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INITIATING THE DEVELOPMENT OF A CURRICULUM FOR SOUTH AFRICAN ADULT CRITICAL CARE RETRIEVAL

By

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DECLARATION

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ABSTRACT

Introduction

The interfacility transfer of critically ill patients is a crucial component of emergency healthcare in South Africa, necessitated by disparities in healthcare infrastructure, specialist availability, and geographic constraints. Emergency Medical Services (EMS) facilitate these transfers, often requiring specialised Critical Care Retrieval (CCR) teams. Despite its significance, there is no standardised CCR training in South Africa, leading to inconsistencies in provider competence and patient outcomes.

Aim of the Study

This research sought to design and validate a contextually relevant and competency-driven curriculum for adult CCR in South Africa. The proposed curriculum aims to enhance the knowledge, clinical proficiency, and decision-making skills of EMS practitioners involved in critical care transport.

Methods

A multi-methods approach was used across four phases:

1. **Scoping Review:** Local and international CCR curricula were analysed to identify best practices and essential competencies.
2. **Retrospective Case Review:** A three-year analysis of Western Cape EMS patient care records (2018–2020) provided insights into the characteristics and needs of CCR patients.
3. **Qualitative Study:** Semi-structured interviews with CCR experts and focus groups with EMS learners were conducted to explore training gaps and competency needs.
4. **Delphi Study:** A panel of 83 experts participated in an iterative consensus-building process to refine and validate curriculum content and learning objectives.

Results

Findings revealed systemic deficiencies in EMS training for CCR, including inadequate exposure to critical care principles, ventilation strategies, interfacility transport physiology, and non-technical skills such as leadership and clinical decision-making. The final curriculum framework includes modules on intensive care principles, advanced patient monitoring, procedural interventions, transport logistics, and evidence-based best practices. The curriculum aligns with NQF Level 8 and incorporates blended learning methodologies, including high-fidelity simulations and supervised clinical exposure.

Conclusion

This study presents the first structured and standardised CCR curriculum for South African EMS, bridging key knowledge and skill gaps while aligning with international best practices. Its implementation could professionalise CCR, establish it as a recognised EMS specialisation, and improve patient safety and outcomes. Future research should focus on implementation strategies, faculty development, and long-term evaluation of its impact on patient care and system efficiency.

Keywords

Critical Care Retrieval, Emergency Medical Services, Curriculum Development, Interfacility Transfer, Advanced Life Support, South Africa, Prehospital Care

DEDICATION

This thesis is dedicated to the healthcare professionals and Emergency Medical Services practitioners who tirelessly serve communities across South Africa. Their unwavering dedication, resilience, and compassion inspire the pursuit of knowledge and the development of systems that enhance critical care and improve patient outcomes.

I also dedicate this work to my parents, Chris and Petra van Rensburg, as well as my family and friends. Your unwavering support, encouragement, and belief in me have been the foundation of this journey. Your patience, sacrifices, and steadfast presence have carried me through every challenge, and I am profoundly grateful for that.

Finally, to all those striving to improve healthcare in resource-constrained settings, this work is a tribute to your perseverance, vision, and relentless commitment to making a difference. It may serve as a small contribution toward building a more equitable and effective healthcare system.

ACKNOWLEDGEMENTS

Completing this PhD has been challenging yet rewarding, and I am deeply grateful to those who have supported me.

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I want to express my gratitude to the Western Cape Department of Health and Wellness—Emergency Medical Services for granting me access to the necessary data and allowing me to conduct this research within the organisation. I would also like to thank the National Department of Health Emergency Medical Services Directorate for their support throughout this journey. To the research participants who generously shared their time and expertise, your input was instrumental in the success of this study.

Finally, I extend my gratitude to all who have walked this path with me, directly or indirectly. Your belief in the value of this work and your encouragement have been a source of strength and motivation for me.

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GLOSSARY OF TERMS

Advanced Life Support - The highest level of prehospital care provided by Paramedics or Emergency Care Practitioners

Ambulance - A motor vehicle appropriately equipped, designed, or adapted solely to provide emergency care and conveyance of patients.

Bloom's Taxonomy - A framework for classifying learning objectives by complexity in cognitive, affective, and psychomotor domains.

Community of Practice - A group sharing knowledge and skills through collaboration to improve professional practice.

Continuous Quality Improvement - Ongoing efforts to enhance healthcare quality, safety, and efficiency through feedback and analysis.

Crew Resource Management - Training to improve teamwork, communication, and decision-making in high-pressure environments.

Critical Care Paramedic - A paramedic trained to manage critically ill patients during advanced prehospital or interfacility care.

Curriculum Mapping - Organizing curriculum to align content, objectives, and assessments with desired outcomes.

Dispatch time - This time is calculated from the time the registration is completed to when the call is dispatched to an ambulance by the Emergency Communication Centre.

Educational Strategies - Planned methods, like lectures or simulations, to achieve learning goals effectively.

Emergency calls/cases - *Clinical* conditions requiring rapid ambulance dispatch and intervention to avert death or disability and those for which treatment delays may make interventions less effective within the out-of-hospital environment.

Emergency Communications Centre - A centre that houses call handlers and dispatch personnel for Emergency Medical Services.

Emergency Medical Services - An organisation or body that is dedicated, staffed and equipped to operate an ambulance, rescue vehicle or emergency response vehicle to offer emergency care.

General Needs Assessment - An evaluation to identify knowledge or skill gaps within a group or organisation.

High-Fidelity Simulation - Realistic scenarios using advanced tools to practice clinical skills in a controlled setting.

Interfacility transfer **-** The transportation of a patient by ambulance from one healthcare facility to another.

Mobile Intensive Care Unit - An ambulance with advanced equipment and staff for critical care during transport

Preparation Time - The time spent on-scene at the sending facility preparing the patient for transport.

Response Time - The time interval from when the EMS crew receives an emergency call from dispatch to the arrival of the first EMS unit at the scene.

Scene Time - The duration spent by EMS personnel at the scene of an emergency, which includes assessing the patient, providing necessary treatment, stabilising the condition, and preparing the patient for transport.

Situated Learning Theory - Learning through real-world participation in authentic activities within a social context.

Targeted Needs Assessment - A focused evaluation to address specific training or resource gaps for a group.

Transfer Time - The time taken to transport the patient from the scene of the emergency to the receiving healthcare facility.

CHAPTER 1 – INTRODUCTION & BACKGROUND

1.1 INTRODUCTION

This first chapter of the thesis provides the reader with the background and context of the study, which focused on developing a contextually relevant curriculum for the training and education of emergency care providers participating in adult CCRs in South African settings. The chapter describes the researcher, the health care context, and the critical care retrieval environment. It also includes some context to EMS education and considerations relating to curriculum design that were present and applicable at the time of the study. Following this, the researcher introduces the problem statement, the aim and objectives of the research, and a summary of the design and methods that were adopted; these are further elaborated on and defended in greater detail in Chapter 4. The chapter concludes with a summary of the thesis layout and an overview of the chapters to follow.

1.2 BACKGROUND AND CONTEXT

1.2.1 The Researcher

The researcher is a registered Emergency Care Practitioner (ECP) with the Health Professions Council of South Africa (HPCSA), possessing extensive experience in public EMS since 2014. The researcher has worked as an Advanced Life Support Paramedic, Emergency Care Practitioner, and Lecturer, contributing to the clinical and academic domains of emergency medical care. At the time of the study, the researcher worked as an EMS District Manager within the National Department of Health. His core roles focused on clinical governance, system improvement, and education. This position enables the researcher to directly influence policy, oversee critical service delivery initiatives and champion innovative approaches to emergency care. The researcher's work emphasises integrating evidence-based practices into the EMS system to enhance patient outcomes and operational efficiency.

Based on his experiences (both as an operational emergency care practitioner and later as a strategic manager), the researcher realised that the time and space allocated for CCR in existing undergraduate EMC programs were insufficient for producing graduates who could confidently and competently participate in CCRs. It was this realisation that prompted the researcher's interest and desire to conduct this study and, in so doing, make a unique contribution to the profession in the form of a contextually relevant curriculum for Adult Critical Care Retrieval (CCR).

