$20 voucher, please select close survey to end this session.

# Appendix 8: HIRAID Information Sheet



## Implementing HIRAID in Southern NSW

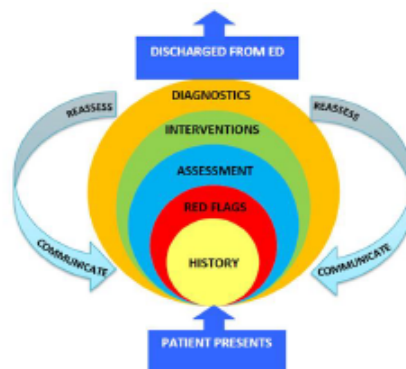
### What is HIRAID?

HIRAID (History, Identify Red flags, Assessment, Interventions, Diagnostics, communication and reassessment) is the only validated framework designed to support emergency nurses in systematic assessment and management of emergency patients after triage.

Emergency nursing is unique. We deliver care to a wide range of clinical presentations with varying degrees of urgency. Patient safety is dependent on our clinical assessment and management.

HIRAID builds on existing assessment frameworks (A-G) by integrating patient history, indicators of urgency, assessment and monitoring, reassessment, and communication. This combines all the elements that are essential in delivery of safe, quality nursing care to patients in the ED.

HIRAID has been successfully piloted with nurses across rural, regional and metropolitan EDs, and is used routinely in Illawarra Shoalhaven and Western East Sydney LHDs.



### What will the introduction of HIRAID mean for me?

All nursing staff will be provided with education related to HIRAID prior to introduction in clinical practice. You will be supported by HIRAID champions (colleagues who have completed train the trainer education) and templates in eMR with prompts reminding you what to do. It is emergency nursing 101, you probably do it all already, this is just providing a consistent structure.

As a part of introducing HIRAID we are participating in a research project to evaluate the impact HIRAID has on staff and patient experience, as well as patient outcomes. Nursing and medical staff will be asked to complete an online survey prior to, and after, the introduction of HIRAID.

### Who can I talk to if I have any questions?

If you have questions about the introduction of HIRAID you can contact any of the following people:

Ms Louise Casey [Louise.Casey1@health.nsw.gov.au](mailto:Louise.Casey1@health.nsw.gov.au)

Emergency CNC contact details included

\*HIRAID image colour scheme was updated during the study.

# Appendix 9: HIRAID® Champion (Instructor) Instructions

## HIRAID champion instructions

Thanks for agreeing to be a HIRAID champion!

### What is HIRAID?

- A structured approach to the emergency nursing assessment of patients post triage
- It comprises of 8 critical components: History, Infection risk, Red flags, Assessments, Interventions, Diagnostics, reassessment and communication.



### Why was HIRAID developed?

- Previously, there was no standardised approach to teach new emergency nurses how to comprehensively assess patients (post triage).
- HIRAID was initially developed as part of the USYD post graduate course, then validated by research evidence and tested in the simulated setting

### Why should ED nurses use HIRAID?

- It is evidence-based and enables a consistent way for us to orientate and teach new ED staff
- Research shows that HIRAID improves emergency nursing care including:
  - The completeness of patient's history
  - Recognition and response to critical indicators (red flags)
  - Communication handover / escalation
  - Reduces clinical deterioration related to ED care
  - Improves documentation

### CHECKLIST (WHAT TO DO WITH NURSING STAFF)

1. Have access to implementation staff check list
2. Mark off staff as they complete the online learning (available on MHL 195463248)
3. Mark off staff as they attend the HIRAID in-service
4. Check your ED nursing list to identify which staff have not recorded as completing either of the above- follow up / allocate time for HIRAID in-service and online learning module.
5. Be very familiar with what HIRAID is, what is expected for each component and why HIRAID is important to use.
  - a. Executive directive for use in ED documentation;
  - b. Improves patient care, documentation and communication;
  - c. Provides a consistent way to teach new ED staff.
6. When you are out and about on the floor, explain what HIRAID is and why it is important if there are questions (*refer to HIRAID participant workbook*)
7. Show Youtube video (<https://youtu.be/zbVvN6Qa05Q>)
8. Get nurse to do a patient assessment (talking through HIRAID components)
9. Get nurse to practice with you handing escalating care using ISBAR and graded assertiveness (*refer to HIRAID participant workbook*)
10. Go through documentation templates and what should be written in each HIRAID template (adult, paed, reassessment, rapid assessment nurse, trauma, mental health)
11. Provide nurse with HIRAID reference card for lanyard if they don't have one
12. Confirm on site records staff tracking and implementation log completed as required.

# Appendix 10: HIRAID Instructor Evaluation Participant Information Sheet



Susan Wakil School of Nursing and Midwifery  
Faculty of Medicine and Health



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Web: <http://www.sydney.edu.au/>

## Implementation and evaluation of an evidence-informed emergency nursing framework in clinical practice (HIRAID)

### IMPLEMENTATION PARTICIPANT INFORMATION STATEMENT

#### (1) What is this study about?

You are invited to take part in a research study evaluating the implementation of the HIRAID (History, Identify Red flags, Assessment, Interventions, Diagnostics, communication and reassessment) nursing assessment framework. HIRAID is the only validated framework designed to teach emergency nurses how to systematically assess and manage emergency patients after the triage process.

You have been invited to participate in this study because you have been assigned to assist lead implementation of the HIRAID. This Participant Information Statement tells you about the research study. Knowing what is involved will help you decide if you want to take part in the research. Please read this sheet carefully and ask questions about anything that you don't understand or want to know more about.

Participation in this research study is voluntary.

By giving your consent to take part in this study you are telling us that you:

- ✓ Understand what you have read.
- ✓ Agree to take part in the research study as outlined below.
- ✓ Agree to the use of your personal information as described.

You will be given a copy of this Participant Information Statement to keep.

#### (2) Who is running the study?

The study is being carried out by the following researchers: Professor Kate Curtis<sup>1,2</sup>, Professor Margaret Fry<sup>3</sup>, Professor Julie Considine<sup>4</sup>, Professor Ramon Shaban<sup>1,5</sup>, Mr Hatem Alkhouri<sup>6</sup>, Professor Steven McPhail<sup>7</sup>, A/Professor Michael Dinh<sup>8</sup>, A/Professor Christina Aggar<sup>9</sup>, Dr James Hughes<sup>10</sup>, Dr Margaret Murphy<sup>3</sup>, Ms Louise Casey<sup>11</sup>, Ms Joanne Dungey<sup>11</sup>, Ms Vivienne Chapman<sup>11</sup>, Dr Mary Lam<sup>1</sup>, Ms Belinda Kennedy<sup>1</sup>, Dr Cristina Sotomayor-Castillo<sup>1</sup>.

<sup>1</sup>Susan Wakil School of Nursing and Midwifery, University of Sydney, <sup>2</sup>Illawarra Shoalhaven Local Health District, <sup>3</sup>The University of Technology Sydney, <sup>4</sup>Deakin University, <sup>5</sup>Western Sydney LHD, <sup>6</sup>Emergency Care Institute, <sup>7</sup>Queensland University of Technology, <sup>8</sup>Sydney LHD, <sup>9</sup>Northern NSW LHD, <sup>10</sup>Southern NSW Local Health District

This study is being funded by a NHMRC partnership grant (GNT2005403).

**(3) What will the study involve for me?**

Throughout the study minutes of meetings you participate in, and implementation log where events are recorded, related to the project may be used to evaluate the implementation of HIRAID across [insert relevant LHD] Local health District.

On completion of implementation you will be requested to complete a short online survey to evaluate implementation fidelity for the site where you worked. That is evaluation of the how the different processes in the implementation plan were used at your site. Online surveys will be completed in REDCap (Research Electronic Data Capture) (<https://catalyst.harvard.edu/services/redcap/>), a secure web-based application for data management and survey tool managed by The University of Sydney. Surveys can be completed at a time convenient to you, with the survey link available for a period of three weeks from the time it is received.

For the online survey, you will be sent a unique link to complete the survey. You should not forward this to anyone. You can be identified by the CPI for the purpose of identifying the sites and if necessary contact you for further details if required.

**(4) How much of my time will the study take?**

The activities will be undertaken as a part of routine work practices related to your roll in the implementation of HIRAID in the workplace. The survey is anticipated to not take any longer than will take 10-15 minutes of your time.

**(5) Who can take part in the study?**

Nursing engaged to implement HIRAID across the study sites will be invited to participate.

**(6) Do I have to be in the study? Can I withdraw from the study once I've started?**

Being in this study is completely voluntary and you do not have to take part. Your decision whether to participate will not affect your current or future relationship with the researchers or anyone else at the University of Sydney, your employment in your respective Local Health District, your relationship with your managers or other members of staff within your team.

When participating in meetings related to HIRAID you are free to not answer any question or engage in group discussion. However, it will not be possible to withdraw comments once the meetings have started as they form part of the group discussion/ meeting minutes.

You will not be able to alter your response once you have completed the implementation fidelity evaluation and submitted the evaluation. You can withdraw your responses any time before you have submitted the questionnaire. If you decide to withdraw from the study, after completing the survey you can do this by contacting the project manager, Dr Cristina Sotomayor-Castillo, [cristina.sotomayor@sydney.edu.au](mailto:cristina.sotomayor@sydney.edu.au).

**(7) Are there any risks or costs associated with being in the study?**

Aside from giving up your time, we do not expect that there will be any risks or costs associated with taking part in this study.

**(8) Are there any benefits associated with being in the study?**

There will be no personal benefit to you. However, we hope the evaluation of the HIRAID implementation will benefit others working to implement in their workplace.

**(9) What will happen to information about me that is collected during the study?**

By providing your consent, you are agreeing to us collecting the information as stated for the purposes of this research study. Your information will only be used for the purposes outlined in this Participant Information Statement.

All data will be de-identified, with a unique study ID allocated, and presented in aggregate format. No individual will be able to be identified in the analysis of the results. The data collected for the project will evaluate the implementation strategy for HIRAID in [insert LHD] Local Health District. Only the chief investigator, project manager and statistician will have access to the data collected. Study data will be stored securely at The University of Sydney for 5 years, after which they will be destroyed.

We plan to present findings at conferences and submit results for peer review publication. In any publication, information will not be provided in any way that you can be identified. A summary of the results can be made available to you on completion of the study at your request.

**(10) Can I tell other people about the study?**

You can tell people about the study. However please don't discuss your responses to the questions with others, as we would like to ensure those invited to participate are not influenced by the opinions of others when completing the survey.

**(11) What if I would like further information about the study?**

When you have read this information, or at any time during the study, if you have any questions related to the study please contact Professor Kate Curtis ( [kate.curtis@sydney.edu.au](mailto:kate.curtis@sydney.edu.au) ), and she will arrange a time to discuss with you further.

**(12) Will I be told the results of the study?**

You have a right to receive feedback about the overall results of this study. This feedback will be in the form of presentations through the Local Health District and publications related to the study will be circulated to staff. Overall results will be circulated with staff involved in the implementation. You will receive this feedback after the study is finished.

**(13) What if I have a complaint or any concerns about the study?**

The ethical aspects of this study have been approved by the HREC of the Greater Western Area Health Service [2020/ETH02164]. As part of this process, we have agreed to carry out the study according to the *National Statement on Ethical Conduct in Human Research (2007)*. This statement has been developed to protect people who agree to take part in research studies.

If you are concerned about the way this study is being conducted or you wish to make a complaint to someone independent from the study, please contact the Manager Research Ethics, Greater Western Area Health Service HREC on 02 6330 5948, or email [wswlhd-ethicscommittee@health.nsw.gov.au](mailto:wswlhd-ethicscommittee@health.nsw.gov.au) . Please quote the study title and protocol number.

*This information sheet is for you to keep*

ABN 15 211 513 464

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**Implementation and evaluation of an evidence-informed emergency nursing framework in  
clinical practice (HIRAID)**

**IMPLEMENTATION PARTICIPANT CONSENT FORM**

Declaration by Participant

- ✓ I understand the purpose of the study, what I will be asked to do, and any risks/benefits involved.
- ✓ I have read the Participant Information Statement and have been able to discuss my involvement in the study with the researchers if I wished to do so.
- ✓ The researchers have answered any questions that I had about the study and I am happy with the answers.
- ✓ I understand that being in this study is completely voluntary and I do not have to take part. My decision whether to be in the study will not affect my relationship with healthcare providers or researchers at the University of Sydney, now or in the future.
- ✓ I understand that my questionnaire responses cannot be withdrawn once they are submitted, as they are anonymous and therefore the researchers will not be able to tell which one is mine.
- ✓ I understand that the results of this study may be published, and that publications will not contain any identifiable information about me.

I understand that I will be given a signed copy of this document to keep.

Name of Participant (please print) \_\_\_\_\_

Signature \_\_\_\_\_ Date \_\_\_\_\_

## Appendix 11: Instructor Resources to Track Implementation

HIRAID Implementation log Southern NSW Local Health District





CROOKWELL

| Date                  | Event   | Actions/ Outcomes/ Comments  |
|-----------------------|---|--|
| <i>Eg. 30/11/2019</i> | <i>Staff not using templates</i>                | <i>Identified three staff not using templates, enquired as to why not using them. 2 identified they did not want to, one was not confident. Reiterated that it is a management directive to use, worked 1:1 with staff member who was not confident.</i> |
| <i>1/12/2019</i>      | <i>Reduced face to face training-time limit</i> | <i>Background information not covered due to limited time for delivery</i>   |
|                       |   |  |

Record activities associated with the implementation, or any adaptations to implementation.  
DO NOT RECORD ANY PERSONAL DETAILS, all entries to be de-identified

### HIRAID IMPLEMENTATION – STAFF TRACKING

SITE: 

| Name  | e-learning | In-service | Prompt card | Template | Audit 1<br>19/4/2021 | Audit 2<br>8/6/2021 |
|---|------------|------------|-------------|----------|----------------------|---------------------|
|   | yes        | 18/2       | yes         | yes      | Y                    | Y                   |
|  | yes        | 18/2       | yes         | yes      | N                    | Y                   |
|  | yes        | 11/3/2021  | yes         | yes      | N                    | Y                   |
|  | yes        | 12/2       | yes         | yes      | Y                    | Y                   |

Template: confirm documentation template (macro) in eMR

Audit 1: 6 weeks post in-service education: confirm template in place, prompt card provided and HIRAID documentation being used- yes/ no, date

Audit 2: 12 weeks post confirm that template being used in documentation- record yes (Y) / no (N) and date

\*e-learning completion crosschecked with My Health Learning records.

## Appendix 12: Modified D-Catch Data Dictionary (Publication 4, Supplementary File 2)

Supplementary File 2: Documentation Audit Data Dictionary

Extract from *Evaluation of an evidence-informed emergency nursing assessment framework (HIRAID) Data Dictionary and Codebook* of sections relevant to HIRAID® Documentation audit using modified D-catch tool.

Full data dictionary available on reasonable request.

### Documentation audit

All fields shaded yellow will be uploaded following randomisation.

| Definition   | Variable          | Field type / Code  |
|--|-------------------|--|
| Personal identifiers (HIRAID audit tool)   |                   |  |
| Emergency Department<br><i>Department where treatment provided</i>   | facility          | (Text uploaded)  |
| Date and time of ED presentation   | Arr_dt            | DD/MM/YYYY, HH:MM  |
| Medical record number (MRN)  | mrn               | Numeric  |
| Patient name<br><i>SURNAME, firstname</i>  | Patient_full_name | Text   |
| Sex  | sex               | text uploaded:<br>Male<br>Female<br>Indeterminate<br>Unknown |
| Date of birth  | dob               | DD/ MM/YYYY  |
| Age <b>at time</b> of ED presentation  | age               | Text (uploaded)  |
| Triage category  | Triage_cat        | 1– 5   |
| <b>Presenting problem</b><br><i>Reason for presentation to ED recorded at time of triage, recorded on report from FirstNet</i> | pres_prob         | Text (from eMR report)                                       |

Data dictionary/codebook-HIRAID Evaluation

| Definition  | Variable             | Field type / Code  |
|---|----------------------|--|
| Emergency department length of stay   | Total_time_in_ed     | text uploaded  |
| Diagnosis at time of ED departure   | Diagnosis_1          | Text   |
| Date and time of triage<br><i>Date/ time triage commenced</i>   | triage_tm            | DD/MM/YYYY, HH:MM  |
| Date and time of ED discharge (EDD)   | dc_dt                | DD/MM/YYYY, HH:MM  |
| Does the record meet any exclusion criteria?<br><ul style="list-style-type: none"> <li>Not admitted or transferred</li> <li>ED length of stay &lt; 1 hour</li> <li>Triage category 1 or 5</li> <li>Team response i.e trauma team, stroke team (event recorded in eMR)</li> <li>Presentation during eMR downtime</li> </ul> <i>Excluded if Yes</i> | excl_record          | 1, Yes<br>0, No  |
| Select the exclusion criteria met<br><i>LOGIC if [excl_record] = 0</i><br><i>No nursing involvement- refers to no nursing staff post-triage involved in care i.e not cared for in an area where nursing staff is allocated.</i>   | excl_met             | 1, ED length of stay < 1 hour<br>2, Triage category 1 or 5<br>3, Presentation during eMR downtime<br>4, No nursing involvement<br>5, Team response<br>7, Other |
| Confirm record met study inclusion for review<br><i>This variable will enable reporting to track included records</i>   | doaudit_included     | 1, Yes<br>0, No  |
| Location post triage<br><i>ie. resus, acute area, sub-acute area, waiting room</i>  | location_post_triage | 1, Resus<br>2, Acute bed<br>3, Fast track/ subacute bed<br>4, Waiting room/ consult  |

Data dictionary/codebook-HIRAID Evaluation

| Definition   | Variable     | Field type / Code  |
|--|--------------|--|
|  |              | 5, Paediatric bed<br>6, Paediatric waiting room<br>7, Ambulance Bay                    |
| Date and time seen by ED medical officer / Nurse practitioner.   | dt_seen_edmo | DD/MM/YYYY, HH:MM  |
| Discharge destination post ED<br><i>Location the patient was discharged to on ED departure.</i><br><i>Critical care = ICU, CCU, HDU</i><br><i>Transfer- to another facility for ongoing care</i> | disch_ed     | 1, General ward/ Short stay<br>2, Critical care<br>3, Operating theatre<br>4, Transfer |

| Description/ data source  | Variable         | Field type/ Code   |
|---|------------------|--|
| Modified D-Catch tool   |                  |  |
| Auditor:<br>Unique identifier assigned to individual conducting audit on documentation  | auditor_id       | Reviewer initial:  |
| Presentation type<br><br><i>Required for branching logic of assessment components.</i>  | PresentationType | 1, Fever<br>2, Respiratory<br>3, Abdominal pain<br>4, Chest pain<br>5, Upper / lower limb pain |
| Q1. Was structured documentation present?   |                  |  |
| Q1. Was a structured assessment framework present? i.e. A-G, systems assessment, HIRAID | q1               | 0, No<br>1, Yes  |
| What structure was used?  | Q1_structure     | 1, A-G<br>2, HIRAID (old template)   |

Data dictionary/codebook-HIRAID Evaluation

| Description/ data source   | Variable   | Field type/ Code   |
|--|------------|--|
| <p><i>HIRAID (old template) –template based on HIRAID format used prior to implementation by some sites/ nurses</i></p> <p><i>HIRAID (current)- template used for current HIRAID project.</i></p> <p><i>Systems- i.e. neurological, respiratory</i></p>  |            | <p>3, HIRAID (current)</p> <p>4, Systems</p> <p>5, Other</p>               |
| <p>Date/ time the assessment is documented</p> <p><i>Date/ time recorded the result date/ time visible in menu for Clinical Notes View and Documentation</i></p>   |            | DD/MM/YYYY HH:MM   |
| <p>Provide further details related to the structure documented</p> <p><i>Comments related to assessment structure (include details of framework used) or any modification made to the template introduced.</i></p>   | q1_comment | text   |
| Q2. Is an accurate nursing record structure present?   |            |  |
| <p>Q2 Is an accurate nursing record structure present?</p> <p><b>4 Points:</b> An individual record is present with a structure that allows describing</p> <ul style="list-style-type: none"> <li>• History (presenting problem and individual health history) - includes historical red flags and infectious risk, immunisation status</li> <li>• Assessment findings - includes physiological red flags</li> <li>• Nursing interventions</li> <li>• Diagnostics</li> <li>• Outcomes and plan</li> <li>• Communication / who is aware of plan</li> </ul> <p><b>3 Points:</b> An individual record that contains four to five of the six items listed above</p> <p><b>2 Points:</b> An individual record that contains at least a note of personal details and a progress evaluation report form</p> <p><b>1 Point:</b> It is not possible to note details in an individual nursing record or the items are included in a collective record with other details related to patient presentation</p> | q2         | <p>4, 4 points</p> <p>3, 3 points</p> <p>2, 2 points</p> <p>1, 1 point</p> |
| <p>Reviewer comments related to assessment completeness.</p> <p>(Q2 comments)</p>  | q2_comment | Text   |

Data dictionary/codebook-HIRAID Evaluation

| Description/ <i>data source</i>  | Variable  | Field type/ Code   |
|--|---|--|
| Q3. Is there accurate nursing documentation about the patient's history?   |   |  |
| <p><b>Q3a. Presenting problem</b></p> <p><i>For each point listed identify whether it is present in documentation of the presenting problem for the nursing entry.</i></p> <ul style="list-style-type: none"> <li>i. Chief complaint</li> <li>ii. Onset- time the symptom started</li> <li>iii. Onset- any previous episodes experienced</li> <li>iv. Location (<i>if painful presentation selected</i>)</li> <li>v. Radiation (<i>if painful presentation selected</i>)</li> <li>vi. Characteristics (<i>if painful presentation selected</i>)</li> <li>vii. Aggravating factors (<i>if painful presentation selected</i>)</li> <li>viii. Relieving factors (<i>if painful presentation selected</i>)</li> <li>ix. Related symptoms</li> <li>x. Current/ previous treatments</li> <li>xi. Outcomes of current/ previous treatments</li> <li>xii. Current/ previous investigations</li> <li>xiii. Outcomes of current/ previous investigations</li> <li>xiv. Severity</li> <li>xv. Mode of arrival (<i>may be in notes or ED visit summary</i>)</li> </ul> | <ul style="list-style-type: none"> <li>q3a_i_quantity</li> <li>q3a_ii_quantity</li> <li>q3a_iii_quantity</li> <li>q3a_iv_quantity</li> <li>q3a_v_quantity</li> <li>q3a_vi_quantity</li> <li>q3a_vii_quantity</li> <li>q3a_viii_quantity</li> <li>q3a_ix_quantity</li> <li>q3a_x_quantity</li> <li>q3a_xi_quantity</li> <li>q3a_xii_quantity</li> <li>q3a_xiii_quantity</li> <li>q3a_xiv_quantity</li> <li>q3a_xv_mode_of_arrival</li> </ul> | <ul style="list-style-type: none"> <li>0, No</li> <li>1, Yes</li> <li>2, NA</li> </ul> |
| <p><b>Q3b. Individual History</b></p> <ul style="list-style-type: none"> <li>i. Allergies- allergies documented or nil known noted</li> <li>ii. Medications- regular medication taken</li> <li>iii. Compliance with taking medications</li> <li>iv. Alcohol intake</li> <li>v. Smoking habits</li> </ul>   | <ul style="list-style-type: none"> <li>q3b_i_quantity</li> <li>q3b_ii_quantity</li> <li>q3b_iii_quantity</li> <li>q3b_iv_quantity</li> <li>q3b_v_quantity</li> </ul>  | <ul style="list-style-type: none"> <li>0, No</li> <li>1, Yes</li> <li>2, NA</li> </ul> |

Data dictionary/codebook-HIRAID Evaluation

| Description/ data source   | Variable          | Field type/ Code   |
|--|-------------------|--|
| vi. Medical history  | q3b_vi_quantity   |  |
| vii. Surgical history  | q3b_vii_quantity  |  |
| viii. Social history   | q3b_viii_quantity |  |
| ix. Pregnancy (select NA if no longer childbearing age) [if Sex = female]  | q3b_ix_quantity   |  |
| x. Menstrual cycle (should be noted in women of appropriate age ~12+, NA for those who do not meet criteria). [if Sex = female]  | q3b_x_quantity    |  |
| xi. Last oral intake   | q3b_xi_quantity   |  |
| xii. Events/environment preceding presentation/ travel   | q3b_xii_quantity  |  |
| <p><b>Quantity: Is there accurate documentation about the patient's history?</b></p> <p><b>4 points:</b> The presenting problem, mode of arrival to ED and patient's individual health history are fully documented.</p> <p><b>3 points:</b> The presenting problem and individual health history is available, but mode of arrival is missing.</p> <p><b>2 points:</b> The presenting problem is available. The patient's individual health history and mode of arrival is missing.</p> <p><b>1 point:</b> The presenting problem, mode of arrival to ED and patient's individual health history are not documented.</p>  | q3_quantity       | <p>4, 4 points</p> <p>3, 3 points</p> <p>2, 2 points</p> <p>1, 1 point</p> |
| <p><b>Quality: Is there accurate nursing documentation about the patient's history?</b></p> <p><b>4 points:</b> The admission report contains details about the mode of arrival (including times and treatment); presenting problem: including details on chief complaint, onset, QRST, mechanism of injury of trauma related; and patient individual health history (AMPLE). The notes are clear, linguistically correct and contain all relevant information.</p> <p><b>3 points:</b> The admission report contains presenting problem and patient individual health history (AMPLE). The mode of arrival may or may not be present. Most of the notes are clear and contain relevant information to assess the patient.</p> | q3_quality        | <p>4, 4 points</p> <p>3, 3 points</p> <p>2, 2 points</p> <p>1, 1 point</p> |



Data dictionary/codebook-HIRAID Evaluation

| Description/ data source  | Variable                       | Field type/ Code   |
|---|--------------------------------|--------------------|
| <p>Select the <b>red flags</b> identified in the emergency nursing initial assessment post triage</p> <p>Select ALL that were identified on initial assessment documented post triage.</p> <p>Selection based on response to [presentation type] see <a href="#">Appendix B</a> for reference.</p> <p>There is the option to enter up to two red flags not in the available options</p> | Nurs_rf_1-78                   | Multiple selection |
|   | nurs_red_oth1<br>nurs_red_oth2 | Free text          |
| <p>Enter the number of red flags identified in the emergency nursing assessment</p> <p>See <a href="#">Appendix B</a> for full detail on red flag for each presentation type.</p>   | nurse_red_total                | numeric            |
| <p>How many red flags recorded by nurses were not recorded in the initial emergency medical assessment?</p> <p>Identify red flags recorded in nursing assessment not recorded in the medical record</p>   | Red_flag_not_rec               | numeric            |
| <p>Select the <b>red flags</b> identified by the reviewer</p> <p>To be identified based on past history and condition on arrival to ED.</p> <p>Selection based on response to [presentation type] see <a href="#">Appendix B</a> for reference</p> <p>There is the option to enter up to two red flags not in the available options</p>   | Rev_rf_1-78                    | Multiple selection |
|   | rev_red_oth1<br>rev_red_oth2   | Free text          |
| <p>Enter the number of red flags identified by the reviewer</p> <p>Based on number identified in previous question</p>  | Rev_red_total                  | numeric            |
| <p>Percentage of red flags identified by the emergency nurse</p> <p><math>((\text{nurse\_red\_total})/(\text{rev\_red\_total})) * 100</math></p>  | Red_flag_percent               | Calculated field   |
| <p><b>Quantity red flags</b></p> <p>Are red flags accurately recorded by nursing staff?</p> <p>Calculated based on the number of red flags identified by the reviewer from record review and review of the initial emergency medical assessment. Refer to calculation in REDCap.</p>  | q4_quantity                    |                    |

Data dictionary/codebook-HIRAID Evaluation

| Description/ data source   | Variable  | Field type/ Code  |
|--|---|---|
| <p><i>If no red flags identified by reviewer for the presentation select not applicable</i></p> <p><b>4 points:</b> All red flags are recorded<br/> <b>3 points:</b> 75-99% of red flags are recorded<br/> <b>2 points:</b> 55-74% of red flags are recorded<br/> <b>1 point:</b> less than 50% of red flags are recorded<br/> <b>0 points:</b> no red flags identified for presentation</p>   |   | <p>4, 4 points<br/>                     3, 3 points<br/>                     2, 2 points<br/>                     1, 1 point<br/>                     0, 0 points</p> |
| Any comments related to the red flags recorded?  | q4_comments   | Notes/ text   |
| Q5. Are assessment findings present?   |   |   |
| <p><i>Are A-G Assessment items recorded in progress notes? (section header)</i></p> <p><i>Identify what assessment items are documented in the medical record/ nursing notes</i><br/> <i>If considered not relevant for the presenting problem, select 'NA'. If relevant, but not documented select 'No'</i></p> <p>Airway<br/>                     Breathing<br/>                     Circulation<br/>                     Disability<br/>                     Exposure<br/>                     Fluids (in)<br/>                     Fluids (out)<br/>                     Glucose</p> | <p>airway<br/>                     breathing<br/>                     circulation<br/>                     disability<br/>                     exposure<br/>                     fluids_in<br/>                     fluids_out<br/>                     glucose</p> | <p>1, Yes<br/>                     0, No<br/>                     2, NA</p>   |
| <i>Was this a paediatric presentation? i.e. less than 16years</i>  | paed_pres   | 1, yes<br>0, no   |
| <p><i>If [paed_pres=1]</i></p> <p><i>Were additional paediatric assessment items present?</i></p>  |   |   |

Data dictionary/codebook-HIRAID Evaluation

| Description/ data source   | Variable            | Field type/ Code |
|--|---------------------|------------------|
| Weight   | weight              | 1, yes           |
| Immunisation status  | immunisation_status | 0, no            |
| Parent/ carer present  | Parent_carer        |                  |
| <p><i>What is the quality of the A-G assessment?</i><br/> <i>The assessment of each component should be based on the expected documentation requirements outlined below, observations <u>must</u> be included where abnormal or interpretation in context relevant:</i></p> <p><i>Airway: patent/ protected, presence of airway noises (paediatric resp presentations or if applicable adult), c-spine noted in trauma.</i></p> <p><i>Breathing: Resp rate, WOB, O2 saturation, air entry, signs of respiratory distress (where applicable)</i></p> <p><i>Circulation: interpretation of HR, BP, rhythm, capillary refill, colour</i></p> <p><i>Disability: AVPU/GCS (as appropriate based on presentation), pain assessment</i></p> <p><i>Exposure: temperature, skin integrity, devices including if ambulance inserted</i></p> <p><i>Fluids: Input – last oral intake, current i.e NBM or oral fluids / IV fluid</i><br/> <i>Output- urine output/ last voided, IDC output if present, urine colour, description e.g. clear/ concentrated.</i></p> <p><i>Glucose: if indicated, for example history of diabetes, abdominal pain, gastro symptoms, child with decreased intake.</i></p> <p><i>4 points: Assessment findings are clear, linguistically correct, concise and contain all relevant information needed to act. Abnormal vital signs noted in documentation.</i></p> <p><i>3 points: At least 50% of the notes meet the above description. Some notes may contain unnecessary wording or relevant information missing; the language in some notes is incorrect. (e.g. note tachycardia but not heart rate documented, incomplete sentences, use of non-standard abbreviations that can be misinterpreted)</i></p> <p><i>2 points: Less than 50% of notes are written as described above; there are some correct notes (e.g. no relevant abnormal observations documented where interpreted as abnormal)</i></p> |                     |                  |

Data dictionary/codebook-HIRAID Evaluation

| Description/ data source  | Variable   | Field type/ Code   |
|---|--|--|
| <p><b>1 point: Generally notes are unclear, linguistically incorrect, and relevant information missing (e.g. only observations noted, but no interpretation or assessment findings included)</b></p> <p>Airway</p> <p>Breathing</p> <p>Circulation</p> <p>Disability</p> <p>Exposure</p> <p>Fluids (in)</p> <p>Fluids (out)</p> <p>Glucose</p>  | <p>airway_qual</p> <p>breathing_qual</p> <p>circ_qual</p> <p>disability_qual</p> <p>expo_qual</p> <p>fluids_in_qual</p> <p>fluids_out_qual</p> <p>glucose_qual</p> | <p>4, 4 points</p> <p>3, 3 points</p> <p>2, 2 points</p> <p>1, 1 point</p> |
| <p><b>Are vital signs recorded or interpreted in the progress notes (eMR)?</b></p> <p><i>These should occur where vital signs are outside normal limits, or when within normal limits, it may need to be interpreted in context of patient presentation e.g. interpretation of normal HR in pt on beta blockers presenting in context of trauma or V&amp;D.</i></p> <p>Heart rate</p> <p>Blood pressure</p> <p>Oxygen saturation</p> <p>Temperature</p> <p>Respiratory rate</p> <p>AVPU/ GCS</p> <p>Pain</p> <p>General statement obs BTF/ within normal limits</p> | <p>q5_i_emr</p> <p>q5_ii_emr</p> <p>q5_iii_emr</p> <p>q5_iv_emr</p> <p>q5_v_emr</p> <p>q5_vi_avpu_gcs</p> <p>q5_vii_pain</p> <p>q5_viii_obs_btf</p>                | <p>1, Yes</p> <p>0, No</p> <p>2, NA</p>                                    |
| <p><b>Are vital signs recorded in eMR observations SAGO chart (firstnet)?</b></p> <p><i>i.e. observations attended post triage</i></p> <p>Heart rate</p> <p>Blood pressure</p>  | <p>q5_i_sago</p> <p>q5_ii_sago</p>   | <p>0, No</p> <p>1, Yes</p>   |

Data dictionary/codebook-HIRAID Evaluation

| Description/ data source  | Variable  | Field type/ Code         |
|---|---|--------------------------|
| Oxygen saturation<br>Temperature<br>Respiratory rate<br>AVPU/ GCS<br>Pain   | q5_iii_sago<br>q5_iv_sago<br>q5_v_sago<br>q5_vi_avpu_gcs<br>q5_vii_pain                 | 2, NA                    |
| <i>Are vital signs accurately recorded / interpreted (compare progress note and eMR observations chart)?</i><br><i>Where vital signs were not recorded in the SAGO chart select N/A</i><br>Heart rate<br>Blood pressure<br>Oxygen saturation<br>Temperature<br>Respiratory rate<br>AVPU/ GCS<br>Pain  | q5_i_acc<br>q5_ii_acc<br>q5_iii_acc<br>q5_iv_acc<br>q5_v_acc<br>q5_vi_acc<br>q5_vii_acc | 0, No<br>1, Yes<br>2, NA |
| <i>Chest Pain Assessment</i><br><i>A combination of the following present focussed assessment for chest pain:</i><br><i><u>Inspects:</u> Rate and rhythm, quality and work of breathing, level of consciousness, patient positioning, central or peripheral oedema, pallor, central or peripheral cyanosis +/- JVP. Review ECG - assess cardiac rhythm.</i><br><i><u>Auscultate:</u> Listen for air entry, crackles, crepitations and adventitious breath sounds +/- heart sounds.</i><br><i><u>Palpation:</u> Pulse rate and quality (strength) central and peripheral. Assess if the palpated pulse matches the rhythm seen on the cardiac monitor.</i> | q5_chest_a  | 0, No<br>1, Yes<br>2, NA |
| <i>Limb assessment</i>  |   |                          |