As a practitioner-researcher closely embedded in the EMS system, the researcher acknowledges that his prior knowledge, professional networks, and leadership roles may have influenced both participant engagement and the interpretation of the findings. While this positionality provided valuable contextual insight and access to key stakeholders, the researcher remained aware of potential bias throughout the qualitative phases of the study. Strategies such as triangulation, reflexive journaling, and member checking were employed to ensure analytic rigour and transparency during data interpretation.

1.2.2 The SA Health Care System

As mentioned above, this study focuses on the field of CCR, which involves transferring patients between healthcare facilities. In South Africa (SA), the need for CCR is inevitable due to a lack of services and specialities offered at various facilities across the healthcare system (1). This is not a uniquely SA problem, as in low to middle-income countries (LMICs), transferring critically ill patients between facilities becomes even more prevalent due to a scarcity of resources. (2).

In SA, the movement of patients is further influenced by the country's tiered healthcare system, which is inherently referral-based (3). The level of care a patient receives depends on the capabilities of the initial receiving facility (3). However, this referral-based model reflects deeply entrenched inequities resulting from historical policies such as the Group Areas Act (4), which perpetuated disparities in resource allocation and access to healthcare services. These structural inequities, particularly pronounced in rural and marginalised areas, continue to impact patients' ability to access specialised care promptly (5,6).

The SA healthcare system is characterised by a high degree of plurality, comprising both public and private sectors that operate in parallel but remain starkly divided (7). The private healthcare

sector, which serves only about 27% of the population, is well-resourced and highly specialised. In contrast, the public sector, which caters to the majority, is underfunded, overcrowded, and struggles to meet demand (5,8). This fragmentation of healthcare services often delays patient transfers and creates gaps in continuity of care (9). Efforts to bridge these disparities by introducing National Health Insurance (NHI) aim to create a unified and equitable healthcare framework (10). However, the NHI's implementation faces significant regulatory, political, and logistical challenges, which further complicate its ability to address the needs of the majority of South Africans(11,12).

Moving critically ill or injured patients between facilities and/or to specialist care timeously may significantly improve patient outcomes (13). However, the systemic and logistical complexities inherent in the SA healthcare context often hinder patients' efficient and equitable movement. Geographic disparities, particularly in rural areas, exacerbate the challenges, with some communities located hours away from advanced care facilities (14). In addition, the inequitable distribution of ambulance services and emergency medical staff further compounds these issues (6,15).

The coordination and continuity of care for critically ill patients become the responsibility of EMS. Therefore, the care rendered to these patients becomes the responsibility of pre-hospital providers registered with the HPCSA. EMS in SA operate within a regulatory framework issued by the National Department of Health (16), and EMS education is shaped by the National Emergency Care Education and Training (NECET) policy (17), which establishes a framework of qualifications leading to registration with the HPCSA. While NECET provides a foundational framework, its implementation remains inconsistent, with disparities in training standards and resource allocation across provinces. Additionally, pre-hospital providers face challenges such as limited access to advanced life-support equipment, inconsistent protocols for critical care transfers, and pressure to adapt their practices to a fragmented healthcare system (18–20).

Despite these challenges, there is significant potential to improve outcomes through strategic investment in EMS systems and leveraging global best practices. A more integrated and cohesive

approach, informed by ongoing community engagement and aligned with NHI goals, could address existing gaps and create a more resilient and equitable critical care retrieval system.

1.2.3 Critical Care Retrieval

Transporting the critically ill and injured does not come without risk. In international contexts, the transportation of such patients is usually facilitated by specialised teams that have undergone specialised training in critical care and transportation (21). Studies show that adverse events during such transfers are more common when critically ill or injured patients are transported by ambulance crews who are not appropriately experienced and or trained to deal with these types of cases (22). For instance, a study evaluating adverse events during transfers from the emergency department to the intensive care unit found that such events occurred in 22% of transfers, with higher rates associated with less experienced teams (22).

Common adverse events that may be experienced during patient transfers include hemodynamic instability, such as significant changes in blood pressure or heart rate; respiratory complications, including desaturation or accidental extubation leading to inadequate oxygenation; and equipment-related issues, such as malfunctions or disconnections of vital monitoring or life-support devices (22,23). Additionally, delays in performing critical interventions due to logistical challenges during transport further jeopardise patient outcomes (22). Such findings underscore the need for dedicated and well-trained transport teams to minimise adverse events and improve the safety and efficacy of patient transfers (19,22,23).

Aspects of critical care are currently taught at all universities offering undergraduate emergency care practitioner (ECP) training; however, this does not guarantee the readiness of graduates at the point of graduation to confidently and competently manage in critical care transportation environments (24).

To safely transport critically ill patients, it is deemed that EMS crews undertaking these transfers need some understanding and a set standard of essential critical care knowledge. Therefore, it is suggested that training developed for such programmes should focus on preparedness to deal with critically ill and injured patients (19). Bartholomew et al. suggest that the curriculum and content of educational programmes should be contextually relevant. Therefore, in the case of

critical care transfers occurring in SA, education and training should focus on the patient population transferred to a South African CCRS context (25).

Despite its importance, Critical Care Retrieval Services (CCRS) remains a nascent field in South African EMS. In response to this, several private and government services have begun establishing CCR units, often based on limited experience and evidence, typically in the form of additional “in-house” training.

Father complicating matters is the fact that we still do not have a universally accepted standard for CCR training in SA; however, a definition of CCR has been derived as "*the stabilisation and transport of a critically ill or injured patient from a location where the patient's healthcare requirements outweigh the diagnostic or treatment abilities, and/or expertise available, to an appropriate facility where these are available*" (26).

The definition of CCRS is multifaceted, and the safe execution of such transfers cannot be reduced solely to the act of transportation (26). It is of utmost importance to remember that CCRS is still deemed an emerging area of specialised practice in SA, and many questions remain about the best approach to facilitating retrievals and transports, both locally and internationally (26). The above definition outlines five equally important steps that should be in place for a service to be deemed a CCRS unit. These five aspects are specific patient populations, case selection, dedicated crew with additional training, dedicated equipment, and continuous quality management and training (26). This study focuses on the need for additional training and on developing emergency care personnel's knowledge, skills, and insights to better manage patient care and systemic demands associated with CCRS.

1.2.4 EMS education and curriculum development

More recently, emergency care providers employed by SA emergency services would have completed one of three higher education qualifications offered by local universities and ambulance training colleges. Completion of each of these programmes leads to registration onto one of three registers at the HPCSA, each with a set scope of practice. As mentioned above, neither of the three existing qualifications extensively focuses on CCR; instead, they emphasise primary response and acute care.

As a consequence, EC providers who end up engaging in the CCR environment face a steep "learning curve" and commonly have to rely on their workplace experiences to develop the required confidence to perform the specialised skills and competencies associated with CCR. As mentioned above, certain private ambulance services conduct additional in-house learning programmes to support and guide their staff in undertaking CCRs.

Where such programmes are developed, it is essential that theories inform their development on Situated Learning. Situated learning theory, developed by Jean Lave and Etienne Wenger, argues that learning does not occur in isolation but is embedded within the social and physical contexts in which it takes place (27,28). Central to this theory is the concept that knowledge is co-constructed through participation in authentic activities rather than being transmitted from instructor to learner. It emphasises the importance of social interaction, collaboration, and engagement within a Community of Practice (CoP), where individuals move from peripheral to full participation as they develop competence.

In the critical care environment, situated learning theory becomes particularly relevant because it aligns with the need for contextualised, experiential learning (29). Here, knowledge and skills are not just abstract concepts but are acquired through real-world application, interaction with peers, and immersion in the complexities of critical care scenarios. This dynamic and relational approach ensures that learners develop a deeper understanding of their roles and responsibilities as they learn to adapt to the rapidly changing demands of critical care practice. Integrating this theory into the CCR educational programme's design enables the fostering of practical, context-specific learning directly relevant to the high-stakes and collaborative nature of critical care (28,30).