Data dictionary/codebook-HIRAID Evaluation

| Description/ data source  | Variable  | Field type/ Code         |
|---|-----------|--------------------------|
| <p>Relevant focussed assessment recorded?</p> <p><i>Any of the following present to indicate limb assessment performed:</i><br/> <u>Inspects</u> limb for size, symmetry, deformity, integrity, colour, and swelling<br/> <u>Palpates</u> for tenderness/ pain, swelling, crepitus, sensation, pulses, warmth.<br/> <u>Assess</u> range of motion</p> <p><i>Neurovascular observations must be included in observations chart recorded in eMR as part of assessment.</i></p>  | q5_limb_a | 0, No<br>1, Yes<br>2, NA |
| <p><b>Abdominal assessment</b></p> <p><i>Any of the following present to indicate abdominal assessment performed:</i><br/> <u>Inspects</u> abdomen e.g. for bruising distension.<br/> <u>Auscultates</u> for bowel sounds<br/> <u>Palpates</u> for pain/ masses, Percusses</p>  | q5_abdo_a | 0, No<br>1, Yes<br>2, NA |
| <p><b>Shortness of breath</b></p> <p>Relevant focussed assessment recorded?</p> <p><i>This can be in the B section of A-G</i><br/> <i>Any of the following present to indicate a focussed respiratory assessment performed:</i><br/> <u>Inspect:</u></p> <ul style="list-style-type: none"> <li>- Work of breathing and respiratory effort</li> <li>- Recession/ tug/ accessory muscle use</li> <li>- Ability to speak in words or phrases. Respiratory rate and pattern</li> <li>- Patient's colour, perfusion, mucous membranes</li> <li>- Peripheral oedema</li> </ul> <p><u>Auscultate:</u></p> <ul style="list-style-type: none"> <li>- work of breathing and respiratory effort</li> <li>- air entry</li> <li>- wheeze?, where? Inspiratory/ expiratory?</li> </ul> <p><u>Palpate:</u></p> <ul style="list-style-type: none"> <li>- work of breathing and respiratory effort</li> <li>- For any subcutaneous emphysema</li> </ul> <p>chest for any area of pain</p> | q5_sob_a  | 0, No<br>1, Yes<br>2, NA |

Data dictionary/codebook-HIRAID Evaluation

| Description/ data source  | Variable    | Field type/ Code  |
|---|-------------|---|
| <p><b>Fever</b></p> <p>Relevant focussed assessment recorded?</p> <p>Any of the following present to indicate focussed assessment performed:</p> <p><u>Inspect:</u></p> <ul style="list-style-type: none"> <li>• Based on likely cause of sepsis eg. abdominal cause- abdo assessment, respiratory cause resp assessment</li> <li>• No readily identifiable cause?                             <ul style="list-style-type: none"> <li>Thorough systematic assessment                                     <ul style="list-style-type: none"> <li>- Alertness, arousal or activity decreased</li> <li>- Breathing difficulties (tachypnoea, increased work of breathing)</li> <li>- Colour (pale or mottled)</li> <li>- Circulation (cool peripheries, skin turgor, dry mucosa);</li> <li>- Decreased fluid intake or decreased urine output.</li> </ul> </li> </ul> </li> <li>• Focus should be on areas of high diagnostic yield:                             <ul style="list-style-type: none"> <li>○ skin lesions, rashes, animal bites</li> <li>○ musculoskeletal bony tenderness</li> </ul> </li> </ul> | Q5_fever    | 0, No<br>1, Yes<br>2, NA                                |
| <p>What was the <u>quantity</u> of overall assessment findings present?</p> <p>4 points: All findings from physical assessment recorded (A-G)</p> <p>3 points: most findings from physical assessment recorded</p> <p>2 points: Some findings from physical assessment recorded</p> <p>1 point: No assessment findings recorded</p>   | q5_quantity | 4, 4 points<br>3, 3 points<br>2, 2 points<br>1, 1 point |
| <p>What was the <u>quality</u> of the overall assessment findings?</p> <p>Take into account both A-G assessment and relevant focussed assessments</p> <p>4 points: Assessment findings are clear, linguistically correct, concise and contain all relevant information needed to act. Abnormal vital signs noted in documentation.</p>  | q5_quality  | 4, 4 points<br>3, 3 points                              |

Data dictionary/codebook-HIRAID Evaluation

| Description/ data source  | Variable          | Field type/ Code                        |
|---|-------------------|---|
| <p><b>3 points:</b> At least 50% of the notes meet the above description. Some notes may contain unnecessary wording or relevant information missing; the language in some notes is incorrect. (e.g. incomplete sentences, use of non-standard abbreviations that can be misinterpreted)</p> <p><b>2 points:</b> Less than 50% of notes are written as described above; there are some correct notes</p> <p><b>1 point:</b> Generally notes are unclear, linguistically incorrect, and relevant information missing</p> |                   | <p>2, 2 points</p> <p>1, 1 point</p>    |
| Any comments related to the quality and quantity of assessment findings?  | q5_comments       | text                                    |
| Q6. Are accurate interventions present?   |                   |   |
| <p>Were appropriate interventions recorded in the medical record?</p> <p><i>These may be recorded anywhere in the eMR- eMEDS; iView; BTF chart. If the intervention below is not relevant to the presenting problem, select NA</i></p>  |                   |   |
| VBG/ ABG  | q6a_iii_int       | 0, No                                   |
| Antibiotics   | q6a_iv_int        | 1, Yes                                  |
| Oxygen  | q6a_v_int         | 2, NA                                   |
| Antiemetic  | q6a_vi_int        |   |
| IV fluids   | q6a_vii_int       |   |
| Salbutamol  | q6a_xi_int        |   |
| Salbutamol date and time <i>LOGIC if [q6a_xi_int] =1</i>  | ventolin_dt       | DD/MM/YYYY, HH:MM                       |
| Hydrocortisone date and time <i>LOGIC if [q6a_xii_int] =1</i>   | hydrocortisone_dt | DD/MM/YYYY, HH:MM                       |
| Analgesia   |                   |   |
| <p>Analgesia administered if indicated</p> <p><i>(may include where given as antipyretic)</i></p>   | analgesia         | <p>1, Yes</p> <p>0, No</p> <p>2, NA</p> |

Data dictionary/codebook-HIRAID Evaluation

| Description/ data source   | Variable                | Field type/ Code   |
|--|-------------------------|--|
| <p>Was analgesia taken/ administered prior to arrival at ED?</p> <p>LOGIC if [presentationtype] =3; 4; or 5</p>  | pre_analgesia           | 1, Yes<br>0, No  |
| <p>What analgesia was taken/ administered prior to ED arrival?</p> <p>Select all that apply</p> <p>Refer to triage details to confirm.</p> <p>Unknown = where specific agent not recorded, but documented in triage analgesia taken.</p> | pre_anal_admin          | 1, Paracetamol<br>2, Ibuprofen<br>3, Methoxyflurane<br>4, Ketorolac<br>5, Panadeine Forte<br>6, Oxycodone<br>7, Morphine<br>8, Fentanyl<br>9, Other<br>10, Unknown |
| Date and time of first dose analgesia  | Analgesia_date_and_time | DD:MM:YYY  |
| <p>What was the first dose analgesia administered in ED?</p> <p>(If more than one administered at the same time, select all that apply)</p>  | analgesia_ed            | 1, Paracetamol<br>2, Ibuprofen<br>3, Methoxyflurane<br>4, Ketorolac<br>5, Panadeine Forte<br>6, Oxycodone<br>7, Morphine<br>8, Fentanyl<br>9, Other                |
| <p>Was a pain score documented prior to, or at the time of analgesia administration?</p> <p>Yes = within 30 minutes of analgesia administration</p> <p>NA - only selected where given as antipyretic</p>                                 | q6_pain_pre             | 1, Yes<br>0, No<br>3, NA   |
| <p>What was the pain score documented prior to, or at the time of, administration?</p> <p>LOGIC if [q6_pain_pre]=1</p>   | pain_score              | Numeric: 0-10  |
| <p>Was a pain score documented within 1 hour post analgesia?</p> <p>Determine based on time of analgesia administration</p> <p>NA only selected where given as antipyretic</p>   | q6_pain_post            | 1, Yes<br>0, No<br>3, NA   |

Data dictionary/codebook-HIRAID Evaluation

| Description/ data source   | Variable      | Field type/ Code         |
|--|---------------|--------------------------|
| Did the medical officer (MO) need to be called in?<br><i>i.e. Medical officer not on site at the time of patient presentation.<br/>If site has 24-hour medical coverage select N/A</i> | q6_mo_call    | 1, Yes<br>0, No<br>2, NA |
| Is the time the MO was called documented on the medical record?<br><i>LOGIC if [q6_xv_int] =1</i>  | q6_mo_call2   | 0, No<br>1, Yes          |
| What is the date/ time the MO was called/ notified?<br><i>LOGIC if [q6_xv_doc] =1</i>  | q6_mo_dt      | dd/mm/yyyy; hh:mm        |
| <b>Were appropriate diagnostics performed?</b>   |               |                          |
| i. BSL (Check BTF chart)   | q6_i_diag     | 0, No                    |
| ii. Urinalysis   | q6_ii_diag    | 1, Yes                   |
| iii. Urine B-HCG (available if female selected)  | q6_iii_diag   | 2, NA                    |
| iv. ECG  | q6_iv_diag    |                          |
| v. Blood pathology   | q6_v_diag     |                          |
| vi. Chest x-ray  | q6_vi_diag    |                          |
| vii. Blood cultures  | q6_vii_diag   |                          |
| <b>Were appropriate interventions documented as being attended and reassessed (where relevant)?</b>  |               |                          |
| i. Dresses patient in hospital gown  | q6_i_int      | 0, No                    |
| ii. Inserts or requests an IV cannula  | q6_ii_int     | 1, Yes                   |
| iii. VBG if indicated (fever/sepsis)   | q6_iii_int    | 2, NA                    |
| iv. Antibiotics if indicated (e.g. sepsis. open fracture)  | q6_iv_int     |                          |
| v. Oxygen if indicated<br><i>e.g. SaO2 &lt; 88% in COPD patient, SpO2 &lt; 95% non COPD; respiratory distress</i>  | q6_v_int      |                          |
| Reassess: Oxygen affect  | q6_v_reassess |                          |

Data dictionary/codebook-HIRAID Evaluation

| Description/ data source  | Variable         | Field type/ Code  |
|---|------------------|---|
| <i>LOGIC if [q6_v_int] =1</i>   |                  |   |
| vi. Administers antiemetic if indicated ( <i>nausea/vomiting</i> )  | q6_vi_int        |   |
| Reassess: antiemetic affect<br><i>LOGIC if [q6_vii_int] =1</i>  | q6_vi_reassess   |   |
| vii. Administers IV fluid if indicated  | q6_vii_int       |   |
| Reassess: IV fluid affect if indicated<br>( <i>i.e. If commenced to address clinical need e.g low blood pressure / tachycardia / low urine output effect to be evaluation. If commenced for hydration secondary to NBM select - Not applicable</i> )<br><i>LOGIC if [q6_vi_int] =1</i>  | q6_vii_reassess  |   |
| viii. Starts fluid balance chart  | q6_viii_int      |   |
| ix. Activate sepsis pathway   | q6_ix_int        |   |
| x. Escalation if need be  | q6_x_int         |   |
| Reassess: Outcome of escalation documented<br><i>LOGIC if [q6_xiv_int] =1</i>   | q6_x_reassess    |   |
| xi. Salbutamol (if indicated)   | q6_xi_int        |   |
| Reassess: Salbutamol affect<br><i>LOGIC if [q6_xi_int] =1</i>   | q6_xi_reassess   |   |
| xii. Hydrocortisone if indicated  | q6_xii_int       |   |
| xiii. Analgesia   | q6_xiii_int      |   |
| Reassess: analgesia- the affect documented  | q6_xiii_reassess |   |
| <p>What was the <b>quantity</b> of interventions recorded in clinical documentation?</p> <p>Quantity refers to the level of clinical detail</p> <p><b>4 points:</b> All nursing interventions relevant to patient presenting problem are recorded as being completed/ planned/ requested and relevant reassessment documented. The aim for <u>all</u> these interventions is logical to the reviewer based on the presentation.</p> | q6_quantity      | 4, 4 points<br>3, 3 points<br>2, 2 points<br>1, 1 point |

Data dictionary/codebook-HIRAID Evaluation

| Description/ data source   | Variable  | Field type/ Code   |
|--|---|--|
| <p><b>3 points:</b> at least 50% of the nursing interventions relevant to patient presenting problem are recorded as being completed/ planned/ requested and relevant reassessment documented. The aim for those interventions documented is logical to the reviewer based on the presentation.</p> <p><b>2 points:</b> Interventions have been noted, but less than 50% are related to the diagnosis. The aim for which the interventions are used are unclear.</p> <p><b>1 point:</b> No interventions in terms of nursing actions are documented</p>  |   |  |
| <p>What was the <u>quality</u> of the nursing interventions recorded in clinical documentation?<br/><i>Quality refers to how well the entry was written</i></p> <p><b>4 points:</b> the intervention is clear, concise and contain all the relevant information required to act. The intervention time is mentioned and reassessment documented.</p> <p><b>3 points:</b> At least 50% of the notes meet the above description. Some notes may contain unnecessary wording or relevant information is missing; the language in some notes is incorrect (e.g. incomplete sentences, use of non-standard abbreviations that can be misinterpreted)</p> <p><b>2 points:</b> less than 50% of the noted are written as described above; there are some correct notes</p> <p><b>1 point:</b> Generally the notes are unclear and relevant information is missing</p> | q6_quality  | <p>4, 4 points</p> <p>3, 3 points</p> <p>2, 2 points</p> <p>1, 1 point</p> |
| Any comment related to the quantity and quality of interventions performed by nursing staff?   | q6_comment  | Notes/ text  |
| Q7. Is an accurate plan recorded?  |   |  |
| <p><i>Were the following recorded in the progress note?</i></p> <p>Consultation/s with MO</p> <p>Plan</p> <p>Patient communication</p> <p>Family communication</p>   | <p>q7_a_comm</p> <p>q7_b_comm</p> <p>q7_c_comm</p> <p>q7_d_comm</p> | <p>0, No</p> <p>1, Yes</p> <p>2, NA</p>                                    |

Data dictionary/codebook-HIRAID Evaluation

| Description/ data source   | Variable    | Field type/ Code   |
|--|-------------|--|
| <p>What was the <u>quantity</u> of the plan recorded?</p> <p><b>4 points:</b> All relevant plans for the patient are recorded</p> <p><b>3 points:</b> Most relevant plans for the patient are recorded</p> <p><b>2 points:</b> Some relevant plans are recorded</p> <p><b>1 point:</b> No plan recorded</p>  | q7_quantity | <p>4, 4 points</p> <p>3, 3 points</p> <p>2, 2 points</p> <p>1, 1 point</p> |
| <p>What was the <u>quality</u> of the plan recorded?</p> <p><b>4 points:</b> All relevant plans for the patient are recorded and indicated. Plan should include a plan for follow up, outstanding tasks and reassessment of specific interventions.</p> <p><b>3 points:</b> At least 50% of the plan is recorded as above.</p> <p><b>2 points:</b> Less than 50% of the plan is recorded and are indicated e.g. there may be plan for interventions but not reassessment.</p> <p><b>1 point:</b> No plan recorded or those recorded are not indicated or just "await MO r/v"</p> | q7_quality  | <p>4, 4 points</p> <p>3, 3 points</p> <p>2, 2 points</p> <p>1, 1 point</p> |
| Any comments related to the accuracy of the plan recorded?   | q7_comments | Notes/ text  |

## 1. Appendix

### Appendix B – Red Flags

Below are the Red Flags available for each of the presenting problems in the database, there are two free text options.

| Chest pain (13)  | Abdominal Pain (19)  |
|--|--|
| Active chest pain<br>Altered Level of consciousness<br>Arrhythmia<br>Cardiac history<br>Cardiac risk factors<br>Decreased systolic blood pressure (blue/ yellow/ red zone)<br>Diaphoresis<br>Epigastric pain<br>Ischaemic ECG changes<br>Shortness of breath<br>Syncope / LOC<br>Representation within 1 week for same problem<br>Any other observations in blue/ yellow/ red zone   | >60 years of age<br>Altered level of consciousness<br>Constipation/Diarrhoea<br>Decreased systolic blood pressure (blue/ yellow/ red zone)<br>Guarding<br>Immunosuppressed/steroids<br>Increased Heart rate (blue/ yellow/ red zone)<br>Known AAA<br>On anticoagulants<br>Peritonism/distended abdomen<br>Pregnancy<br>Recent abdominal or gynaecological surgery<br>Recent trauma<br>Sudden onset<br>Suspected ectopic pregnancy<br>Symptoms of gastrointestinal bleeding<br>Unrelieved pain<br>Representation within 1 week for same problem<br>Any other observations in blue/ yellow/ red zone |
| Limb pain/ injury (11)   | Fever (18)   |
| External signs of haemorrhage<br>Gross limb deformity (including dislocation)<br>Intoxicated patients (Drugs +/- Alcohol)<br>Neurovascular compromise<br>Open fracture<br>Pain level exceeding what would be expected despite analgesia<br>Signs of joint infection<br>Suspected non-accidental injury<br>Tenting of skin<br>Representation within 1 week for same problem<br>Any other observations in blue/ yellow/ red zone | > 65 years of age<br>Altered level of consciousness<br>Decreased systolic blood pressure (blue/ yellow/ red zone)<br>Fall (non-mechanical)<br>Immunosuppressed/steroids<br>Increased Heart rate (blue/ yellow/ red zone)<br>Indwelling medical device<br>Non blanching rash<br>Oncology/haematology diagnosis<br>Organ transplant recipient<br>Peritonism/distended abdomen<br>Pregnancy<br>Recent surgery or wound<br>Recent travel<br>Representation within 48 hours<br>Shortness of breath<br>Signs/Symptoms of life-threatening organ dysfunction<br>Two or more yellow zone BTF criteria      |

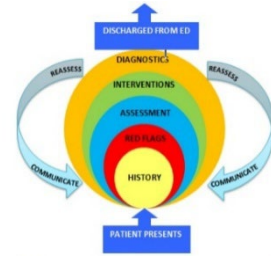
Data dictionary/codebook-HIRAID Evaluation

| Shortness of breath (22)   | Shortness of breath- asthma (17)   |
|--|--|
| Altered level of consciousness<br>Bradypnea<br>Comorbidities<br>Cyanosis<br>Foreign body aspiration<br>Inspiratory/expiratory stridor<br>Malignancy<br>Oropharyngeal swelling<br>Postpartum (3/12)<br>Pregnancy<br>Presyncope<br>Previous history of intubation/ICU admission<br>Recent travel<br>Respiratory distress<br>Silent chest<br>Talking in words only<br>Temperature $\geq 38.5$<br>Unresponsive to prehospital management<br>Urticarial rash<br>Ventricular arrhythmia<br>Representation within 1 week for same problem<br>Any other observations in blue/ yellow/ red zone | Altered level of consciousness<br>Bradypnea<br>Comorbidities<br>Current/recent steroid use<br>Cyanosis<br>Inspiratory/expiratory stridor<br>Postpartum (3/12)<br>Pregnancy<br>Previous history of intubation/ICU admission<br>Recent travel<br>Respiratory distress<br>Silent chest<br>Talking in words only<br>Unresponsive to prehospital management<br>Urticarial rash<br>Representation within 1 week for same problem<br>Any other observations in blue/ yellow/ red zone   |
| Shortness of breath- COPD (14)   | Shortness of breath- Cardiac (14)  |
| Altered level of consciousness<br>Arrhythmia<br>Confusion/agitation/unresponsive<br>Exhaustion<br>Hypoventilation<br>Inspiratory/expiratory stridor<br>Malignancy<br>Previous history of intubation/ICU admission<br>Recent travel<br>Respiratory distress<br>Sudden onset<br>Talking in words only<br>Unresponsive to prehospital management<br>Representation within 1 week for same problem<br>Any other observations in blue/ yellow/ red zone   | Altered level of consciousness<br>Arrhythmia<br>Audible crepitations<br>Blood-stained sputum<br>Central Cyanosis<br>Decreased systolic blood pressure (blue/ yellow/ red zone)<br>History of COPD<br>Increased Heart rate (blue/ yellow/ red zone)<br>Oedema-central/peripheral<br>Patient taking medicines for Erectile Dysfunction, Pulmonary Arterial hypertension or thromboembolic pulmonary hypertension<br>Respiratory distress with exhaustion<br>Talking in words only<br>Representation within 1 week for same problem<br>Any other observations in blue/ yellow/ red zone |

# Appendix 13: Instructor Course Evaluation

## HIRAID Southern NSW Train-the-Trainer (Instructor) Evaluation

Date: \_\_\_\_\_



| Rate each question on a scale of 1 (strongly disagree) to 5 (strongly agree)              | Strongly disagree ← Strongly agree |   |   |   |   |
|---|------------------------------------|---|---|---|---|
|   | 1                                  | 2 | 3 | 4 | 5 |
| The e-learning module provided good basis to build on at the TTT course                   | 1                                  | 2 | 3 | 4 | 5 |
| Simulation sessions gave greater understanding of the application of the HIRAID framework | 1                                  | 2 | 3 | 4 | 5 |
| I felt engaged throughout the day   | 1                                  | 2 | 3 | 4 | 5 |
| I am clear in how to apply the HIRAID framework in clinical practice                      | 1                                  | 2 | 3 | 4 | 5 |
| I have clear understanding of my role as a HIRAID train-the-trainer                       | 1                                  | 2 | 3 | 4 | 5 |
| I am confident in my ability to deliver the HIRAID training                               | 1                                  | 2 | 3 | 4 | 5 |

Do you have any suggestions to improve the HIRAID TTT course?

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General feedback

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Thank you for taking the time to provide feedback.

## Appendix 14: HIRAID Implementation Evaluation Survey (Fidelity)

*Survey created in REDCap for distribution.*

### **Survey introduction**

You are invited to complete this survey because you attended the HIRAID train the trainer education and/or were involved in introducing HIRAID in your ED / MPS.

Please don't forward this link to anyone else as it is unique. If you know of another staff member involved in the implementation that hasn't received a survey link please contact Dr Cristina Sotomayor-Castillo, [REDACTED] or Ms Belinda Kennedy [REDACTED] who will contact them directly.

We are keen to get your honest feedback about how things were implemented. It's an important part of working out what helps and what doesn't, so we can improve implementation elsewhere. No one will see your responses other than researchers at The University of Sydney. As outlined in the participant information sheet, they may contact you for further information if any clarification is required.

As acknowledgement of your time we will send you a \$30 voucher, to your email, as acknowledgement of your time.

| Field Label   | Variable  | Field attributes   |
|---|---|--|
| 1   | If you have not already received it, a copy of the participant information sheet can be accessed here.  | Fidelity_pis<br>PIS embedded in REDCap   |
| 2   | Please confirm you have read and understand the participant information sheet   | consent<br>1. I have read and understand the participant information   |
| HIRAID Champions  |   |  |
| 3   | Were there HIRAID Champions at your site during the introduction of HIRAID?   | champion1*<br>1. Yes<br>0. No  |
| 4   | Were HIRAID champions able to fulfill the tasks outlined in the HIRAID Champion instructions sheet? (HIRAID Champion role inbox below)<br>Show the field ONLY if: [champion1] = '1'   | champion2*<br>1. WERE NOT able to complete the tasks outlined<br>2. Only able to complete A FEW of the tasks<br>3. Completed MOST of the tasks<br>4. Were able to fulfill ALMOST ALL the tasks |
| <p>The HIRAID champions role included:</p> <ul style="list-style-type: none"> <li>Delivering HIRAID in-service</li> <li>Use of the implementation check list to: keep a track of staff online learning completion; keep records of staff attendance at in-service</li> <li>Follow up with staff not completed education, arrange time for completion</li> <li>Be familiar with HIRAID Framework, including the evidence and rationale for introduction in SNSW</li> <li>Show HIRAID video to staff who have not seen it</li> <li>Nurses completed assessment talking through HIRAID framework with champions</li> <li>Get nursing staff to practice using ISBAR and graded assertiveness with you</li> <li>Go through the documentation templates and the documentation requirements</li> <li>Provide nursing staff with the HIRAID reference card (Flip card)</li> <li>Complete the staff tracking and implementation log as required</li> </ul> |   |  |
| 4b  | Please explain in further about completion of tasks related to the HIRAID champions role: e.g. there were plenty of us so it was easy to do; we tried however we were so busy.<br>Show the field ONLY if: [champion1] = '1' | champion2_text<br>Free text  |
| 5   | It was planned that individuals would be asked to volunteer for the role of HIRAID champions.   | champion_adapt*<br>1. ALL volunteered<br>2. SOME volunteered and some were asked   |

| Field Label   | Variable          | Field attributes   |
|---|-------------------|--|
| How were HIRAID champions were selected at your site?   |                   | 3. NO ONE volunteered, all had to be asked   |
| Please explain how HIRAID champions were selected at your site<br>Show the field ONLY if: [champion_adapt] = '2' or '3'             | champion_text     | Free text  |
| 6 Did all the HIRAID champions at your site attended a train the trainer session (TtT) with staff from the University?              | champion_train*   | 1. NO champions went to the TtT session run by University staff<br>2. SOME of the champions went to the TtT session<br>3. MOST of the champions went to the TtT session<br>4. ALL the champions attended the TtT session   |
| 7 I used the HIRAID documentation templates in documentation  | Modelling*        | 1. I DID NOT use the HIRAID documentation templates<br>2. I RARELY used the HIRAID templates for ED nursing assessment after triage<br>3. I used HIRAID templates about HALF THE TIME for ED nursing assessment after triage<br>4. I use the HIRAID templates ALMOST ALWAYS for ED nursing assessment after triage |
| 8 HIRAID Flip cards were distributed to staff   | Flip*             | 1. flip cards WERE NOT distributed<br>2. SOME staff that work in the ED got one<br>3. the MAJORITY of staff that work in ED got one<br>4. I am pretty sure ALL staff working in the ED received a flip card  |
| 9 Nursing staff went through a patient assessment and explained the HIRAID components to champions                                  | champion_support* | 1. NEVER did this happen<br>2. This happened OCCASIONALLY with staff<br>3. This happened with MOST staff<br>4. This happened with ALMOST ALL staff   |
| Please explain your response: e.g. the staff did not need it, I could not do it with my workload, it worked well because I had time | champion_sup_text | Free text  |
| HIRAID education  |                   |  |

| Field Label  | Variable       | Field attributes   |
|--|----------------|--|
| 11<br>Was the PowerPoint* presentation delivered in face-to-face education sessions?<br>*the presentation may have been modified for your site use               | f2f_1*         | 1. the PowerPoint was NOT delivered<br>2. the PowerPoint was HARDLY EVER delivered<br>3. the PowerPoint was delivered IN MOST sessions<br>4. the power point was delivered IN ALL sessions   |
| Please provide further detail on how the face-to-face education was delivered in your ED   | f2f_comment    | Free text  |
| 12<br>Was the education delivered by a person who completed a HIRAID train the trainer session (TtT)?  | f2f_2*         | 1. the education was NOT delivered by someone who completed TtT<br>2. the education was HARDLY EVER delivered by someone who completed TtT<br>3. the education was delivered in the MOST sessions by someone who completed TtT<br>4. the education was delivered in ALL sessions by someone who completed TtT  |
| 13a<br>Did you make any changes to the PowerPoint presentation that was used in the face-to-face education?  | f2f_adapt*     | 1. presentation was delivered as provided<br>2. 1-2 slides were removed<br>3. > 2 slides were removed  |
| 13b<br>What parts of the presentation were that changed/ removed.<br><i>Select all that apply</i><br><br><i>Show the field ONLY if: [f2f_adapt] = '2' or '3'</i> | f2f_adapt_spec | 1. Background information related to previous studies using HIRAID<br>2. Detail on why the HIRAID framework is being delivered in SNSW<br>3. Staff survey feedback<br>4. Implementation plan<br>5. Change to any of the HIRAID case study or components (History/ red flags/ assessment/ interventions/ Diagnostics)<br>6. Communication video<br>7. Documentation templates |

| Field Label  | Variable           | Field attributes  |
|--|--------------------|---|
|  |                    | 8. HIRAID video<br>9. Other   |
| Please provide any further details on the changes made<br><i>Show the field ONLY if: [f2f_adapt_spec(9)] = '1'</i>   | f2f_adapt_comment  | Other   |
| 14 Were any simulated scenarios/ role play delivered as part of the HIRAID education?  | f2f_simulation*    | 1. Never<br>2. Rarely<br>3. Sometimes<br>4. Almost always   |
| HIRAID Communication   |                    |   |
| 15 Nursing staff received communication from the ED NUM or educator reinforcing the use of HIRAID in the ED e.g. email communication, staff meetings                     | Communication*     | 1. There was NO COMMUNICATION from the directing staff to use HIRAID and/or complete training.<br>2. There was RARELY COMMUNICATION directing staff to use HIRAID and/or complete training.<br>3. There was SOMETIMES COMMUNICATION directing staff to use HIRAID and/or complete training<br>4. There was ALMOST ALWAYS COMMUNICATION regarding HIRAID use and/or completion of training |
| Please explain the type of communication staff received at your ED about the introduction and use of HIRAID  | communication_text | Free text   |
| 16 HIRAID posters were displayed in the ED   | Posters*           | 1. No posters<br>2. 1-3 posters<br>3. 3-4 posters<br>4. > 4 posters   |
| Please provide further details on where they were displayed, and where you think they were most noticed.<br><i>Show the field ONLY if: [posters] = '1' or '2' or '3'</i> | posters_comment    | Free text   |
| 17 The results of the HIRAID documentation template use audits were communicated to ED nursing staff   | feedback           | 1. NO feedback was provided directly to staff<br>2. Feedback was RARELY given to staff  |

| Field Label   | Variable   | Field attributes  |                 |
|---|--|---|-----------------|
|   |  | 3. Feedback was given about HALFTHE TIME to staff<br>4. staff were ALMOST ALWAYS provided feedback on the audit results |                 |
| Please explain how feedback was provided e.g. informally direct to staff, formal communication via email<br><i>Show the field ONLY if: [feedback] = '1' or '2' or '3'</i> | feedback_text  | Free text   |                 |
| <b>HIRAID Feedback</b>  |  |   |                 |
| 18  | What do you like about the HIRAID framework for emergency nurses?  | experience1   | Free text       |
| 19  | What do you not like about the HIRAID framework for emergency nurses?  | experience2   | Free text       |
| 20  | Would you be interested in participating in a short interview related to your experience introducing HIRAID into your ED? If you select 'yes' we will be in touch in the near future to provide you with further information, so you can decide if you would be happy to talk to us. | Interview*  | 1. Yes<br>0. No |

\*Mandatory fields for completion

### Survey completion

Thank you for taking the survey, we will be in touch with your voucher when the survey has closed.

We will contact you directly if we require any further information in relation to your responses.

Have a nice day!

## Appendix 15: Emergency Nurse Survey Post Implementation

*Surveys established in REDCap*

### Survey instructions

Thank you for taking the time to give your perspective on both nursing assessment when caring for a patient after triage, and the introduction of HIRAID in your emergency department.

This is a follow up survey now that you have introduced HIRAID into your emergency department.

All nursing staff permanently employed in the ED are invited to participate. Your responses will help us evaluate the introduction of HIRAID in Southern NSW Emergency Departments/ Multipurpose Services.

This survey should take no longer than 15 minutes.

On completion of the survey, you will have the opportunity to provide your contact details to receive a \$20 gift voucher, as acknowledgement for your time. The details you provide will not be linked to your survey. Your responses remain confidential, and you cannot be identified.

If you have any questions related to this research study, please contact one of the investigators below prior to proceeding.

[Site investigator details removed]

| Item no.     | Field label  | Variable          | Field Attributes   |
|--------------|--|-------------------|--|
| 1            | If you have not read the participant information, a copy can be accessed below.          | desc1             | Link PIS Nursing   |
| 2            | Please confirm you have read and understood the participant information provided to you. | Consent*          | 1. I have read the participant information sheet                         |
| Demographics |  |                   |  |
| 3            | Current position<br><i>Select one</i>  | current_position* | 1. RN<br>2. EEN<br>3. Leadership role - NUM / CNC /CNS / CNE<br>4. Other |

| Item no. | Field label  | Variable                | Field Attributes   |
|----------|--|-------------------------|--|
|          | Other position<br>Show the field ONLY if: [current_position] = '4'   | current_position_other* | Free text  |
| 4        | How many years have you worked as a nurse?   | Years*                  | text (integer. Min: 0. Max: 50).Required   |
| 5        | How many years have you worked as a nurse in the emergency department?   | years_ed*               | text (integer. Min: 0. Max: 50).Required   |
| 6        | Please tick your highest level of post-graduate nursing qualification.   | Qualification*          | 1. None<br>2. Graduate Certificate<br>3. Graduate Diploma<br>4. Masters/ PhD<br>5. Other   |
|          | Please provide details on other level of postgraduate qualification<br>Show the field ONLY if: [qualification] = '5' | qualification_other*    | Free Text  |
| 7        | What areas of the ED do you work?<br><i>Select all applicable</i>  | areas_worked*           | 1. General acute area<br>2. Fast track<br>3. Paediatrics<br>4. Triage<br>5. Resuscitation room<br>6. Clinical Initiatives Nurse<br>7. Emergency short stay area / unit<br>8. other |
|          | Please provide details on other areas worked in ED<br>Show the field ONLY if: [areas_worked(8)] = '1'                |                         | Free text  |
| 8        | Please select the Southern NSW facility that you currently work at most.   | Site*                   | 1. Batemans Bay Hospital<br>2. Bega District Hospital<br>3. Bombala Hospital<br>4. Braidwood (MPS)<br>5. Cooma Health Service  |

| Item no.  | Field label   | Variable    | Field Attributes   |
|---|---|-------------|--|
|   |   |             | 6. Crookwell Hospital<br>8. Goulburn Hospital<br>9. Moruya Hospital<br>10. Pambula District Hospital<br>11. Queanbeyan Health Service<br>12. Yass Health Service |
| <b>Evaluation of the HIRAID Framework</b>   |   |             |  |
| The questions below ask about the strategies used to introduce HIRAID to your ED. To help HIRAID implementation at other hospitals, we want to know about your experience. Please be honest and provide more details where you can. |   |             |  |
| 1   | Did you watch the short video about HIRAID featuring Southern NSW Local Health District staff?  | Video*      | 1. Yes<br>0. No  |
| 2   | Were you given a HIRAID flip card to attach to your hospital ID?  | Flipcard8   | 1. Yes<br>0. No  |
| 2a  | Did you attach to your ID?<br>Show the field ONLY if: [flipcard] = '1'  | flipcard_1* | 1. Yes<br>0. No  |
| 2b  | Have you ever used the flip card attached to your ID to help your recall of HIRAID?<br>Show the field ONLY if: [flipcard] = '1'                     | flipcard_2* | 5. Always<br>4. Most of the time<br>3. Sometimes<br>2. Seldom<br>1. Never  |
| 3   | Did you receive any HIRAID education from a CNC/ Nurse educator or HIRAID clinical champion?<br><i>If you attended train the trainer select yes</i> | Education*  | 1. Yes<br>0. No<br>3. Cannot recall  |
| 3a  | How was this education delivered?<br>Show the field ONLY if: [education] = '1'  | edu_del*    | 1. in-service (group) away from clinical area<br>2. in-service (group) in clinical area<br>3. 1:1 away from clinical space<br>4. 1:1 in clinical area            |

| Item no. | Field label   | Variable        | Field Attributes  |
|----------|---|-----------------|---|
|          |   |                 | 5. Skype/ remote learning<br>6. other                                     |
|          | Please explain how the education was delivered<br>Show the field ONLY if: [edu_del] = '6'                                     | edu_del_other*  | Free Text   |
| 3b       | What were the good things about the HIRAID education?<br>Show the field ONLY if: [education] = '1'                            | edu_comment     | Free Text   |
| 3c       | What were the bad things about the HIRAID education?<br>Show the field ONLY if: [education] = '1'                             | edu_comment2    | Free Text   |
| 4        | Do you think about the HIRAID components as you do a patient assessment in the ED?  | hiraid_recall1* | 5. Always<br>4. Most of the time<br>3. Sometimes<br>2. Seldom<br>1. Never |
| 5        | Do you think HIRAID helps you remember to do all parts of a full assessment when needed?                                      | hiraid_recall2* | 5. Always<br>4. Most of the time<br>3. Sometimes<br>2. Seldom<br>1. Never |
| 5a       | Tell us why HIRAID supports you in patient assessment<br>Show the field ONLY if: [hiraid_recall2] = '5' or '4' or '3'         | hiraid_comm1    | Free text   |
| 5b       | Tell us why HIRAID does not support you in patient assessment<br>Show the field ONLY if: [hiraid_recall2] = '3' or '2' or '1' | hiraid_comm2    | Free text   |
| 6        | Do you use the HIRAID documentation templates in ED for your initial documentation (post triage)?                             | docu_temp*      | 5. Always<br>4. Most of the time<br>3. Sometimes<br>2. Seldom<br>1. Never |

| Item no. | Field label  | Variable             | Field Attributes   |
|----------|--|----------------------|--|
|          | What are the reasons that you do not use it? ##<br><i>Select all that apply</i><br>Show the field ONLY if:<br>[docu_temp] = '4' and '3' and '2'and '1' and '1' | docu_no              | 1. Takes too long<br>2. Too hard to follow<br>3. I don't need to do an assessment on some patients<br>4. Too much detail needed<br>5. Not appropriate for patient presentation<br>6. I have my own way<br>7. Other |
|          | Please explain 'other' reason/s for not using the HIRAID template. ##<br>Show the field ONLY if: [docu_no] = '7'   | docu_other           | Free text*   |
| 7        | Please tell us more about why you do / do not use the HIRAID documentation templates   | docu_comment         | Free text  |
| 8        | Do you think HIRAID helps teach new emergency nurses how to assess and manage patients?  | hiraid_teach*        | 5. Always<br>4. Most of the time<br>3. Sometimes<br>2. Seldom<br>1. Never  |
| 9        | Please tell us why HIRAID does / does not support new emergency nurses to assess and manage ED patients.   | hiraid_teach_comment | Free text  |

\*Compulsory field. ## error in survey logic, field not available for completion

#### Survey Completion text

The next page will take you to a separate form where you can choose which place would you like your \$20 voucher for. Your responses to this survey are NOT linked to the voucher form. This means your responses will remain confidential and cannot be identified.