Building on these theoretical foundations, the CoP offers a structured framework to deepen the understanding of learning within such contexts. Lave and Wenger (1991) define a CoP as a group of individuals who share a concern or passion for something they do and learn to do it better through regular interaction (31). Sergiovanni reinforces the idea that learning is most effective when it takes place in communities, and this would be ideal for the EMS cadre as it is argued that

the academic and social outcomes will improve only when classrooms become learning communities and teaching becomes learner-centred (27).

A CoP comprises three core elements: mutual engagement, joint enterprise, and shared resources. These elements create an environment where learning becomes a social, participatory process embedded in the community's practices and relationships.

The principles of Situated Learning Theory and CoP are particularly well-suited for the EMS environment, where training must mirror the real-world demands of critical care scenarios. Critical outcomes such as enhanced problem-solving, improved cooperation and trust, and a stronger professional identity can be achieved by fostering a learning community within the EMS cadre. Furthermore, aligning this approach with constructivist and learner-centred educational frameworks ensures that learners are not merely passive recipients of knowledge but active participants in co-creation.

By grounding the CCR educational programme in these theories, the programme can create a platform for contextualised, experiential learning that equips practitioners with the technical, social, and cognitive skills needed to excel in critical care. This alignment also reinforces the broader goal of transforming EMS training into a community-driven, learner-centred experience that fosters excellence in practice and improved patient outcomes. The aforementioned EMS education and training context, along with the theory on approaches to designing contextually relevant curricula, underpin the rationale for and approaches used in this study.

1.3 RESEARCH PROBLEM

Evidence showed that, at the time of the study, graduates were emerging from existing undergraduate emergency medical care education and training programmes without the required knowledge, skills and insights to confidently and competently conduct CCRs in their contexts. This placed an additional burden on the industry, requiring extra support and top-up training. The absence of an appropriate contextually relevant adult CCR curriculum, therefore, became the core problem this study aimed to address.

1.4 RESEARCH QUESTION

Considering the problem statement described above, the core research question becomes: What constitutes a relevant curriculum for adult CCR education and training in the South African context?

1.5 RESEARCH AIM

This study aimed to initiate the development of a curriculum for adult CCR in SA grounded in local needs, expert consensus, and contextual realities.

1.6 RESEARCH OBJECTIVES

In order to achieve the above aim and, in so doing, address the research problem and answer the research question, the following four key objectives were derived:

- **To conduct a situational analysis to understand the current state of critical care transfers.** This included describing the adult patient population being transferred in South Africa through a retrospective chart review, focusing on their demographics, clinical presentations, and the interventions provided by ALS providers.
- **To explore the content and curricula of local and international adult CCR training programmes.** This was done by performing a scoping review to evaluate programme aims, learning outcomes, core curricula, delivery modes, clinical exposure, and evaluation strategies.
- **To assess the needs of both the EMS industry and its learners.** This was accomplished through semi-structured interviews with CCRS experts and EMS role players. In doing this, the general needs of the industry, including gaps in training and opportunities for improvement, were identified. Simultaneously, targeted needs assessments were conducted with EMS learners through focus group discussions to gain insights into their educational gaps, learning preferences, and specific needs for entering the CCRS environment.

- **To reflect on the insights and understandings that emerged from completing the above three objectives to inform the development and validation of a formal CCR curriculum tailored to the South African context**. This was approached using the Delphi method, where a panel of experts reviewed and achieved consensus on the curriculum's content, core competencies, and training outcomes.

1.7 RESEARCH DESIGN

A summary of the design and methods that were selected is provided in this chapter. These are described and defended in greater detail in Chapter 4 – Methodology.

1.7.1 Design

A multi-methods design was adopted for this study to comprehensively address the complexities involved in developing a contextually relevant curriculum for critical care retrieval in South Africa (32,33). This design was chosen because it allows for the systematic integration of quantitative and qualitative data, ensuring a holistic approach to addressing the research aims (33). The nature of the design enabled each phase's outcomes to inform and support the approach to the subsequent phase, promoting a logical and iterative development process. Combining methods provided both breadth and depth, ensuring that findings were data-driven and contextually relevant (33). A summary of these phases is illustrated in Figure 1.

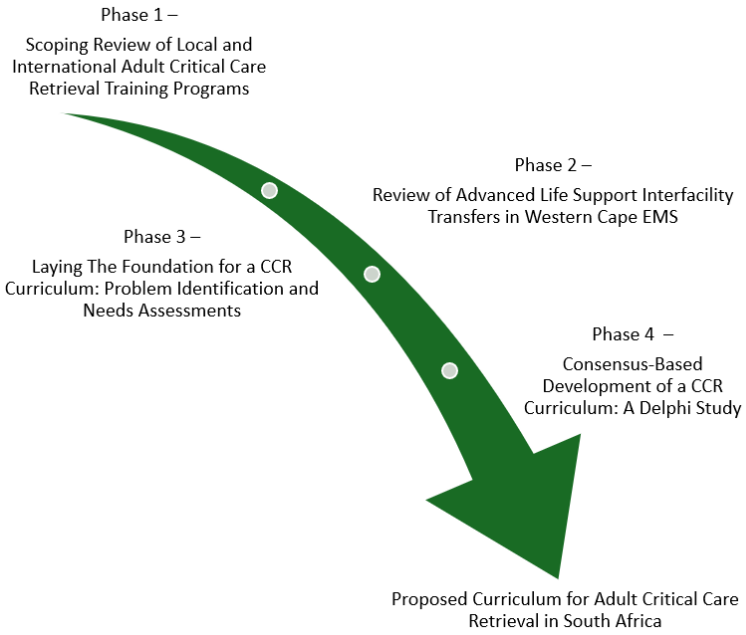

Figure 1: Sequential Flow of Phases 1 - 4

1.7.2 Methods

The methods used for each phase of the study are briefly summarised below:

1.7.2.1 Phase 1: Scoping Review.

- A systematic scoping review was conducted to explore international critical care retrieval training programmes. This phase identified best practices, curriculum content, delivery methods, and evaluation strategies that could inform the development of a South African-specific curriculum.

1.7.2.2 Phase 2: Retrospective Case Review

- This phase involved a detailed analysis of electronic patient care reports from the Western Cape Emergency Medical Services (EMS) from 2018 to 2020. The aim was to characterise the demographics, clinical conditions, and interventions of critically ill patients requiring interfacility transfers, providing a foundation for understanding the local context.

1.7.2.3 Phase 3: Qualitative Study

- This phase included semi-structured interviews with critical care retrieval experts and focus group discussions with EMS learners. The goal was to identify existing education and training gaps and understand stakeholder perspectives on the essential competencies required for critical care retrieval.

1.7.2.4 Phase 4: Delphi Study

- Using the Delphi methodology, consensus was achieved among a panel of 83 experts regarding the goals and objectives of the proposed curriculum. This iterative process involved multiple rounds of feedback and refinement to ensure the curriculum's relevance and alignment with local and international standards.

Each phase contributed to the structured development of a contextually appropriate adult critical care retrieval curriculum tailored to the unique needs and challenges of the South African healthcare system. Using a multi-methods design ensured that the study captured the complexity of the subject matter, combining quantitative precision with qualitative richness to develop a robust and actionable curriculum (32,33).

1.8 SIGNIFICANCE OF THE STUDY

EMS aims to provide emergency medical services to patients in the out-hospital environment. Providing emergency medical services to patients includes transferring critically ill or injured patients between healthcare facilities to meet their complex specialist care needs (19,34).

The transportation of critically ill patients is a high-stakes endeavour that significantly impacts patient outcomes. In the SA healthcare context, systemic inequities, resource constraints, and the inherent challenges of a referral-based system exacerbate the risks associated with inter-facility transfers (14,35). These challenges are compounded by the absence of standardised CCRS and formalised training programmes tailored to the SA landscape (19).

This study addresses these critical gaps by developing an evidence-based curriculum for CCR that aligns with the unique needs of the industry and emergency care providers in SA. By incorporating

situated learning theory and global best practices, the curriculum seeks to equip providers with the contextualised knowledge and skills necessary to navigate the complexities of critical care retrieval. This approach enhances the preparedness of EMS personnel and aims to standardise care, thereby reducing variability in practice and improving patient safety during transfers.