If you would like to proceed to claim your \$20 voucher, please [click here to complete your details](#). If you do not want to receive a \$20 voucher, please select close survey to end this session.

# Appendix 16: Emergency Nurse Interview Participant Information Sheet



THE UNIVERSITY OF  
SYDNEY

Susan Wakil School of Nursing and Midwifery  
Faculty of Medicine and Health



Health  
Southern NSW  
Local Health District

ABN 15 211 513 464

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## Implementation and evaluation of an evidence-informed emergency nursing framework in clinical practice (HIRAID)

### NURSING STAFF INTERVIEWS PARTICIPANT INFORMATION STATEMENT

#### (1) What is this study about?

We are conducting a research study evaluating the implementation of The HIRAID Framework for emergency nurses. HIRAID is the only validated framework designed to teach emergency nurses how to systematically assess and manage emergency patients after the triage process.

This Participant Information Statement tells you about the research study. Please read this sheet carefully and ask questions about anything that you don't understand or want to know more about.

Participation in this research study is voluntary.

#### (2) Who is running the study?

The study is being carried out by the following researchers: Professor Kate Curtis<sup>1,2</sup>, Professor Margaret Fry<sup>3</sup>, Professor Julie Considine<sup>4</sup>, Professor Ramon Shaban<sup>1,5</sup>, Mr Hatem Alkhouri<sup>6</sup>, Professor Steven McPhail<sup>7</sup>, A/Professor Michael Dinh<sup>8</sup>, A/Professor Christina Aggar<sup>9</sup>, Dr James Hughes<sup>10</sup>, Dr Margaret Murphy<sup>5</sup>, Ms Louise Casey<sup>11</sup>, Ms Joanne Dungey<sup>11</sup>, Ms Vivienne Chapman<sup>11</sup>, Dr Mary Lam<sup>1</sup>, Ms Belinda Kennedy<sup>1</sup>, Dr Cristina Sotomayor-Castillo<sup>1</sup>.

<sup>1</sup>Susan Wakil School of Nursing and Midwifery, University of Sydney, <sup>2</sup>Illawarra Shoalhaven Local Health District, <sup>3</sup>The University of Technology Sydney, <sup>4</sup>Deakin University, <sup>5</sup>Western Sydney LHD, <sup>6</sup>Emergency Care Institute, <sup>7</sup>Queensland University of Technology, <sup>8</sup>Sydney LHD, <sup>9</sup>Northern NSW LHD, <sup>10</sup>Southern NSW Local Health District

This study is being funded by a NHMRC partnership grant (GNT2005403).

#### (3) Who can take part in this study?

We are seeking emergency nursing staff who were working in the emergency department during the introduction of the HIRAID framework for emergency nurses.

You are invited to take part in this study because you have participated in the implementation activities and we want to know about your experience.

You are free to tell people about the study.

**(4) What will the study involve for me?**

If you agree to participate, it will involve a short semi structured interview with a researcher from The University of Sydney. The interview will be conducted at a time convenient to you, via zoom or telephone. It is anticipated that the interview will take 20-30 minutes of your time.

You will be asked about the education and support you were provided during the introduction of HIRAID in your workplace. The purpose of the interview is to better understand what strategies used in the introduction of HIRAID staff found most effective and why, or why not, staff wish to engage in using the HIRAID framework in practice.

Interviews will be recorded. The recording will be transcribed, with transcripts de-identified and a unique study ID allocated, prior to content analysis. No individual will be able to be identified in the analysis of the results. If you would like to review the transcript prior to de-identification, you can do so by contacting the project manager within one week of interview.

**(5) Can I withdraw from the study once I've started?**

Being in this study is completely voluntary and you do not have to take part.

Your decision whether to participate will not affect your current or future relationship with the researchers or anyone else at the University of Sydney, your employment in your respective Local Health District, your relationship with your managers or other members of staff within your team. Your employer will not know you have participated unless you chose to disclose to them yourself.

You can withdraw from the study at any time prior to de-identification of the transcript. During interviews you have the right to refuse to answer any questions that you do not wish to answer. You can request that any part of your interview be erased and not included in the study. You may also cease an interview that is underway at any stage. If you participate in an interview and do not wish to continue, the audio recording will be erased, and the information provided will not be included in the study. If you decide to withdraw from the study, after completing the interview you can do this by contacting the project manager, Dr Cristina Sotomayor-Castillo, [crisrina.sotomayor@sydney.edu.au](mailto:crisrina.sotomayor@sydney.edu.au), within one week of interview.

**(6) Are there any risks or costs associated with being in the study?**

Aside from giving up your time, we do not expect that there will be any risks or costs associated with taking part in this study.

**(7) Are there any benefits associated with being in the study?**

You will not receive any direct benefits from being in the study.

**(8) What will happen to information about me that is collected during the study?**

By providing your consent, you are agreeing to us collecting the information as stated for the purposes of this research study.

Any information you provide us will be stored securely and we will only disclose it with your permission, unless we are required by law to release information. We are planning for the study findings to be published. You will not be individually identifiable in these publications.

Interview recordings will be stored on the Research Data Store, secure data base at The University of Sydney. Interviews will be transcribed and de-identified, with a unique study ID allocated, prior to content analysis. No individual will be able to be identified in the analysis of the results. The chief investigator controls access to the data, with only researchers directly involved in the analysis to be

granted access to the data collected. Study data will be stored securely at The University of Sydney for 15 years, after which they will be destroyed.

**(9) Will I be told the results of the study?**

You have a right to receive feedback about the overall results of this study. This feedback will be in the form of presentations through the Local Health District and publications related to the study will be circulated to staff. If you wish to request direct feedback, this can be done by contacting the project manager Dr Cristina Sotomayor-Castillo, [cristina.sotomayor@sydney.edu.au](mailto:cristina.sotomayor@sydney.edu.au). You will receive this feedback after the study is finished, this will be in the form of a brief lay summary.

**(10) What if I would like further information about the study?**

When you have read this information, if you have any questions related to the study, please contact Professor Kate Curtis ( [kate.curtis@sydney.edu.au](mailto:kate.curtis@sydney.edu.au) ), and she will arrange a time to discuss with you further.

**(11) What if I have a complaint or any concerns about the study?**

The ethical aspects of this study have been approved by the HREC of the Greater Western Area Health Service, according to the *National Statement on Ethical Conduct in Human Research (2007)*. This statement has been developed to protect people who agree to take part in research studies.

If you are concerned about the way this study is being conducted or you wish to make a complaint to someone independent from the study, please contact the Manager Research Ethics, Greater Western Area Health Service HREC on 02 6330 5948, or email [wswlhd-ethicscommittee@health.nsw.gov.au](mailto:wswlhd-ethicscommittee@health.nsw.gov.au) . Please quote the study title and protocol number.

*This information sheet is for you to keep*

Susan Wakil School of Nursing and Midwifery  
Faculty of Medicine and Health

ABN 15 211 513 464

**Kate Curtis**

*Professor of Trauma and Emergency Nursing*

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The University of Sydney  
NSW 2006 AUSTRALIA  
Telephone: +61 2 9351 0604  
Email: [kate.curtis@sydney.edu.au](mailto:kate.curtis@sydney.edu.au)  
Web: <http://www.sydney.edu.au/>

**Implementation and evaluation of an evidence-informed emergency nursing framework in  
clinical practice (HIRAID)**

**STAFF INTERVIEWS- PARTICIPANT CONSENT FORM**

**Declaration by Participant**

- ✓ I understand the purpose of the study, what I will be asked to do, and any risks/benefits involved.
- ✓ I have read the Participant Information Statement and have been able to discuss my involvement in the study with the researchers if I wished to do so.
- ✓ The researchers have answered any questions that I had about the study and I am happy with the answers.
- ✓ I understand that being in this study is completely voluntary and I do not have to take part. My decision whether to be in the study will not affect my relationship with my employer or researchers at the University of Sydney, now or in the future.
- ✓ I understand that my participation will be audio-taped and the transcript will be de identified with reference to any names removed prior to analysis.
- ✓ I understand that I am free to withdraw from this study at any time and that I can choose to withdraw any information I have already provided prior to de-identification and analysis of the transcript.
- ✓ I understand that the results of this study may be published, and that publications will not contain any identifiable information about me.

|   |
|---|
| Name of Participant (please print) _____    |
| Name of researcher confirming consent _____ |
| Researcher Signature _____ Date _____       |

*Copy of completed consent to be sent to participant via post/email*

# Appendix 17: Interview Booking

## Email Invitation

**Subject:** HIRAID interviews- tell us about your experience  
**Date:** Monday, 18 October 2021 9:35:00 AM  
**Attachments:** [Appendix18\\_PIS\\_and\\_consent\\_staff\\_interviews\\_SNSW\\_14Sept21.pdf](#)  
**Importance:** High

---

Good morning,

Thank you for indicating an interest to participate a semi structured interview related to your experience with the introduction of HIRAID emergency nursing framework into your ED.

Attached is a copy of the full participant information sheet for your reference, if you have any questions related to the interviews please get in touch via email or phone.

Interviews bookings are currently available from Thursday 28<sup>th</sup> October to Saturday 4<sup>th</sup> December. You can view available times, and make bookings for a time that suits you via the following link.

<https://outlook.office365.com/owa/calendar/HIRAIDinterviews@unisyd.onmicrosoft.com/bookings/s/GLy1hwbMJEC1rWIEKvV8Sw2>

Within two weeks of completing the interview, you will receive a \$50 eGift voucher as acknowledgement of your time. Interviews are anticipated to take up to 30 minutes over the phone, the bookings are made for one hour in the event they are slightly longer.

If you cannot find a suitable time, or require assistance to book, please reply to this email and we will work to arrange a time that suits you.

I look forward to speaking with you.

Best wishes,  
Belinda

Belinda Kennedy | RN, BN, MPhil (Nurs)  
Project Manager | PhD Candidate  
Susan Wakil School of Nursing and Midwifery  
Faculty of Medicine and Health

Rm 169, RC Mills | The University of Sydney | NSW | 2006  
[REDACTED]

E [belinda.kennedy@sydney.edu.au](mailto:belinda.kennedy@sydney.edu.au) | W <http://sydney.edu.au/nursing/>

I work flexibly. I'm sending you this message now because it's a good time for me, but do not expect you to read, respond or action it outside your regular hours.

# Interview Booking Page Example

## HIRAID interviews

HIRAID interview  
1 houri

---

May 28

< > May 2025

| M  | T  | W  | T  | F  | S  | S  | 10:00 | 10:30 | 11:00 |
|----|----|----|----|----|----|----|-------|-------|-------|
|    |    |    | 1  | 2  | 3  | 4  | 11:30 | 12:00 | 12:30 |
| 5  | 6  | 7  | 8  | 9  | 10 | 11 | 13:00 | 13:30 | 14:00 |
| 12 | 13 | 14 | 15 | 16 | 17 | 18 | 14:30 | 15:00 | 15:30 |
| 19 | 20 | 21 | 22 | 23 | 24 | 25 |       |       |       |
| 26 | 27 | 28 | 29 | 30 | 31 |    |       |       |       |

⌚ All times are in (UTC+10:00) Canberra, Melbourne, Sydney ▼

---

**Add your details**

Notes

Add any special requests (optional)

Book

## Booking Confirmation

Example booking confirmation, sent to participant and duplicate sent to thesis author as the person allocated to the calendar.

**Subject:** New booking: Bob Charles for HIRAID interview  
**Date:** Monday, 26 May 2025 12:39:17 PM

---

New booking from  
**Bob Charles**

---

HIRAID interview with  
Belinda Kennedy



Wednesday, 28 May 2025  
10:00 - 11:00  
(UTC+10:00) Canberra, Melbourne, Sydney

Additional Information

Thank you for making your booking for HIRAID  
interview.

You will be called on the phone number provided in  
the booking.

If you have any questions please contact Belinda,  
[belinda.kennedy@sydney.edu.au](mailto:belinda.kennedy@sydney.edu.au)

HIRAID interviews [REDACTED]

You are receiving this email notification because you are an active staff  
member for this booking calendar.

[Manage your membership](#)

# Appendix 18: Detailed Interview Guide



THE UNIVERSITY OF  
SYDNEY

## Nursing staff INTERVIEW GUIDE

---

### Interview Preamble for staff who agreed to participate

1. Thank you for booking the time for interview today, is now still a good time for you?  
*My name is Belinda, I am an emergency nurse with more than 15 years experience and I currently work for the University of Sydney on the HIRAIID project.*
2. After reading the participant information that was emailed through, do you have any questions for me about the study?  
*Yes – answer any questions prior to proceeding, if they decide not to proceed thank them for their time.  
No – continue*
3. We have eighteen questions, it will take us approximately 20- 30 minutes to complete.  
Are you happy to go ahead with the interview now?  
*Yes – continue  
No – thank them for their time and consideration*
4. I will complete the consent form that is on the back of your participant information. Would you like a copy emailed to you?
5. Is it alright if I start the recording now. The recording will ensure I do not miss anything you tell me. If at any time during the interview you need me to stop recording just tell me
6. Before we start with the questions, I just need to check some basic demographic details. Are you happy if I do that now?

## HIRAID INTERVIEW DEMOGRAPHICS

Interview number: \_\_\_\_\_ Interview date: \_\_\_\_\_

Attended formal train the trainer session:  Yes  No

Gender:  Female  Male

Interview start time: \_\_\_\_\_

Site: \_\_\_\_\_

1. Years working in emergency department: \_\_\_\_\_

2. Years working as a registered nurse: \_\_\_\_\_

3. Age: \_\_\_\_\_

4. Highest level of qualification:  Bachelor's degree  
 Graduate Certificate  
 Master's or above  
 Other: \_\_\_\_\_

Interview stop time: \_\_\_\_\_

## SEMI STRUCTURED INTERVIEW SCHEDULE

---

1. Did you have a role in the implementation of HIRAID at your emergency department?  
(*PROMPT: train the trainer; responsibility designated; part of work role*)

---

2. What do you think the purpose of the HIRAID framework is?

---

I would like to ask you about the different parts of the framework.

3. Has the introduction of HIRAID changed the way you approach history taking in ED?  
(*PROMPTS: consistent; more thorough, focussed on relevant details, examples*)  
*How is it different from before (examples)*  
*PROBE: Do you think that is the same for your colleagues?*  
What about others?

- 
4. Has HIRAID resulted in any change in your physical assessment of the patient?  
*(PROMPTS: quality of assessment, relevant focused physical assessment. For you/ other nurses, examples of practice change)*  
*How has it changed your/ others practice?*  
*(systematic, better documentation, more focussed assessment)*

---

**HIRAID advocates nurses identify red flags as they are assessing their patient.**

5. Do you think HIRAID has changed practice related to recognition, or understanding, of red flags?  
*(PROMPTS: documented in notes; informed decision making; escalation, examples)*

- 
6. Has the introduction of HIRAID changed nursing interventions or investigations in the ED?  
*(PROMPTS: pain relief; pathology; imaging; communication treatment needs)*  
*More thorough, greater confidence – communication/ instigating treatment*

- 
7. Has HIRAID improved timeliness of care in your ED?

- 
8. Thinking about communication, written or verbal, do you feel there has been any change in how you communicate about patient care?  
*(PROMPTS: handover; concise information; clear message; effective escalation; initiation of care; clinical documentation- Probe for written and verbal, examples if change indicated)*  
**PROBE:** what about for other nurses, has there been any change in their communication?
-

---

**Evaluation HIRAID implementation strategies**

9. Can you describe the support provided to you in the clinical environment with the introduction of HIRAID?  
(**PROMPT:** access to someone who knew about HIRAID educators/ clinical champions, posters, any other resources, templates)  
**Probe:** Did you find anything else useful?

---

**I am keen to explore the education delivered to introduce HIRAID in your ED**

10. What did you think about the eLearning?  
(**PROMPT:** likes/ dislikes, relevance, logic, flow)  
**Probe:** How did you find it compared with other learning modules you have done? e.g. HETI modules

- 
11. Can you tell me what you thought about the face-to-face education you received?  
(**PROMPT:** likes/ dislikes, relevance, content)

- 
12. Did you find the face-to-face education more helpful than the elearning module?  
(Which learning method do you prefer?)

- 
13. What is your experience using the HIRAID documentation templates?  
(**PROMPTS:** Flow; logic; relevance; format; ease of access)  
**PROBE:** Did you use them as they were or change them?  
Did you use the different templates depending on the presentation?
-

---

14. Were any of the strategies used to implement HIRAID particularly helpful?

**PROMPT RESOURCES:** -flip cards; educators/staff champions assisting and answering questions; posters, education).

**PROBE:** Why was it helpful?  
Can you recall any other that you found helpful?

---

**Nearly there, just four more questions**

15. Do you think HIRAID has been well received by staff in your ED?

(**PROMPT:** nursing staff; medical staff)

**Probe:** What makes you think that? Can you give me an example?

(**PROMPT example:** a situation where it was clear it was being used, graded assertiveness, nurse advocacy- request pain relief, initiation of treatment; clinical handover)

---

16. Were there any challenges using HIRAID in practice?

(**PROMPT** time; requirements; initiation treatment)

---

17. Do you recall any feedback given to staff about how it was going introducing HIRAID in your ED?

(**PROMPTS:** audit results; documentation informal feedback on use)

**PROBE:** Who was it that gave you that feedback

---

---

18. Do you feel, with HIRAID, assessment and documentation is better in your department than before it was introduced?

**(Prompts:** consistent assessment, initiation treatment/ diagnostics; recognition clinical urgency; safer practice; prevention of deterioration; escalation)

**PROBE:** What make you say that

---

Are there any other comments you would like to make?

---

Thank you for taking the time to talk to me today.

I am extremely grateful for your input, what you have told me is so valuable to truly understand the experience of those using HIRAID in different contexts.

I will get your voucher arranged for you, it will be sent to your email address

**Interview stop time:** \_\_\_\_\_

## Appendix 19: Data Management Plan

### Implementation evaluation of an evidence-informed emergency nursing framework in clinical practice

#### Description:

HIRAID is an evidence-based emergency nursing assessment framework. The project was initially evaluated in Illawarra Shoalhaven LHD (ISLHD). The next stage of the project will involve the implementation and evaluation of HIRAID across four clusters - Southern NSW LHD, Northern NSW LHD, Western Sydney LHD, Eastern Health (Victoria) and Royal Brisbane & Woman's Hospital.

### Project Details

---

**Project Short Code:** HIRAID

**Lead Investigator:** Kate Curtis

**Data Classification:** Protected

#### Project Timeline:

- Created on: 2020-03-09
- Active since: 2020-03-09

**Faculty:** Faculty of Medicine and Health

**IRMA ID/s:** 208378

**Indigenous Community:** No

Research Data Management Planning

#### Data Management Notes

##### Funding Source

ISLHD - funded by Agency for Clinical Innovation and Australasian College of Nursing  
Larger evaluation: NHMRC GNT2005403

##### Data

There are four data sources:

1. Rapid response data- records identified via the local reporting processes (PACE/ Rapid response, etc) are reviewed with data entered into REDCap.
2. Clinical documentation - medical records identified meeting inclusion criteria entered into REDCap reviewed for documentation quality and time to analgesia.
3. Staff surveys
4. Patient Evaluation surveys

All data collected from the above sources for the evaluation for HIRAID is to be collected using Research Electronic Data Capture (REDCap)

Data produced will be numerical/ text, saved in csv format when downloaded from REDCap.

PACE data from ISLHD is provided and stored in Excel format.

SPSS to be used for analysis of quantitative data and NVIVO to be used for qualitative data.

Metadata

Metadata related to the project include study protocol, survey instruments, data dictionary. All metadata will be saved on The University of Sydney OneDrive, with access mediated by CI Professor Curtis, with final versions also kept with data saved in RDS.

A README T(text) document in the RDS folder keeps record of all metadata in the RDS

**Ethical/ privacy**

Data collected from data source 1-2 will contain individual identifiers, with data separated per the study protocol prior to analysis

Survey data collected (source 3 and 4) will be deidentified, with no personal information collected at the time of survey completion.

Study will have ethical approval prior to commencement.

What will you do with data after the project is complete?

Data will be archived on completion of project, with access mediated or restricted to approved individuals.


Data will be stored for a minimum of 15 years, in accordance with The University of Sydney policy for clinical trials.

**Data Management Declaration Exceptions**

None

## Project Members

---

| Name  | Role              | Admin | Data Declaration | Exceptions |
|---|-------------------|-------|------------------|------------|
| Kate Curtis   | Lead Investigator | ✓     | ✓                |            |
| Belinda Anne Kennedy  | Researcher        | ✓     | ✓                |            |
|  | Researcher        |       | ✓                |            |
|   | Researcher        | ✓     | ✓                |            |

External Collaborators

| Credential | Name | Email | Role |
|------------|------|-------|------|
|------------|------|-------|------|

## Research Services

---

High Performance Computing (HPC)

-

Research Data Storage

RDS - \\shared.sydney.edu.au\research-data\PRJ-HIRAIID

Specialty Platforms

Imaging Data Service: No

## Appendix 20: Implementation Strategy (Publication 3, Supplementary Material)

### HIRAID® Proposed Implementation Strategy

| Proposed Activities           | Overview   | Target/ outcome measure   |
|-------------------------------|--|---|
| <b>Stakeholder engagement</b> | <p>It involves engaging and collaborating with individuals who will be key to supporting the implementation activities across the health district.</p> <p>Investigators conducted site visits to nine sites in September 2020, meeting with managers and clinical staff to provide a brief overview of HIRAID® and the background behind the framework. Monthly meetings were established for a local steering committee with representatives from across all sites and will continue through implementation, to be revised at 12 weeks to determine ongoing requirements.</p> <p>Site representatives invited are emergency department Nurse Managers and/or staff responsible for coordinating and/or delivering education, e.g., clinical nurse consultants, and nurse educators.</p>   | <p><b>Target:</b> representative attendance at monthly steering committee meetings at minimum until the end of the implementation period (12 weeks),</p> <p>Record stakeholder meeting attendance per site.</p>   |
| <b>eLearning module</b>       | <p>It is a self-directed module targeted at end users to increase their knowledge related to the HIRAID® Emergency Nursing Framework, to be completed by emergency nurses at the beginning of implementation, and ongoing new staff on commencing employment in the ED.</p> <p>The module aids in knowledge and skill development through demonstration and instruction on behaviour for the HIRAID® framework stages. It also provides information related to the health consequences and benefits and enables practice rehearsal through interactive design, adult learning principles and activities to reinforce content. Developed by Dr Belinda Munroe and Professor Kate Curtis, along with emergency nursing and educational experts, the education module is available via My Health Learning, a state-based eLearning system.<sup>1</sup></p> <p>All NSW Health staff have access to My Health Learning in the workplace and remotely if required. The plan for staff completion will require consultation with sites; taking into consideration access to computer resources, the training plan may need to be modified to cater to individual site staffing and resources.</p> | <p><b>Target:</b> 80% completion emergency nurses</p> <p>All ED staff and relevant ward staff at each site will be recorded in site audit records.</p> <p>Staff will provide a copy of the certificate of completion to the CNC/ Nurse educator or HIRAID Champion designated to track completion for the site.</p> |

<sup>1</sup> HIRAID eLearning has been updated since this study.

Details for current eLearning accessible <https://www.sydney.edu.au/medicine-health/our-research/research-centres/project-hiraid.html>

## HIRAID® Proposed Implementation Strategy

|  |  |  |
|--|--|--|
| <p><b>Train the Trainer Course</b></p> | <p>This course prepares individuals to deliver training and/or support the implementation of HIRAID® within the local health district.</p> <p><u>Course synopsis:</u> The course is a 6.5-hour program for emergency nurses that teaches the HIRAID® components and rationale. It includes lectures (PowerPoint) and simulations delivered by an experienced emergency nurse leader in HIRAID® training. Lunch is provided, and people attending are identified by Nurse Managers/ CNCs/ NE across the district.</p> <p><u>Overview:</u><br/>The course provides education and training on the HIRAID® framework with case study presentations and role-play activities to apply knowledge. It will equip staff to act as role models across the site, with the capacity to support and teach the HIRAID framework across SNSW LHD.</p> <p>The teaching includes site-specific information that identifies the need for practice change and highlights the benefits, identified through previous research, of applying the HIRAID framework into clinical practice. Feedback from nursing staff who have used the framework at other sites is incorporated into the training. Instruction will be provided on feedback processes for the health district (i.e. auditing site compliance to enable comparison of sites across the district).</p> <p>Nursing staff will be empowered to communicate with colleagues related to the practice to ensure a consistent message is delivered, instructors will work to brainstorm with participants how they may communicate with staff who are less receptive, some <u>examples of</u> phrases that may assist when encountering resistance from fellow staff members:</p> <ul style="list-style-type: none"> <li>• <i>“I use HIRAID, it helps me ensure I have covered everything I need to when it is busy....”</i></li> <li>• <i>“The evidence supports us using HIRAID, I use it as I want to ensure I am providing the best care I can for my patients...”</i></li> </ul> <p>Delivering the course on multiple occasions at different sites will enable access from across the LHD. Consultation with the LHD on the most appropriate locations and number of courses required.</p> | <p><b>Target:</b> Minimum one champion from each site that is not part of the education team.</p> <p>Measured based on attendance records.</p> |
|--|--|--|

## HIRAID® Proposed Implementation Strategy

|  |   |   |
|--|---|---|
| <p><b>Inservice (short education)</b></p>              | <p>The short face to face education helps to consolidate the information learned from self-directed learning, receiving direct feedback on the application.</p> <p><u>Synopsis:</u> A 45-minute session with an explanation of HIRAID®, including visual prompts (slides) and interactive. Delivered by emergency educators and staff identified as HIRAID® champions, who completed the Train the trainer course.</p> <p><u>Overview:</u><br/>The short education builds on the content delivered in the online module. In addition to aiding knowledge development, it aids in the application of the skill through case study presentation and staff engagement as the case progresses through each stage of the HIRAID framework. The integration of role-play in training will increase staff confidence and capacity using the HIRAID framework.</p> <p>The education session includes the benefits of HIRAID® use in clinical practice, encompassing the benefit to patients and staff, along with improved communication and confidence related to patient assessment findings.</p> <p>The teaching includes site-specific information that identifies the need for practice change and highlights the benefits, both for patients and staff, identified through previous research of the HIRAID® framework in practice. The environmental changes (eMR templates, FLIP cards) to be implemented with the roll out of HIRAID in clinical practice will be covered in the session. The teaching session will reinforce the messages communicated by executives and managers related to the requirement that the framework be implemented in clinical practice. Staff will be informed of the audits and evaluation to be undertaken related to the HIRAID® framework implementation.</p> <p><b>Course to reinforce the variety of templates, full detailed assessment not required for all presentations.</b></p> <p>The session can be delivered face-to-face or through virtual platforms if required. The delivery plan will be established based on individual site needs.</p> | <p><b>Target:</b> 80% emergency nursing attendance</p> <p>Attendance at training will be recorded for each site.</p> <p>Evaluation by attendees will identify the components covered during the teaching.</p> |
| <p><b>eMR modification- documentation template</b></p> | <p>HIRAID documentation templates will be incorporated into eMR, and all staff will be set up to have them available for documentation. The templates support mental recall with prompts for content. Previous documentation templates will be removed from eMR.</p>  | <p><b>Target:</b> 80% staff using</p> <p>Use evaluated through a routine audit – CNC/ NE/ HIRAID champions audit 6 and 12 weeks.</p>  |

## HIRAID® Proposed Implementation Strategy

|                                      |   |  |
|--------------------------------------|---|--|
| <b>Video-Promo</b>                   | <p><b>Overview:</b> The HIRAID video will be a short 2-minute video that outlines the HIRAID® framework. The video will promote familiarity with the framework and how it fits with existing practice. It will include information related to the benefits of using the framework in clinical practice and the mechanisms in place to support use.</p> <p>The video promoting the use of the HIRAID framework includes staff from various roles, including nursing, medical, and executive.</p>   | <p><b>Target:</b> minimum 80% will emergency nurses to view the video (as part of training)</p> <p>Proxy measures based on staff surveys indicate how many view the video</p>  |
| <b>Orientation process</b>           | <p>To promote sustainability, the HIRAID® training needs to be incorporated into existing ED nurse orientation programs.</p> <p>Training for the HIRAID® framework will be incorporated into department orientation and include eLearning, short in-service and role-play applications.</p> <p>Instruction on the HIRAID® templates will be incorporated into orientation, highlighting the difference in documentation to other clinical areas, and the expected practice standard in the emergency department.</p>  | <p><b>Target:</b> existing orientation programs to be updated and in place during the implementation period.</p> <p>Completion is to be tracked as per the standard process for monitoring orientation completion.</p>                     |
| <b>Short Comms (Posters, emails)</b> | <p>Communication related to staff expectations and the use of the HIRAID® framework will occur at the executive and local levels before the go-live date and during the roll-out phase.</p> <ul style="list-style-type: none"> <li>• The executive will email staff to communicate the expected use of HIRAID in clinical practice across the district.</li> <li>• Expectations will be reinforced at a local level via staff communication from managers through meetings, email communication and 1:1 communication.</li> <li>• Communication will include information on audit and follow-up to occur to monitor use, processes for staff not using in practice.</li> </ul> <p>Posters will be used to communicate the commencement and remind staff of the expectation for to be used in all ED clinical documentation.</p> | <p><b>Target:</b> Minimum one formal communication from the hospital executive at the commencement of implementation.</p> <p>Staff survey- feedback on communication received.<br/>Monitor formal communication during implementation.</p> |
| <b>Incentives</b>                    | <p>To motivate staff engagement, there will be an opportunity for material incentives for staff during the HIRAID® implementation.</p> <p>The audit process will monitor the use of HIRAID in practice. Sites have input into prize choice, e.g., ED text, and voucher.</p>   | <p><b>Target:</b> Sites aim for minimum 80% education completion and HIRAID audit template use.</p> <p>First three sites to achieve target to be rewarded.</p>   |
| <b>Modelling</b>                     | <p>Modelling the use of HIRAID® in clinical practice will occur through senior ED nurses completing the train-the-trainer education and using in practice. These staff will fulfil the role of HIRAID® Champions.</p> <p>HIRAID® champions will support clinicians to aid in skill development and encourage use in practice. A guide to role and expectations will be provided during training.</p>  | <p><b>Target:</b> Self-report measure via Implementation survey - instructors' response to use in practice</p>   |

### HIRAID® Proposed Implementation Strategy

|                                   |  |  |
|-----------------------------------|--|--|
| <b>Resources/ prompts</b>         | To aid in recall and support use in documentation, all emergency staff will be provided with a flip card that outlines the HIRAID framework to support recall of the framework and content.  | <b>Target:</b> All rostered staff should receive a flip card.<br>Proportion determined through implementation records and Staff survey responses.                        |
| <b>Reporting (Meetings, data)</b> | Feedback and monitoring- support for the HIRAID® framework will be supported through direct feedback on performance by CNCs, HIRAID® champions.<br>Evaluation of the implementation of HIRAID will be conducted pre- and post-implementation through patient/ staff satisfaction; documentation review; pain management in ED; patient deterioration events. | <b>Target:</b> Audit throughout initial three-month implementation- education (in service and e learning), Flip cards, documentation templates, HIRAID framework in use. |

ED- emergency department; eMR – electronic medical record; CNC- Clinical Nurse Consultant



## Appendix 21: Documentation Audit Results (Publication 4, Supplementary File 3)

### Supplementary File 3: Detailed Results of Documentation Audit

#### *Structure and Red Flags*

| Record structure                        | Pre (N = 110) n (%) | Post (N = 112) n (%) | p-value <sup>a</sup> |
|---|---------------------|----------------------|----------------------|
| Structured assessment framework present |                     |                      | < .001               |
| Yes                                     | 50 (45.5%)          | 94 (83.9%)           |                      |
| No                                      | 60 (54.5%)          | 18 (16.1%)           |                      |
| Structure used                          | n = 50              | n = 94               |                      |
| A-G (1)                                 | 36 (72%)            | 2 (2.1%)             |                      |
| HIRAID (old template) (2)               | 7 (14%)             | 10 (10.6%)           |                      |
| HIRAID (current template) (3)           | 0 (0%)              | 78 (83%)             |                      |
| Systems (4)                             | 0 (0%)              | 1 (1.1%)             |                      |
| Other (5)                               | 7 (14%)             | 3 (3.2%)             |                      |
| Red flags, mean (SD)                    |                     |                      |                      |
| No. red flags identified by auditor     | 2.8 (1.8)           | 2.5 (1.5)            |                      |
| No. red flags identified ED nurse       | 0.8 (1.3)           | 1.3 (1.3)            | .01                  |
| Percentage of red flags identified      | 27.5 (33.6)         | 54.7 (40)            | < .001               |