Furthermore, this study contributes to the broader discourse on healthcare equity in SA. Focusing on the development of a contextual curriculum underscores the need for targeted interventions to address disparities in healthcare access and service quality. The findings have the potential to inform national policy and professional standards, offering a robust framework for integrating critical care retrieval training into existing EMS education.

Ultimately, the study aspires to bridge the gap between current educational offerings and the specialised demands of CCRS. By fostering a competent and well-trained cadre of emergency care providers, this initiative could be a cornerstone for establishing a resilient and equitable healthcare system, benefiting both providers and critically ill patients.

1.9 LAYOUT OF THE THESIS AND OVERVIEW OF CHAPTERS

The thesis is divided into nine chapters, each describing specific elements necessary to achieve the study's aims and objectives.

Chapter 1 introduces the study and provides an in-depth background and context, exploring the South African healthcare system, critical care retrieval (CCR) environment, the role of educational theory, and the regulatory framework. It establishes the study's significance in addressing gaps in CCR training and the need for a standardised curriculum.

Chapter 2 outlines the theoretical framework underpinning the study. It highlights the application of Situated Learning Theory and Communities of Practice, emphasising experiential, context-based learning and collaboration within a professional community. These concepts guide the curriculum's development to align with the demands of CCR.

Chapter 3 presents the findings from Phase 1, focusing on a scoping review of existing literature and training programmes. This phase evaluates both local and international best practices, identifying gaps and informing the foundational design of a contextual CCR curriculum.

Chapter 4 details the research methods used throughout the study, including retrospective case reviews, qualitative needs assessments, and the Delphi process. It provides a comprehensive methodology for gathering and analysing data to inform curriculum design.

Chapter 5 is dedicated to Phase 2, focusing on the retrospective case review conducted during the study. This phase examines electronic patient care records to characterise the critically ill and injured adult patients being transferred in South Africa. It explores patient demographics, clinical conditions, and the interventions provided by ALS providers during transfers. The findings highlight trends, challenges, and opportunities within the current CCR landscape, offering critical insights that directly inform the curriculum development process.

Chapter 6 focuses on Phase 3, which involves the qualitative needs analysis to identify and address gaps in CCR training. This phase draws on semi-structured interviews with CCR experts and focus group discussions with EMS learners to explore both general and targeted needs within the industry. The chapter highlights key themes, including the challenges practitioners face and the specific skills required for effective CCR. These qualitative insights inform the refinement of curriculum objectives, ensuring the development of core competencies, learning outcomes, and curriculum content that align with the demands of the South African EMS context.

Chapter 7 presents Phase 4, focusing on the consensus-building process conducted through the Delphi method. This chapter details how iterative rounds of expert feedback were utilised to refine and finalise the curriculum goals and objectives. The Delphi process enabled the identification and validation of key competencies, learning outcomes, and training priorities, ensuring that the proposed curriculum framework aligns with global best practices while addressing the specific requirements of the South African EMS context. The chapter highlights the collaborative approach taken to achieve consensus and the contributions of diverse expert perspectives to the design of the curriculum.

Chapter 8 synthesises the findings into a cohesive map and overall thesis discussion. It evaluates how the proposed curriculum addresses the systemic challenges of the South African healthcare and EMS landscape, offering actionable insights for implementation.

Finally, **Chapter 9** concludes the thesis with recommendations, limitations, and a summary of the study's contributions. This chapter provides guidance for future implementation, acknowledges the study's constraints, and outlines its impact on EMS education and critical care retrieval practices.

Through this structure, the thesis comprehensively addresses the lack of standardised CCR training and offers a robust, contextually relevant curriculum framework aimed at enhancing EMS capacity and improving patient outcomes in South Africa.

1.10 CONCLUSION

This first chapter of the thesis provided the reader with the background and context to the study, which focused on developing a contextually relevant curriculum for the training and education of emergency care providers participating in adult CCRs in South African settings. The chapter describes the researcher, the health care context, and the critical care retrieval environment. Also mentioned in this chapter were the problem statement, aim, and objectives of the research, as well as a summary of the design and methods adopted; these are further elaborated on and defended in greater detail in Chapter 4. The chapter concluded with a description of the study's academic merit and significance, as well as its layout and the content to be included in the subsequent chapters. The next chapter will provide the knowledge assumptions and theoretical framework that underpinned the study.

CHAPTER 2 - THEORETICAL FRAMEWORK

2.1 INTRODUCTION

This chapter presents the theoretical framework underpinning curriculum development for South African Adult Critical Care Retrieval (CCR). It integrates key theories relevant to curriculum design, adult learning, and critical care education. These theories provide the foundation for addressing the study's aim of developing an evidence-informed and contextually appropriate curriculum.

2.2 THE ROLE OF A THEORETICAL FRAMEWORK IN RESEARCH

The theoretical framework serves multiple functions in this research (36,37):

- Connecting the study to established knowledge in curriculum development and education.
- Providing a structured basis for formulating research questions and objectives.
- Guiding methodological decisions, including data collection and analysis.
- Offering a lens for interpreting the findings within the broader CCR training and practice context.
- Informing the design of a curriculum grounded in theory and adapted to the South African EMS environment.

This framework combines curriculum development and adult learning theories to support the study's objectives.

2.3 THEORIES AND CONTEXT RELEVANT TO THIS RESEARCH

2.3.1 Situated Learning Theory

Situated Learning Theory, developed by Jean Lave and Etienne Wenger, asserts that meaningful learning occurs in the context of authentic, real-world activities (27,28). This theory moves beyond traditional, abstract classroom-based instruction, emphasising that knowledge is best

acquired when learners actively engage in practical tasks within their social and physical environments. (28). The theory is particularly relevant to CCR training, where practitioners must acquire critical knowledge and skills under conditions that mirror the high-pressure, real-life scenarios they will encounter in practice.

A cornerstone of situated learning theory is participation in communities of practice, which are informal groups of individuals who share a common professional domain and learn through mutual engagement (31). In the context of CCR, CoPs are essential for fostering collaboration, mentorship, and the co-construction of knowledge between novice and experienced practitioners (38). Through CoPs, CCR trainees gain access to the tacit knowledge, problem-solving strategies, and nuanced decision-making skills required for high-acuity patient care.

Situated Learning Theory also highlights the importance of legitimate peripheral participation, where novices gradually transition from observing and supporting tasks to becoming fully competent practitioners (28,39). This staged learning approach aligns seamlessly with CCR training as learners progress from foundational knowledge acquisition to mastering advanced clinical skills through active participation in simulations, supervised clinical work, and hands-on patient care during critical transfers. Below is a figurative model of the theory:

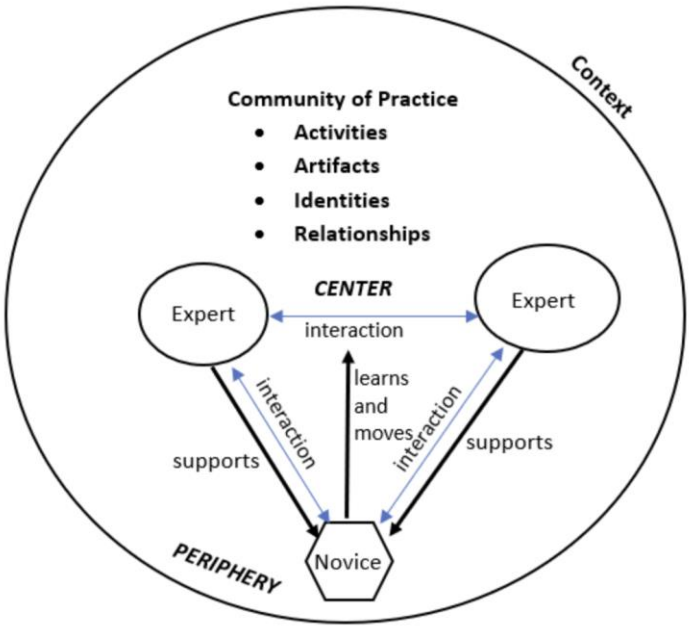

Figure 2: Model of Situated Learning Theory (39)

For this study, Situated Learning Theory directly informs the inclusion of experiential learning activities within the curriculum. Techniques such as high-fidelity simulations, case-based discussions, interprofessional collaboration exercises, and supervised clinical practice are integral to creating an immersive learning environment. These activities not only build technical proficiency but also enhance decision-making, teamwork, and adaptability under the complex and dynamic conditions of CCR.

The curriculum aims to bridge the gap between theoretical knowledge and practical application by embedding CCR training within authentic contexts and leveraging the principles of situated learning theory. This ensures that practitioners are prepared to deliver high-quality, patient-centered care in the unique and challenging environments they will face. Furthermore, the theory emphasises the importance of mentorship and reflective learning, which are crucial in cultivating a culture of continuous improvement and clinical excellence within CCR teams.

2.3.2 Kern's Six-Step Model for Curriculum Development

Kern's Six-Step Model provides a systematic and evidence-based framework for curriculum development, making it an ideal approach for this study. Initially developed for medical education, the model ensures that curricular design is purposeful, comprehensive, and adaptable to the needs of learners and stakeholders. (40,41). Its structured methodology makes it particularly well-suited for addressing the complexities of CCR training in South Africa.

The six steps are as follows:

(i) Problem identification and general needs assessment: This step focuses on identifying the healthcare need or problem the curriculum aims to address. This thesis seeks to highlight the need for specialised, dedicated care for critically ill and injured patients during inter-facility transfers. A thorough problem identification includes examining the current approach to managing these cases, identifying the practitioners responsible for patient retrieval, and analysing their educational needs. This process seeks to uncover existing training and operational protocol gaps, emphasising the critical importance of a curriculum designed for CCRS. Understanding these gaps

ensures the curriculum directly responds to healthcare system demands and patient care priorities.

(ii) Targeted needs assessment: This step involves determining the specific educational and skill development needs of practitioners undergoing CCRS training. These needs may differ significantly between EMS learners and experienced healthcare providers, as CCRS requires advanced competencies that may not be part of standard EMS training. For EMS learners lacking CCRS exposure, foundational training in critical care concepts must be integrated. Targeted needs assessment also includes aligning identified needs with existing curricula, where applicable, ensuring the new curriculum builds on established knowledge and meets the nuanced demands of CCRS practice.

(iii) Goals and objectives: Goals and objectives are defined based on the needs identified in the previous steps. These goals encompass broad, overarching aims for the curriculum, while objectives focus on the development of specific competencies in cognitive (knowledge), affective (attitudes), and psychomotor (skills) domains. For CCRS, objectives may include mastering clinical decision-making in high-stakes environments, effective interprofessional collaboration, and the ability to stabilise and manage critically ill patients during transfers. Articulated goals and objectives guide curriculum content, facilitate communication with stakeholders, and provide a basis for developing robust assessment strategies to evaluate practitioner performance.

(iv) Educational strategies: This step involves selecting diverse teaching and learning methods aligned with the curriculum's goals and objectives. Strategies include simulation-based training to replicate high-pressure scenarios, case-based learning to encourage critical thinking and field placements for hands-on experience. Additionally, interprofessional education fosters collaboration and teamwork among multidisciplinary practitioners. Together, these methods ensure that learners acquire theoretical knowledge and practical skills, preparing them for the complexities of CCR practice.

(v) Implementation: The implementation phase focuses on transforming the curriculum into practice. This involves securing political and industry support, procuring simulation equipment and faculty resources, and addressing logistical challenges like accessibility and funding. A pilot programme tests the curriculum's feasibility, identifying areas for refinement. During this phase, assessment techniques are developed to measure learner progress and curriculum effectiveness, ensuring the programme's success and alignment with its objectives.

(vi) Feedback and evaluation: Feedback and evaluation are integral to ensuring the curriculum remains effective and responsive to evolving needs. Feedback mechanisms should include formative (ongoing) and summative (final) evaluations to assess learner performance and the curriculum's impact. Formative feedback enables iterative improvements throughout the programme, while summative assessment measures overall competency and readiness for CCRS practice. Stakeholder input, including that of learners, educators, and administrators, provides valuable insights into areas for improvement. Evaluation outcomes are then used to refine the curriculum, ensuring its continuous relevance and alignment with global best practices in critical care education.

2.3.3 Adult Learning Theory

Malcolm Knowles's Adult Learning Theory provides a robust foundation for designing education programmes tailored to adult learners, emphasising the principles of andragogy (42,43). This theory is particularly relevant for CCRS training, where learners are experienced healthcare professionals transitioning into specialised roles (42). This theory ensures that the curriculum is engaging and effective by recognising the unique characteristics of adult learners.

The key principles include:

(i) Self-Directed Learning: Adult learners thrive when they have control over their educational journey. For CCR trainees, this means providing opportunities to take ownership of their learning through reflection, independent study, and guided self-

assessment. Encouraging autonomy fosters deeper engagement and promotes lifelong learning habits critical for adapting to evolving practices in CCR.

(ii) Relevance and Practicality: Adult learners are highly motivated when they see the immediate applicability of their learning. For CCR training, this principle underscores the importance of designing activities that directly align with the demands of critical care retrieval, such as managing high-acuity patients, operating specialised equipment, and navigating complex transport scenarios. Practical, real-world applications ensure learners can seamlessly transfer their skills to the field.

(iii) Experiential Learning: Drawing on prior professional experience is a cornerstone of adult learning. CCR trainees bring diverse knowledge and skills to the programme, which can be leveraged to enhance their education. Incorporating hands-on activities, simulations, and scenario-based learning builds on existing expertise and reinforces critical thinking and problem-solving in high-pressure environments.

For this study, Adult Learning Theory informs the curriculum design by aligning educational strategies with the unique needs of experienced healthcare professionals (42). By incorporating elements such as self-directed learning, practical relevance, and experiential approaches, the curriculum fosters a learner-centred environment that respects the maturity, autonomy, and professional background of CCR trainees. This alignment ensures practitioners are equipped with the technical skills required for CCR and empowered to apply their learning effectively in real-world settings. This tailored approach maximises engagement, builds confidence, and enhances the overall quality of critical care retrieval training.

2.4 APPLICATION OF THE THEORETICAL FRAMEWORK TO THE STUDY

The theoretical framework presented in this chapter provides a comprehensive foundation for developing a curriculum tailored to the unique demands of South African Adult CCR. By integrating Situated Learning Theory (28), Kern's Six-Step Model (41), and Adult Learning Theory (42), the framework ensures that the curriculum design is both evidence-based and contextually relevant.

Situated Learning Theory emphasises embedding learning within authentic, real-world contexts (27). Its application to this study highlights the importance of experiential learning activities, such as high-fidelity simulations, case-based discussions, and supervised fieldwork. These activities align with the principles of CoPs, fostering collaboration, mentorship, and the gradual progression of learners from novices to competent practitioners (31). By situating CCR training within realistic scenarios, the curriculum bridges the gap between theoretical knowledge and practical application, ensuring practitioners are well-prepared to manage high-acuity cases effectively.

Kern's Six-Step Model offers a structured approach to curriculum development, ensuring that the process addresses identified gaps and aligns with both local and global best practices (40,41). Each step—problem identification, needs assessment, goal setting, educational strategies, implementation, and feedback—has been adapted to meet the specific challenges of CCR in South Africa. This model ensures that the curriculum is responsive to the healthcare system's demands, integrates diverse educational strategies, and includes mechanisms for continuous improvement. Adult Learning Theory further enriches the curriculum by addressing the unique characteristics of adult learners (42,43). Its principles of self-directed learning, relevance, and experiential learning ensure that the curriculum engages experienced healthcare professionals and enables them to build on their prior knowledge (42). Activities designed with these principles foster autonomy, encourage practical application, and enhance critical thinking and problem-solving in high-pressure environments.

Together, these theories provide a synergistic framework that guides every aspect of the curriculum's design and implementation. They ensure the curriculum equips practitioners with

the technical and clinical skills necessary while fostering adaptability, teamwork, and decision-making—core competencies essential for CCR practice in a resource-constrained yet dynamic healthcare environment.