#### *History*

|                                 | Pre (N = 110) n (%) | Post (N = 112) n (%) | p-value <sup>a</sup> |
|---------------------------------|---------------------|----------------------|----------------------|
| History of presenting problem   |                     |                      |                      |
| <i>Chief complaint</i>          |                     |                      | < .001               |
| Yes                             | 56 (50.9%)          | 96 (85.7%)           |                      |
| No                              | 54 (49.1%)          | 16 (14.3%)           |                      |
| <i>Onset - time the symptom</i> |                     |                      | < .001               |
| Yes                             | 30 (27.3%)          | 65 (58%)             |                      |
| No                              | 80 (72.7%)          | 47 (42%)             |                      |
| <i>Onset - previous</i>         |                     |                      | .04                  |
| Yes                             | 7 (10.6%)           | 17 (25%)             |                      |
| No                              | 59 (89.4%)          | 51 (75%)             |                      |
| Not applicable                  | 44                  | 44                   |                      |
| <i>Related symptoms</i>         |                     |                      | < .001               |
| Yes                             | 34 (36.2%)          | 66 (68.8%)           |                      |
| No                              | 60 (63.8%)          | 30 (31.3%)           |                      |
| Not applicable                  | 16                  | 16                   |                      |

|  | Pre (N = 110) n (%) | Post (N = 112) n (%) | p-value <sup>a</sup> |
|--|---------------------|----------------------|----------------------|
| <i>Current/previous treatments</i>                 |                     |                      | .48                  |
| Yes  | 25 (31.6%)          | 25 (38.5%)           |                      |
| No   | 54 (68.4%)          | 40 (61.5%)           |                      |
| Not applicable                                     | 31                  | 47                   |                      |
| <i>Outcomes of current/previous treatments</i>     |                     |                      | .17                  |
| Yes  | 5 (15.2%)           | 12 (30.8%)           |                      |
| No   | 28 (84.8%)          | 27 (69.2%)           |                      |
| Not applicable                                     | 77                  | 73                   |                      |
| <i>Current/previous investigations</i>             |                     |                      | .02                  |
| Yes  | 3 (16.7%)           | 12 (40%)             |                      |
| No   | 15 (83.3%)          | 18 (60%)             |                      |
| Not applicable                                     | 64                  | 69                   |                      |
| <i>Outcomes of current/previous investigations</i> |                     |                      | .12                  |
| Yes  | 3 (16.7%)           | 12 (40%)             |                      |
| No   | 15 (83.3%)          | 18 (60%)             |                      |
| Not applicable                                     | 92                  | 82                   |                      |
| <i>Severity</i>                                    |                     |                      | .01                  |
| Yes  | 6 (8.8%)            | 24 (23.5%)           |                      |
| No   | 62 (91.2%)          | 78 (76.5%)           |                      |
| Not applicable                                     | 42                  | 10                   |                      |
| <i>Mode of arrival</i>                             |                     |                      | .004                 |
| Yes  | 33 (30%)            | 55 (49.1%)           |                      |
| No   | 77 (70%)            | 57 (50.9%)           |                      |
| <b>Pain assessment</b>                             | <b>(n = 66)</b>     | <b>(n = 66)</b>      |                      |
| <i>Location</i>                                    |                     |                      | < .001               |
| Yes  | 22 (33.3%)          | 46 (69.7%)           |                      |
| No   | 41 (62.1%)          | 20 (30.3%)           |                      |
| Not applicable                                     | 3                   | 0                    |                      |
| <i>Radiation</i>                                   |                     |                      | < .001               |
| Yes  | 3 (6.5%)            | 18 (35.3%)           |                      |
| No   | 43 (93.5%)          | 33 (64.7%)           |                      |
| Not applicable                                     | 20                  | 15                   |                      |
| <i>Characteristics</i>                             |                     |                      | .16                  |
| Yes  | 8 (14.3%)           | 15 (25.9%)           |                      |
| No   | 48 (85.7%)          | 43 (74.1%)           |                      |
| Not applicable                                     | 10                  | 8                    |                      |
| <i>Aggravating factors</i>                         |                     |                      | .02                  |
| Yes  | 3 (6.7%)            | 14 (26.4%)           |                      |
| No   | 42 (93.3%)          | 39 (73.6%)           |                      |
| Not applicable                                     | 21                  | 13                   |                      |

|  | Pre (N = 110) n (%) | Post (N = 112) n (%) | p-value <sup>a</sup> |
|--|---------------------|----------------------|----------------------|
| <i>Relieving factors</i>                                 |                     |                      |                      |
| Yes  | 1 (2.2%)            | 8 (14.8%)            | .04                  |
| No   | 44 (97.8%)          | 46 (85.2%)           |                      |
| Not applicable   | 21                  | 12                   |                      |
| <b>Individual history</b>                                |                     |                      |                      |
| <i>Allergies or nil known noted</i>                      |                     |                      |                      |
| Yes  | 11 (10%)            | 40 (35.7%)           | < .001               |
| No   | 99 (90%)            | 72 (64.3%)           |                      |
| <i>Medications: regular medications taken</i>            |                     |                      |                      |
| Yes  | 6 (5.6%)            | 33 (32%)             | < .001               |
| No   | 101 (94.4%)         | 70 (68%)             |                      |
| Not applicable   | 3                   | 9                    |                      |
| <i>Compliance with taking medications</i>                |                     |                      |                      |
| Yes  | 3 (4.7%)            | 3 (4.8%)             | 1                    |
| No   | 61 (95.3%)          | 59 (95.2%)           |                      |
| Not applicable   | 46                  | 50                   |                      |
| <i>Alcohol intake</i>                                    |                     |                      |                      |
| Yes  | 2 (2%)              | 28 (26.4%)           | < .001               |
| No   | 97 (98%)            | 78 (73.6%)           |                      |
| Not applicable   | 11                  | 6                    |                      |
| <i>Smoking habits</i>                                    |                     |                      |                      |
| Yes  | 2 (2%)              | 37 (34.9%)           | < .001               |
| No   | 97 (98%)            | 69 (65.1%)           |                      |
| Not applicable   | 11                  | 6                    |                      |
| <i>Medical history</i>                                   |                     |                      |                      |
| Yes  | 23 (20.9%)          | 69 (62.7%)           | < .001               |
| No   | 87 (79.1%)          | 41 (37.3%)           |                      |
| Not applicable   | 0                   | 2                    |                      |
| <i>Surgical history</i>                                  |                     |                      |                      |
| Yes  | 7 (9.9%)            | 30 (40.5%)           | < .001               |
| No   | 64 (90.1%)          | 44 (59.5%)           |                      |
| Not applicable   | 39                  | 38                   |                      |
| <i>Social history</i>                                    |                     |                      |                      |
| Yes  | 10 (9.1%)           | 56 (50%)             | < .001               |
| No   | 100 (90.9%)         | 56 (50%)             |                      |
| <i>Events/environment preceding presentation/ travel</i> |                     |                      |                      |
| Yes  | 22 (20%)            | 54 (48.2%)           | < .001               |
| No   | 87 (79.1%)          | 58 (51.8%)           |                      |
| Not applicable   | 1                   | 0                    |                      |

|                        | Pre (N = 110) n (%) | Post (N = 112) n (%) | p-value <sup>a</sup> |
|------------------------|---------------------|----------------------|----------------------|
| <i>Pregnancy</i>       | n = 51              | n = 51               |                      |
| Yes                    | 1 (2%)              | 0 (0%)               |                      |
| No                     | 9 (17.6%)           | 10 (19.6%)           |                      |
| Not applicable         | 41 (80.4%)          | 41 (80.4%)           |                      |
| <i>Menstrual cycle</i> | n = 51              | n = 51               |                      |
| Yes                    | 0 (0%)              | 0 (0%)               |                      |
| No                     | 10 (19.6%)          | 11 (21.6%)           |                      |
| Not applicable         | 41 (80.4%)          | 40 (78.4%)           |                      |

<sup>a</sup> Not applicable excluded from 2x2 analysis, count provided for information.

### Assessment

| Assessment                                     | Pre (N = 110) n (%) | Post (N = 112) n (%) | p-value <sup>a</sup> |
|--|---------------------|----------------------|----------------------|
| A-G assessment items recorded in progress note |                     |                      |                      |
| <i>Airway</i>                                  |                     |                      | < .001               |
| Yes  | 52 (47.3%)          | 86 (76.8%)           |                      |
| No   | 58 (52.7%)          | 26 (23.2%)           |                      |
| <i>Breathing</i>                               |                     |                      | < .001               |
| Yes  | 58 (52.7%)          | 95 (84.8%)           |                      |
| No   | 52 (47.3%)          | 17 (15.2%)           |                      |
| <i>Circulation</i>                             |                     |                      | < .001               |
| Yes  | 58 (52.7%)          | 94 (83.9%)           |                      |
| No   | 52 (47.3%)          | 18 (16.1%)           |                      |
| <i>Disability</i>                              |                     |                      | < .001               |
| Yes  | 56 (50.9%)          | 89 (79.5%)           |                      |
| No   | 54 (49.1%)          | 23 (20.5%)           |                      |
| <i>Exposure</i>                                |                     |                      | < .001               |
| Yes  | 47 (42.7%)          | 81 (72.3%)           |                      |
| No   | 63 (57.3%)          | 31 (27.7%)           |                      |
| <i>Fluids (in)</i>                             |                     |                      | < .001               |
| Yes  | 27 (27.8%)          | 56 (56%)             |                      |
| No   | 70 (72.2%)          | 44 (44%)             |                      |
| Not applicable                                 | 13                  | 12                   |                      |
| <i>Fluids (out)</i>                            |                     |                      | < .001               |
| Yes  | 15 (15.6%)          | 43 (43.4%)           |                      |
| No   | 81 (84.4%)          | 56 (56.6%)           |                      |
| Not applicable                                 | 14                  | 13                   |                      |
| <i>Glucose</i>                                 |                     |                      | .01                  |
| Yes  | 16 (17%)            | 31 (35.2%)           |                      |
| No   | 78 (83%)            | 57 (64.8%)           |                      |
| Not applicable                                 | 16                  | 24                   |                      |

| Assessment  | Pre (N = 110) n (%) | Post (N = 112) n (%) | p-value <sup>a</sup> |
|---|---------------------|----------------------|----------------------|
| Paediatric presentation information documented            | n=8                 | n = 6                |                      |
| <i>Weight</i>   |                     |                      |                      |
| Yes   | 2 (25%)             | 6 (100%)             |                      |
| No  | 6 (75%)             | 0 (0%)               |                      |
| <i>Immunisation status</i>                                |                     |                      |                      |
| Yes   | 1 (12.5%)           | 2 (33.3%)            |                      |
| No  | 7 (87.5%)           | 4 (66.7%)            |                      |
| <i>Parent/carer present</i>                               |                     |                      |                      |
| Yes   | 4 (50%)             | 5 (83.3%)            |                      |
| No  | 4 (50%)             | 1 (16.7%)            |                      |
| Vital signs interpreted or recorded in progress note/ eMR |                     |                      |                      |
| <i>Heart rate</i>   |                     |                      | .004                 |
| Yes   | 37 (38.9%)          | 48 (61.5%)           |                      |
| No  | 58 (61.1%)          | 30 (38.5%)           |                      |
| Not applicable  | 15                  | 34                   |                      |
| <i>Blood pressure</i>                                     |                     |                      | < .001               |
| Yes   | 35 (39.8%)          | 58 (67.4%)           |                      |
| No  | 53 (60.2%)          | 28 (32.6%)           |                      |
| Not applicable  | 22                  | 26                   |                      |
| <i>Oxygen saturation</i>                                  |                     |                      | .01                  |
| Yes   | 35 (39.8%)          | 47 (62.7%)           |                      |
| No  | 53 (60.2%)          | 28 (37.3%)           |                      |
| Not applicable  | 22                  | 37                   |                      |
| <i>Respiratory rate</i>                                   |                     |                      | .02                  |
| Yes   | 34 (39.5%)          | 42 (60%)             |                      |
| No  | 52 (60.5%)          | 28 (40%)             |                      |
| Not applicable  | 24                  | 42                   |                      |
| <i>Temperature</i>  |                     |                      | < .001               |
| Yes   | 40 (40.8%)          | 68 (73.1%)           |                      |
| No  | 58 (59.2%)          | 25 (26.9%)           |                      |
| Not applicable  | 12                  | 19                   |                      |
| <i>AVPU/GCS</i>   |                     |                      | < .001               |
| Yes   | 51 (58%)            | 84 (88.4%)           |                      |
| No  | 37 (42%)            | 11 (11.6%)           |                      |
| Not applicable  | 22                  | 17                   |                      |
| <i>Pain</i>   |                     |                      | .01                  |
| Yes   | 28 (27.2%)          | 45 (45.9%)           |                      |
| No  | 75 (72.8%)          | 53 (54.1%)           |                      |
| Not applicable  | 7                   | 14                   |                      |

| Assessment  | Pre (N = 110) n (%) | Post (N = 112) n (%) | p-value <sup>a</sup> |
|---|---------------------|----------------------|----------------------|
| General statement obs BTF / within normal limits        |                     |                      |                      |
| Yes   | 9 (13.2%)           | 7 (8%)               | 0.3                  |
| No  | 59 (86.8%)          | 81 (92%)             |                      |
| Not applicable  | 42                  | 24                   |                      |
| <b>Vital signs recorded in eMR observations chart</b>   |                     |                      |                      |
| <i>Heart rate</i>                                       |                     |                      |                      |
| Yes   | 93 (85.3%)          | 102 (91.1%)          | .21                  |
| No  | 16 (14.7%)          | 10 (8.9%)            |                      |
| Not applicable  | 1                   | 0                    |                      |
| <i>Blood pressure</i>                                   |                     |                      |                      |
| Yes   | 84 (77.8%)          | 98 (87.5%)           | .07                  |
| No  | 24 (22.2%)          | 14 (12.5%)           |                      |
| Not applicable  | 2                   | 0                    |                      |
| <i>Oxygen saturation</i>                                |                     |                      |                      |
| Yes   | 93 (85.3%)          | 100 (89.3%)          | .42                  |
| No  | 16 (14.7%)          | 12 (10.7%)           |                      |
| Not applicable  | 1                   | 0                    |                      |
| <i>Respiratory rate</i>                                 |                     |                      |                      |
| Yes   | 92 (84.4%)          | 102 (91.1%)          | .15                  |
| No  | 17 (15.6%)          | 10 (8.9%)            |                      |
| Not applicable  | 1                   | 0                    |                      |
| <i>Temperature</i>                                      |                     |                      |                      |
| Yes   | 50 (45.9%)          | 71 (63.4%)           | .01                  |
| No  | 59 (54.1%)          | 41 (36.6%)           |                      |
| Not applicable  | 1                   | 0                    |                      |
| <i>AVPU/GCS</i>   |                     |                      |                      |
| Yes   | 81 (74.3%)          | 86 (76.8%)           | .76                  |
| No  | 28 (25.7%)          | 26 (23.2%)           |                      |
| Not applicable  | 1                   | 0                    |                      |
| <i>Pain</i>   |                     |                      |                      |
| Yes   | 45 (41.3%)          | 53 (47.3%)           | .42                  |
| No  | 64 (58.7%)          | 59 (52.7%)           |                      |
| Not applicable  | 1                   | 0                    |                      |
| <b>Accurate recording/interpretation of vital signs</b> |                     |                      |                      |
| <i>Heart rate</i>                                       |                     |                      |                      |
| Yes   | 23 (60.5%)          | 41 (87.2%)           | .01                  |
| No  | 15 (39.5%)          | 6 (12.8%)            |                      |
| Not applicable  | 71                  | 65                   |                      |
| <i>Blood pressure</i>                                   |                     |                      |                      |
| Yes   | 24 (64.9%)          | 49 (87.5%)           | .02                  |
| No  | 13 (35.1%)          | 7 (12.5%)            |                      |
| Not applicable  | 72                  | 56                   |                      |

| Assessment                           | Pre (N = 110) n (%) | Post (N = 112) n (%) | p-value <sup>a</sup>        |
|--------------------------------------|---------------------|----------------------|-----------------------------|
| <i>Oxygen saturation</i>             |                     |                      |                             |
| Yes                                  | 23 (57.5%)          | 39 (83%)             | .02                         |
| No                                   | 17 (42.5%)          | 8 (17%)              |                             |
| Not applicable                       | 69                  | 65                   |                             |
| <i>Respiratory rate</i>              |                     |                      |                             |
| Yes                                  | 22 (66.7%)          | 35 (83.3%)           | .11                         |
| No                                   | 11 (33.3%)          | 7 (16.7%)            |                             |
| Not applicable                       | 76                  | 70                   |                             |
| <i>Temperature</i>                   |                     |                      |                             |
| Yes                                  | 21 (52.5%)          | 50 (82%)             | .002                        |
| No                                   | 19 (47.5%)          | 11 (18%)             |                             |
| Not applicable                       | 69                  | 51                   |                             |
| <i>AVPU/GCS</i>                      |                     |                      |                             |
| Yes                                  | 38 (79.2%)          | 67 (89.3%)           | 0.19                        |
| No                                   | 10 (20.8%)          | 8 (10.7%)            |                             |
| Not applicable                       | 60                  | 36                   |                             |
| <i>Pain</i>                          |                     |                      |                             |
| Yes                                  | 19 (57.6%)          | 22 (57.9%)           | 1                           |
| No                                   | 14 (42.4%)          | 16 (42.1%)           |                             |
| Not applicable                       | 76                  | 74                   |                             |
| <b>Quality of the A-G assessment</b> |                     |                      | <b>T-value, p-value</b>     |
| <i>Airway</i>                        |                     |                      |                             |
| 4 points                             | 46 (41.8%)          | 86 (76.8%)           | T(220) = -5.16,<br>p < .001 |
| 3 points                             | 5 (4.5%)            | 0 (0%)               |                             |
| 2 points                             | 1 (0.9%)            | 0 (0%)               |                             |
| 1 point                              | 58 (52.7%)          | 26 (23.2%)           |                             |
| Mean (SD)                            | 2.4 (1.5)           | 3.3 (1.3)            |                             |
| <i>Breathing</i>                     |                     |                      |                             |
| 4 points                             | 7 (6.4%)            | 20 (17.9%)           | T(220) = -6.00,<br>p < .001 |
| 3 points                             | 22 (20%)            | 47 (42%)             |                             |
| 2 points                             | 21 (19.1%)          | 23 (20.5%)           |                             |
| 1 point                              | 60 (54.5%)          | 22 (19.6%)           |                             |
| Mean (SD)                            | 1.8 (1)             | 2.6 (1)              |                             |
| <i>Circulation</i>                   |                     |                      |                             |
| 4 points                             | 3 (2.7%)            | 8 (7.1%)             | T(220) = -5.32,<br>p < .001 |
| 3 points                             | 16 (14.5%)          | 44 (39.3%)           |                             |
| 2 points                             | 26 (23.6%)          | 28 (25%)             |                             |
| 1 point                              | 65 (59.1%)          | 32 (28.6%)           |                             |
| Mean (SD)                            | 1.6 (0.8)           | 2.3 (1)              |                             |