In conclusion, this theoretical framework offers a robust foundation for achieving the study's aim: to develop a contextually appropriate and evidence-informed curriculum for South African CCR. By combining the principles of Situated Learning Theory, Kern's Six-Step Model, and Adult Learning Theory, the curriculum is designed to meet the educational needs of CCR practitioners while addressing the broader goals of improving patient outcomes and enhancing the quality of critical care retrieval (28,31,41,42). The subsequent chapters will build upon this framework, detailing the study's methodology, findings, and recommendations for implementing this innovative curriculum.

2.5 CONCLUSION

In conclusion, Chapter 2 outlines a robust theoretical framework that serves as the cornerstone for developing a contextually relevant CCR curriculum for South Africa. The integration of Situated Learning Theory emphasises the importance of experiential learning in authentic, real-world contexts, bridging the gap between theoretical knowledge and practical application. Kern's Six-Step Model offers a structured and systematic approach to curriculum development, ensuring the process is comprehensive, evidence-based, and adaptable to the challenges of CCR training. Finally, Adult Learning Theory enriches the framework by tailoring the curriculum to the unique needs of experienced adult learners, fostering engagement, autonomy, and critical thinking. These theories provide a cohesive foundation for designing a curriculum that equips CCR practitioners with the skills, knowledge, and adaptability required to excel in complex and resource-constrained environments. The following chapters will build on this framework, detailing the study's methodology, findings, and the proposed implementation of this innovative curriculum.

CHAPTER 3 - EVIDENCE REVIEW

3.1 INTRODUCTION

Chapter 3 presents a scoping review of CCR training and curricula, both locally and internationally. As a foundational step in developing a tailored curriculum for South African CCRS, this review maps existing training programmes, highlighting key gaps, challenges, and opportunities. The chapter underscores the critical need for a standardised approach to CCR education, particularly within the unique and resource-constrained context of South Africa. The review identifies essential components of a comprehensive curriculum by examining seven core domains of CCR: expanded skills and scope, additional training, case selection, dedicated crew, dedicated equipment, quality management, and continuing medical education. It further emphasises the importance of aligning training content with the specific demands of the South African healthcare system to ensure contextual relevance and system-wide applicability. This chapter sets the stage for the study's subsequent phases, which focus on curriculum development, contextualisation, and expert consensus.

3.2 THE ROLE OF EVIDENCE REVIEW IN RESEARCH

A scoping review was conducted as the formal evidence review for this study. Unlike a traditional literature review, which critically appraises and synthesises existing knowledge, a scoping review is used to systematically map the breadth and depth of available evidence on a given topic (44,45). This approach was selected to accommodate the diverse and evolving nature of CCR training internationally and to ensure the inclusivity of peer-reviewed, grey, and programmatic literature (46).

The scoping review was conducted in accordance with the PRISMA Extension for Scoping Reviews (PRISMA-ScR), providing a transparent and structured methodology. It informed the development of subsequent study phases by identifying educational gaps, training trends, and emerging priorities relevant to the South African context.

The importance of evidence review lies in its ability to:

- Establish the research context: It situates the study within the broader field, providing a background that underscores the relevance of the research question.
- Identify gaps and inconsistencies: It uncovers areas where knowledge is lacking or where evidence is contradictory, offering a basis for refining the research focus.
- Support methodological choices: Reviewing approaches used in prior studies helps guide the selection of appropriate data collection and analysis methods.
- Ensure academic rigour: It thoroughly engages with existing research, lending credibility and depth to the study.
- Avoid redundancy: It helps ensure that the research builds upon, rather than duplicates, previous efforts.

The review is crucial for exploring the unique requirements of critical care retrieval in South Africa. By examining local and international programmes, it identifies best practices and contextually relevant strategies that will inform the development of a comprehensive and tailored curriculum.

3.3 APPROACH TO THE GATHERING OF LITERATURE AND EXISTING EVIDENCE

3.3.1 Methods

3.3.1.1 Study Design

The researcher conducted a scoping review of grey literature and articles published between January 2011 and August 2024. The search used an *a priori*-developed search strategy to identify literature on critical care retrieval training programmes and curricula locally and internationally. The Human Research Ethics Committee of the University of Cape Town waived ethical approval for this scoping review (see Appendix 1 - Ref. No. HREC 408/2022), as it relies solely on publicly available literature.

The search was conducted on September 30, 2022 (reran on August 13, 2024). Studies published before 2011 were excluded due to the relative nascency of CCRS worldwide and, more

specifically, in South Africa. Results in this study are reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Extension for Scoping Reviews (PRISMA-ScR) (47).

3.3.1.2 Search strategy and eligibility criteria

As recommended by Aromataris et al., a search strategy was developed to identify all literature systematically (48). The search strategy included six elements:

a) Critical Care Retrieval - involves transporting critically ill patients between healthcare facilities, requiring specialised medical management and skilled personnel for safe transfer.

b) Critical Care Retrieval Curriculum - outlines essential skills and knowledge for safely managing and transporting critically ill patients.

c) Critical Care Retrieval Training - involves specialised programmes that train healthcare professionals to safely transport critically ill or injured patients between healthcare facilities under challenging conditions.

d) Standards - refers to established guidelines and benchmarks ensuring the quality, safety, and consistency of critical care retrieval practices, including training and patient care protocols.

e) Learners - those undergoing advanced training in critical care retrieval, enhancing their skills beyond standard medical education to transport critically ill or injured patients under challenging conditions safely.

f) International - refers to CCR activities and training that happens outside of the South African borders.

A search string (see Appendix 3) was developed for each of these elements using appropriate keywords and synonyms, and these elements were combined using Boolean operators. The search was conducted using Medline (via PubMed) and Scopus databases. Due to the nature of the literature, we did not get excellent yields from searching scientific databases alone. Grey

literature was searched on Google and Google Scholar using specific keywords such as "critical care retrieval training programme" and "curricula." The advanced search operators were used to refine the results and explore academic repositories, government websites, and professional forums to source literature pertaining to critical care training.

Sources were restricted to English articles that contained relevant information in their titles, keywords, or abstracts regarding critical care retrieval training programmes and qualification frameworks. Any articles published outside the realm of critical care retrieval, articles not in English, and those without full-text availability were excluded.

After removing duplicate entries, two investigators (LvR, NV) independently assessed the eligibility of titles and abstracts. Any disputes were resolved in the next phase, and the papers were then reviewed for inclusion based on their full text, with any uncertainties or ambiguities resolved through consensus by the same two investigators (LvR, NV). Additionally, the reference lists for all included articles were examined similarly to determine eligibility.

3.3.1.3 Data extraction and analysis

Information extracted from the full-text articles was extracted by the principal author (LvR) into an Excel spreadsheet (Microsoft Corp. Redmond, Washington, United States) using *a priori*-designed extraction matrix. The matrix included study aims, methodological details, study population and sample size, methods, main findings, sources of bias/potential limitations and bibliographic information. The two investigators independently piloted the full-text extraction matrix (LvR, NV), and topic domains were refined through consensus (see Appendix 4). Any disagreements were expanded to full-text excerpts and subjected to an additional round of consensus. Topic domains were then deductively matched to a consensus definition for CCRS in SA. The following framework defines Critical Care Retrieval Services, including specific patient populations, case selection, a dedicated crew with additional training, dedicated equipment, and continuous quality management and training (16). Corresponding with the ScR methodology, a formal risk of bias assessment was not performed (47).

3.4 CONTEXT OF CCR IN SA

SA has seen a shift in its disease burden, which has historically been similar to that of other low- to middle-income countries (LMICs), from primarily infectious or communicable diseases to an alarming increase in non-communicable diseases (NCDs) through urbanisation and changing patterns in lifestyle and culture (49). It is estimated that the NCD disease burden has risen by approximately 27% in the Sub-Saharan African region over the last decade (49,50)

In addition to NCDs, several other diseases are on the rise in LMICs, such as SA. These include severe infections, respiratory illnesses, both intentional and unintentional injuries, maternal complications, and cardiovascular disease, which leads to a quadruple burden (14). Timely treatment is essential to minimise the risk of severe illness or death. However, hospitals in South Africa face additional challenges, including unequal distribution of resources, poor quality of care, and overcrowding. (3,4). The frequency of interfacility transfers is even more regular in SA because of the tiered healthcare system, which is based on referral, and the level of care depends on the capabilities of the initial receiving healthcare facility (3). This phenomenon is not unique to SA, and it is also observed in other LMICs, where transferring critically ill patients between facilities becomes increasingly prevalent due to resource scarcity (2). Complicating matters is the fact that patients requiring critical care retrieval often experience emergent medical conditions of high acuity (18,34). They are dynamic and often find themselves in precarious physiological conditions. Transferring them puts them at risk of additional harm and instability due to transport stress (52).

The goal of transferring critically ill or injured patients should be to maintain the continuity of high-quality care during transit to specialist care in a timely and safe manner, as this may significantly improve patient outcomes (52–54). An Australian-based study indicated that the prevalence of adverse events during such transfers can be reduced significantly when a dedicated crew and experienced providers undertake the transfer (22). The study revealed a diverse range of critically ill patients transferred. Trauma cases were the most common (30%), followed by neurological conditions (25%), such as strokes and brain injuries. Toxicology cases (9%), cardiovascular conditions (10%), and respiratory issues (7%) also featured prominently.

Gastrointestinal conditions (7%) and infections or sepsis (4%) were noted, along with smaller proportions of ENT (3%) and psychiatric cases (1%). Other unspecified medical conditions made up 4%. This variety highlights the complexity of patients requiring ICU transfer(22). The overall adverse event rate of 22% in their 6-month prospective observational study was significantly lower than the 35-70% reported in similar studies, reflecting the importance of expertise among the healthcare team (22).

To transport critically ill and injured patients safely, it is deemed that EMS crews undertaking these transfers need some understanding and a set standard of essential CCRS knowledge (19). Therefore, it is suggested that training be developed for CCRS crews, primarily focused on enabling them to safely and competently deal with any critically ill and injured patient (19,43). Bartholomew et al. suggest that training content must inherently be contextually appropriate. Thus, any attempt to develop CCRS education and training for South Africa should be focused on the patient population within the South African CCRS context (25).

In High-Income Countries (HICs), the critical care transport (CCT) of patients is often reserved for specialised medical and paramedical teams who have undergone specialised training in critical care transportation(56). However, the HPCSA mandates that CCT and CCRS fall within the scope of practice of specific professionals. These include ECPs (who have obtained a four-year Bachelor of Emergency Medical Care (BEMC) degree) and paramedics with a three-year national diploma, a two-year diploma in emergency medical care, or, historically, a nine-month short course. There is no requirement for additional training.

Conradie et al. compared the content taught in critical care transportation modules across various SA bachelor's degrees in emergency medical care. It was shown that aspects of critical care are currently taught at most of the SA universities offering this degree. However, that does not necessarily translate into provider readiness for the critical care transportation environment (57). It is also still unclear whether these educational components are contextual and whether the graduates are adequately prepared to undertake CCTs independently (14,15). A study done by Senekal et al. argues that the current undergraduate training does not sufficiently prepare providers to conduct CCTs (18).

CCRS is a developing field within South African EMS. Many private and government services have started establishing CCRS to meet the growing need. As we currently do not have a universally accepted standard for CCR training in SA, these units have varying levels of experience, potentially lack contextually appropriate educational materials, and are usually limited to in-house staff with no external credentialing. Expertise in such a specialised field does not result from experience and traditional undergraduate education alone; specific training opportunities must be created where deliberate practice and application can occur (58).

One of the first logical steps in developing a curriculum for South African adult CCRS is to understand the full scope of critical care retrieval curricula locally and internationally, thereby informing a general needs assessment within the context of CCRS. This scoping review describes the content and curricula of local and international adult critical care retrieval training, as well as the available programmes. This study forms part of a larger project seeking to initiate the development of a curriculum for SA CCRS.

3.5 RESULTS

The initial search for critical care retrieval training programmes and curricula, both locally and internationally, was concluded on 30 September 2022 on PubMed and Scopus (re-run on 13 August 2024). The search yielded 871 articles for initial review (no additional articles were included after rerunning; they were excluded based on title); after removing duplicates and titles and conducting abstract screening, 82 full-text articles were assessed for eligibility, and a total of 52 full-text articles were included. In addition to published literature, seven additional records identified through other sources, such as grey literature sources on critical care retrieval training, were included.

The search was repeated on 13 August 2024, with the results limited to those between 30 September 2022 and 13 August 2024 (no additional results were included). A total of 59 sources have been included, as shown in Figure 3.

The majority (85%) of the literature originated from HICs such as Australia, the United States of America, the United Kingdom, and Qatar. The remaining literature (15%) stemmed from LMICs, including South Africa.

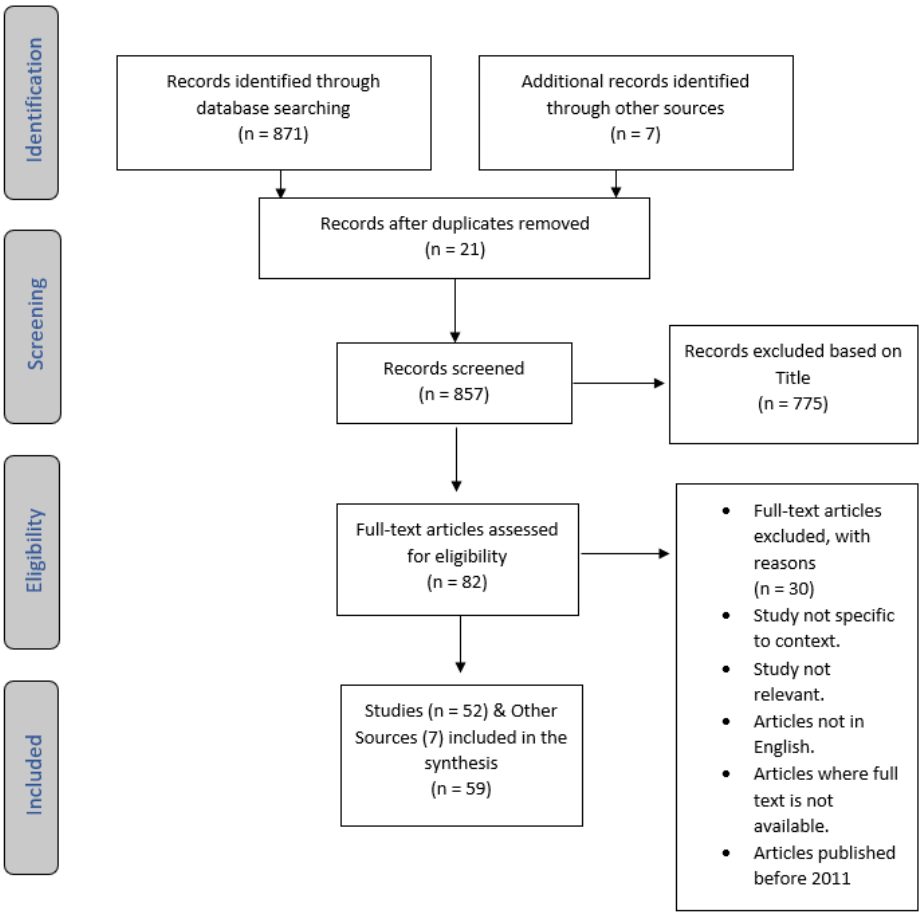

Figure 3: PRISMA Flow Diagram

All the literature was deductively mapped into seven categories, which aligns with the existing framework for defining CCRS:

- Additional Skills/Expanded scope
- Additional Training
- Case selection/ Specific patient populations
- Dedicated Crew

- Dedicated Equipment
- Quality Management
- Continuing Medical Education

3.5.1 Additional Skills & Expanded Scope

Additional skills and expanded scope relate to studies that propose or review the addition of certain medications, diagnostic capabilities or interventions for healthcare providers functioning in CCRS. Nine studies from the United States (n = 6) (59–64), Australia (n = 1) (65), the United Kingdom (n = 1) (66), and South Africa (n = 1) (20) addressed this issue. Each study employed a different methodology, ranging from retrospective case reviews to literature reviews to Delphi consensus methods.