| Assessment                   | Pre (N = 110) n (%) | Post (N = 112) n (%) | T-value, p-value            |
|------------------------------|---------------------|----------------------|-----------------------------|
| <i>Disability</i>            |                     |                      |                             |
| 4 points                     | 14 (12.7%)          | 35 (31.3%)           |                             |
| 3 points                     | 16 (14.5%)          | 34 (30.4%)           |                             |
| 2 points                     | 22 (20%)            | 15 (13.4%)           |                             |
| 1 point                      | 58 (52.7%)          | 28 (25%)             |                             |
| Mean (SD)                    | 1.9 (1.1)           | 2.7 (1.2)            | T(220) = -5.33,<br>p < .001 |
| <i>Exposure</i>              |                     |                      |                             |
| 4 points                     | 6 (5.5%)            | 14 (12.5%)           |                             |
| 3 points                     | 7 (6.4%)            | 31 (27.7%)           |                             |
| 2 points                     | 25 (22.7%)          | 32 (28.6%)           |                             |
| 1 point                      | 72 (65.5%)          | 35 (31.3%)           |                             |
| Mean (SD)                    | 1.5 (0.8)           | 2.2 (1)              | T(220) = -5.52,<br>p < .001 |
| <i>Fluids (in) (n =101)</i>  |                     |                      |                             |
| 4 points                     | 7 (6.9%)            | 17 (16.8%)           |                             |
| 3 points                     | 4 (4%)              | 20 (19.8%)           |                             |
| 2 points                     | 7 (6.9%)            | 13 (12.9%)           |                             |
| 1 point                      | 83 (82.2%)          | 51 (50.5%)           |                             |
| Not applicable               | 9                   | 11                   |                             |
| Mean (SD)                    | 1.4 (0.9)           | 2 (1.2)              | T(200) = -4.65,<br>p < .001 |
| <i>Fluids (out) (n =100)</i> |                     |                      |                             |
| 4 points                     | 3 (3%)              | 14 (14%)             |                             |
| 3 points                     | 3 (3%)              | 21 (21%)             |                             |
| 2 points                     | 3 (3%)              | 5 (5%)               |                             |
| 1 point                      | 91 (91%)            | 60 (60%)             |                             |
| Not applicable               | 10                  | 12                   |                             |
| Mean (SD)                    | 1.2 (0.6)           | 1.9 (1.2)            | T(198) = -5.35,<br>p < .001 |
| <i>Glucose (n =97)</i>       |                     |                      |                             |
| 4 points                     | 13 (13.4%)          | 26 (29.9%)           | .01                         |
| 3 points                     | 0 (0%)              | 3 (3.4%)             |                             |
| 2 points                     | 1 (1%)              | 0 (0%)               |                             |
| 1 point                      | 83 (85.6%)          | 58 (66.7%)           |                             |
| Not applicable               | 13                  | 25                   |                             |
| Mean (SD)                    | 1.4 (1)             | 2 (1.4)              | T(182) = -3.10,<br>p = .002 |
| Focused assessment completed |                     |                      | p-value <sup>a</sup>        |
| <i>Chest pain</i>            |                     |                      |                             |
| Yes                          | 9 (34.6%)           | 15 (60%)             | .10                         |
| No                           | 17 (65.4%)          | 10 (40%)             |                             |
| Not applicable               | 84                  | 87                   |                             |

| Assessment         | Pre (N = 110) n (%) | Post (N = 112) n (%) | p-value |
|--------------------|---------------------|----------------------|---------|
| <i>Limb</i>        |                     |                      | 1       |
| Yes                | 5 (22.7%)           | 5 (22.7%)            |         |
| No                 | 17 (77.3%)          | 17 (77.3%)           |         |
| Not applicable     | 88                  | 90                   |         |
| <i>Abdominal</i>   |                     |                      | .41     |
| Yes                | 2 (8.3%)            | 4 (18.2%)            |         |
| No                 | 22 (91.7%)          | 18 (81.8%)           |         |
| Not applicable     | 86                  | 90                   |         |
| <i>Respiratory</i> |                     |                      | .58     |
| Yes                | 12 (48%)            | 13 (56.5%)           |         |
| No                 | 13 (52%)            | 10 (43.5%)           |         |
| Not applicable     | 85                  | 89                   |         |
| <i>Fever</i>       |                     |                      | .03     |
| Yes                | 4 (20%)             | 13 (54.2%)           |         |
| No                 | 16 (80%)            | 11 (45.8%)           |         |
| Not applicable     | 90                  | 88                   |         |

Note: eMR: electronic medical record; AVPU: alert, verbal, pain, unresponsive; GCS: Glasgow Coma Scale; BTF: between the flags. <sup>a</sup> Not applicable excluded from 2x2 analysis and calculated mean scores where relevant, count provided for information.

### ***Interventions and Diagnostics***

|                                      | Pre (N = 110) | Post (N = 112) | p-value <sup>a,b</sup> |
|--------------------------------------|---------------|----------------|------------------------|
| <b>Interventions recorded in eMR</b> |               |                |                        |
| <i>VBG/ ABG</i>                      |               |                |                        |
| Yes                                  | 79 (100%)     | 82 (97.6%)     |                        |
| No                                   | 0 (0%)        | 2 (2.4%)       |                        |
| Not applicable                       | 31            | 28             |                        |
| <i>Antibiotics</i>                   |               |                |                        |
| Yes                                  | 42 (91.3%)    | 43 (95.6%)     |                        |
| No                                   | 4 (8.7%)      | 2 (4.4%)       |                        |
| Not applicable                       | 64            | 67             |                        |
| <i>Oxygen</i>                        |               |                |                        |
| Yes                                  | 34 (91.9%)    | 31 (88.6%)     |                        |
| No                                   | 3 (8.1%)      | 4 (11.4%)      |                        |
| Not applicable                       | 73            | 77             |                        |
| <i>Antiemetic</i>                    |               |                |                        |
| Yes                                  | 13 (92.9%)    | 17 (94.4%)     |                        |
| No                                   | 1 (7.1%)      | 1 (5.6%)       |                        |
| Not applicable                       | 96            | 94             |                        |

|  | Pre (N = 110) | Post (N = 112) | p-value <sup>a,b</sup> |
|--|---------------|----------------|------------------------|
| <i>IV fluid</i>                                    |               |                |                        |
| Yes  | 41 (37.3%)    | 51 (45.5%)     | .04                    |
| No   | 13 (11.8%)    | 5 (4.5%)       |                        |
| Not applicable                                     | 56            | 56             |                        |
| <i>Salbutamol</i>                                  |               |                |                        |
| Yes  | 13 (92.9%)    | 11 (91.7%)     |                        |
| No   | 1 (7.1%)      | 1 (8.3%)       |                        |
| Not applicable                                     | 96            | 100            |                        |
| <i>Hydrocortisone</i>                              |               |                |                        |
| Yes  | 8 (72.7%)     | 11 (100%)      |                        |
| No   | 3 (27.3%)     | 0 (0%)         |                        |
| Not applicable                                     | 99            | 101            |                        |
| <b>Analgesia</b>                                   |               |                |                        |
| <i>Analgesia administered (overall)</i>            |               |                |                        |
| Yes  | 61 (55.5%)    | 62 (55.4%)     | 1                      |
| No   | 49 (44.5%)    | 50 (44.6%)     |                        |
| <i>Analgesia administered (painful conditions)</i> |               |                |                        |
|  | n = 66        | n = 66         | 85                     |
| Yes  | 45 (68.2%)    | 43 (65.2%)     |                        |
| No   | 21 (31.8%)    | 23 (34.8%)     |                        |
| <i>Pain score documented pre<sup>c</sup></i>       |               |                |                        |
| Yes  | 20 (44.4%)    | 18 (41.9%)     | .83                    |
| No   | 25 (55.6%)    | 25 (58.1%)     |                        |
| <i>Pain score documented post<sup>c</sup></i>      |               |                |                        |
| Yes  | 14 (31.8%)    | 17 (41.5%)     | .38                    |
| No   | 30 (68.2%)    | 24 (58.5%)     |                        |
| <b>Diagnostics performed</b>                       |               |                |                        |
| <i>BSL</i>   |               |                |                        |
| Yes  | 47 (50%)      | 41 (44.6%)     | .47                    |
| No   | 47 (50%)      | 51 (55.4%)     |                        |
| Not applicable                                     | 16            | 20             |                        |
| <i>Urinalysis</i>                                  |               |                |                        |
| Yes  | 35 (57.4%)    | 37 (66.1%)     | .35                    |
| No   | 26 (42.6%)    | 19 (33.9%)     |                        |
| Not applicable                                     | 49            | 56             |                        |
| <i>Urine B-HCG</i>                                 |               |                |                        |
| Yes  | 4 (50%)       | 1 (20%)        | .57                    |
| No   | 4 (50%)       | 4 (80%)        |                        |
| Not applicable                                     | 102           | 107            |                        |
| <i>EKG</i>   |               |                |                        |
| Yes  | 64 (71.9%)    | 75 (84.3%)     | .07                    |
| No   | 25 (28.1%)    | 14 (15.7%)     |                        |
| Not applicable                                     | 21            | 23             |                        |

|  | Pre (N = 110) | Post (N = 112) | p-value <sup>a,b</sup> |
|--|---------------|----------------|------------------------|
| <i>Blood pathology</i>   |               |                | .25                    |
| Yes  | 99 (100%)     | 105 (97.2%)    |                        |
| No   | 0 (0%)        | 3 (2.8%)       |                        |
| Not applicable   | 11            | 4              |                        |
| <i>Chest x-ray</i>   |               |                | 1                      |
| Yes  | 49 (84.5%)    | 56 (84.8%)     |                        |
| No   | 9 (15.5%)     | 10 (15.2%)     |                        |
| Not applicable   | 52            | 46             |                        |
| <i>Blood cultures</i>  |               |                | 1                      |
| Yes  | 30 (96.8%)    | 39 (95.1%)     |                        |
| No   | 1 (3.2%)      | 2 (4.9%)       |                        |
| Not applicable   | 79            | 71             |                        |
| <b>Documentation of appropriate interventions/ diagnostics</b> |               |                |                        |
| <i>Dresses patient in hospital gown</i>                        |               |                | .41                    |
| Yes  | 5 (5.3%)      | 9 (9.1%)       |                        |
| No   | 90 (94.7%)    | 90 (90.9%)     |                        |
| Not applicable   | 15            | 13             |                        |
| <i>Inserts or requests IV cannula</i>                          |               |                | .03                    |
| Yes  | 53 (66.3%)    | 68 (81.9%)     |                        |
| No   | 27 (33.8%)    | 15 (18.1%)     |                        |
| Not applicable   | 30            | 29             |                        |
| <i>VBG/ABG if indicated</i>                                    |               |                | .02                    |
| Yes  | 43 (61.4%)    | 44 (81.5%)     |                        |
| No   | 27 (38.6%)    | 10 (18.5%)     |                        |
| Not applicable   | 40            | 58             |                        |
| <i>Antibiotics</i>   |               |                | .61                    |
| Yes  | 16 (50%)      | 17 (58.6%)     |                        |
| No   | 16 (50%)      | 12 (41.4%)     |                        |
| Not applicable   | 78            | 83             |                        |
| <i>Oxygen if indicated</i>                                     |               |                | .07                    |
| Yes  | 22 (59.5%)    | 27 (81.8%)     |                        |
| No   | 15 (40.5%)    | 6 (18.2%)      |                        |
| Not applicable   | 73            | 79             |                        |
| <i>Reassess: Oxygen effect</i>                                 |               |                | .08                    |
| Yes  | 7 (33.3%)     | 17 (63%)       |                        |
| No   | 14 (66.7%)    | 10 (37%)       |                        |
| Not applicable   | 1             | 0              |                        |
| <i>Antiemetic administered</i>                                 |               |                | .46                    |
| Yes  | 11 (68.8%)    | 7 (50%)        |                        |
| No   | 5 (31.3%)     | 7 (50%)        |                        |
| Not applicable   | 94            | 98             |                        |

|   | Pre (N = 110) | Post (N = 112) | p-value <sup>a,b</sup> |
|---|---------------|----------------|------------------------|
| <i>Reassess: Antiemetic effect</i>                |               |                |                        |
| Yes   | 1 (9.1%)      | 1 (14.3%)      | 1                      |
| No  | 10 (90.9%)    | 6 (85.7%)      |                        |
| <i>Administers IV fluids if indicated</i>         |               |                |                        |
| Yes   | 21 (51.2%)    | 30 (71.4%)     | .07                    |
| No  | 20 (48.8%)    | 12 (28.6%)     |                        |
| Not applicable                                    | 69            | 70             |                        |
| <i>Reassess: IV fluids effect</i>                 |               |                |                        |
| Yes   | 3 (21.4%)     | 7 (31.8%)      | .71                    |
| No  | 11 (78.6%)    | 15 (68.2%)     |                        |
| Not applicable                                    | 7             | 8              |                        |
| <i>Starts fluid balance chart</i>                 |               |                |                        |
| Yes   | 0 (0%)        | 11 (22.4%)     | < .001                 |
| No  | 62 (100%)     | 38 (77.6%)     |                        |
| Not applicable                                    | 48            | 63             |                        |
| <i>Activate sepsis pathway</i>                    |               |                |                        |
| Yes   | 8 (44.4%)     | 5 (35.7%)      | .73                    |
| No  | 10 (55.6%)    | 9 (64.3%)      |                        |
| Not applicable                                    | 92            | 98             |                        |
| <i>Escalation if need be</i>                      |               |                |                        |
| Yes   | 8 (50%)       | 7 (41.2%)      | .73                    |
| No  | 8 (50%)       | 10 (58.8%)     |                        |
| Not applicable                                    | 94            | 95             |                        |
| <i>Reassess: Outcome of escalation documented</i> |               |                |                        |
| Yes   | 3 (42.9%)     | 6 (85.7%)      | .27                    |
| No  | 4 (57.1%)     | 1 (14.3%)      |                        |
| Not applicable                                    | 1             | 0              |                        |
| <i>Salbutamol (if indicated)</i>                  |               |                |                        |
| Yes   | 5 (33.3%)     | 4 (36.4%)      | 1                      |
| No  | 10 (66.7%)    | 7 (63.6%)      |                        |
| Not applicable                                    | 95            | 101            |                        |
| <i>Reassess: Salbutamol effect</i>                |               |                |                        |
| Yes   | 2 (40%)       | 1 (25%)        | 1                      |
| No  | 3 (60%)       | 3 (75%)        |                        |
| Not applicable                                    |               |                |                        |
| <i>Hydrocortisone (if indicated)</i>              |               |                |                        |
| Yes   | 4 (44.4%)     | 5 (71.4%)      | .36                    |
| No  | 5 (55.6%)     | 2 (28.6%)      |                        |
| Not applicable                                    | 101           | 105            |                        |
| <i>Analgesia (if indicated)</i>                   |               |                |                        |
| Yes   | 37 (48.7%)    | 32 (45.1%)     | .74                    |
| No  | 39 (51.3%)    | 39 (54.9%)     |                        |
| Not applicable                                    | 34            | 41             |                        |

|   | Pre (N = 110) | Post (N = 112) | p-value <sup>a,b</sup> |
|---|---------------|----------------|------------------------|
| <i>Reassess: analgesia: effect documented</i> |               |                | .12                    |
| Yes   | 16 (43.2%)    | 7 (22.6%)      |                        |
| No  | 21 (56.8%)    | 24 (77.4%)     |                        |
| Not applicable                                | 0             | 1              |                        |

<sup>a</sup> Not applicable excluded from 2x2 analysis, count provided for information. <sup>b</sup> p-value not reported where more than 20% of cells have less than the required cell count or the minimum expected cell count is less than one. <sup>c</sup> Recorded for painful conditions where analgesia administered.

### **Plan**

| Plan recorded                 | Pre (N = 110) | Post (N = 112) | p-value <sup>a,b</sup> |
|-------------------------------|---------------|----------------|------------------------|
| <i>Consultation/s with MO</i> |               |                | .001                   |
| Yes                           | 9 (9.2%)      | 17 (30.4%)     |                        |
| No                            | 89 (90.8%)    | 39 (69.6%)     |                        |
| Not applicable                | 12            | 56             |                        |
| <i>Care plan</i>              |               |                | < .001                 |
| Yes                           | 52 (47.3%)    | 86 (76.8%)     |                        |
| No                            | 58 (52.7%)    | 26 (23.2%)     |                        |
| Not applicable                |               |                |                        |
| <i>Patient communication</i>  |               |                | .28                    |
| Yes                           | 2 (1.9%)      | 5 (4.7%)       |                        |
| No                            | 106 (98.1%)   | 101 (95.3%)    |                        |
| Not applicable                | 2             | 6              |                        |
| <i>Family communication</i>   |               |                | .01                    |
| Yes                           | 5 (5.3%)      | 14 (18.9%)     |                        |
| No                            | 90 (94.7%)    | 60 (81.1%)     |                        |
| Not applicable                | 15            | 38             |                        |

Note: <sup>a</sup> Not applicable excluded from 2x2 analysis, count provided for information.