Internationally, it is widely advocated that practitioners working in the CCT environment require expanded skill sets and scope. This expansion necessitates additional training, which in turn produces procedures and actions that are potentially life-saving and can optimise patient care whilst reducing risks of adverse events in CCTs (59). The specific additional skills and scope expansion should differ depending on the patient population and local needs (60). The addition of skills is linked to the unique environment in which CCT takes place, and it often also aims to improve the overall monitoring and diagnostic ability to improve care (61). Many argue that the inclusion of additional skills and the expansion of scope within the CCT environment can be done safely with additional training, adequate guidelines, and solid clinical governance (61–64).

Internationally and locally, there seems to be considerable advocacy for improved skillsets and scopes compared to normal operations. (20,65). Several sources supported the notion of additional skills and expanded scopes. They identified a crucial deficiency in adequately skilled critical care trained personnel to ensure safe CCTs with minimal adverse events and improved patient outcomes (66,67). Additional skills and an expanded scope that should form part of the training for CCR providers include but are not limited to, advanced airway management and extracorporeal membrane oxygenation. For a more comprehensive overview, please see Tables 1 and 2 below.

3.5.2 Need for Additional Training

Additional training in the context of this study refers to supplementary educational components beyond the foundational or core curriculum taught in the emergency medical care undergraduate programmes in South Africa. This additional training could cover specialised topics, advanced techniques, or specific skills that may not be covered comprehensively in the standard curriculum. Twenty-three studies addressing this topic were conducted across multiple countries, including the United States (n=10) (68–77), South Africa (n=3) (18,57,78), Australia (n=3) (79–81), United Kingdom (n=2) (82,83), New Zealand (n=1) (81), and one study each from Canada (84), Japan (85), Norway (86) and Iran (87). Each study used varying methodologies, including curriculum analysis (qualitative and quantitative) (57), simulation evaluations (pre-post assessments and mixed effects models) (68,77,85,86), secondary data analysis (70,78), modified surveys (71,81,82), randomised trials (75), framework adaptation (76), retrospective reviews (74,80), and qualitative interviews (18,83,88).

A recurring theme in the literature suggests that practitioners working in CCRS require additional training, as the standard education provided does not sufficiently prepare them for the expectations in the critical care retrieval environment (18,20,57,87). This is echoed in the literature, which describes the CCRS case mix as drastically different from that encountered during primary response unit operations (71). Patients in the critical care environment are often of higher complexity and, therefore, require care from providers with additional postgraduate training. (18,70,71,79,82,86). Practitioners working on CCRS are often the only providers skilled enough to initiate, continue and provide clinical care, which requires them to operate outside of what has been taught historically (68,72,73,80).

In addition to the apparent need for expanding the standard paramedic training regarding the depth and scope of knowledge, the literature emphasises so-called “non-clinical skills” that should form part of standard training practices (71,77,83,85,89). Some examples include communication skills, attitude and confidence, teamwork, empathy and conflict resolution, amongst others (74,78,81,84,90). Crew Resource Management (CRM) training is a popular method of packaging and transferring these skills, which is described as “*the effective use of all*

available resources to assure a safe and efficient operation, reducing error, avoiding stress and increasing efficiency"(78), which is said to add immense value to the well-rounded clinician (78) Handovers are often the most critical part of the patient care journey, and structured patient handover procedures have been identified as one of the critical aspects which could have a significant impact on patient morbidity and mortality(74–76,88,91).

The main theme from the grey literature strongly advocates that paramedics operating in the CCRS environment need specialised training and additional qualifications that fall outside of regular day-to-day operational EMS practices (40,41). The literature clearly establishes the need for additional training for CCR providers. This training should not only address clinical skills but also emphasise non-clinical competencies to ensure a comprehensive skill set. Tables 1 and 2 (pg 53 & 54) below provide further details on these areas.

3.5.3 Case Selection & Specific Patient Population

Case selection and the specific patient population in this study refer to selecting relevant clinical cases and identifying the target patient group that might benefit from CCRS. It involves identifying critical care cases and patient demographics to tailor the curriculum effectively. Five studies addressing this topic were conducted across multiple countries, including South Africa (n = 2) (34, 93), the United States (n = 1) (94), Scotland (n = 1) (95), and Qatar (n = 1) (93). The studies employed various methodologies, including prospective observational simulations for paediatric resuscitation, retrospective data reviews (34,94,95), and analysis of mission times to assess intervention appropriateness (96).

Due to the fact that critical care retrieval services only serve the sickest subset of the population, much like critical care services in hospitals, it would make logical sense for critical care services to employ appropriate triage to prevent being diluted in day-to-day operations for lower acuity cases (93,95). In a study titled "A National Retrospective Descriptive Analysis of Critical Care Transfers in the Private Sector in South Africa, " Venter et al. highlight the complexity and acuity of the patients undergoing these transfers, stressing the need for specialised training and equipment to handle these cases effectively (34). In the SA-based study, 1,839 CCT patients from the private sector were analysed, revealing a diverse and complex case mix. Cardiovascular

disease was the most common diagnosis, accounting for 25% of cases (n = 456), followed by infections at 10% (n = 180) and head injuries at 7% (n = 133) (34). Trauma-related conditions, including head injuries, polytrauma, extremity fractures, and spinal injuries, comprised 21% of cases (34). Other significant diagnoses included central nervous system disorders (4%), respiratory diseases (2%), neoplasms (2%), burns (2%), endocrine disorders (2%), and gastrointestinal conditions (2%) (34). Less frequent diagnoses, each contributing 1%, included mental and behavioural disorders, overdoses, post-surgical complications, and preterm labour (34). A Scottish study looking at aeromedical taskings found that only 42% of taskings were deemed appropriate because critical care or advanced medical interventions were performed (96). Although noted to be less than 50%, it was deemed acceptable and appropriate by the author, indicating that HICs are likely more accepting of significant over-triage than LMICs might be. This statement is supported by a study conducted by Vlok et al., who emphasised the importance of correct patient selection to maximise the benefits of helicopter emergency medical services (HEMS), particularly in resource-constrained environments. The same could be said for CCR resources being utilised in traditional road operations (94). Exploring the dilemma of which specific cases define and warrant CCRS, Venter et al. acknowledge that “critically ill or injured” is poorly defined and problematic at present (26).

3.5.4 Dedicated Crew

In this study, a dedicated crew refers to a specialised team of healthcare professionals assigned to manage critical care transfers as needed. Eight studies exploring this topic were undertaken across various countries, encompassing the United States (n=3) (97–99), United Kingdom (n=2) (82,100), South Africa (n=1) (18), and one study each from Canada (90) and Sweden (n=1 each) (101). It is well described that patient type and severity vary within critical care, owing to a wide variety of pathologies across the entire spectrum of life phases. In Paediatric CCR and literature, the need for dedicated training and crews due to their nuanced care is well described, which slightly contrasts with the adult critical care population (97). Regional variation also means that the composition of critical care transport teams varies significantly internationally. Whereas the USA seems to favour a mixture of physicians, nurse practitioners, critical care paramedics and

respiratory therapists, Qatar only utilises physicians in 8% of their critical care transfer with universal critical care paramedic involvement (93,97).

In a study conducted in the USA, it was found that dedicated Critical Care Flight Paramedics (CCFPs) who received additional training in critical procedures demonstrated statistically significant improvements in survival rates when compared to the non-specialised crew dealing with trauma patients (98). During the COVID-19 pandemic in 2020, the London Ambulance Service successfully utilised dedicated military CCRS teams of physicians, nurses, or critical care paramedics to transfer critically ill patients in a civilian setting (100). In Sweden's aeromedical service, physician and nurse specialists undertake long aeromedical transfers (101). In a UK-based study, there are variations regarding the roles and training of Critical Care Paramedics (CCP), but their impact on the system and the patients they see Is clear despite the cost being a significant limitation to standardising the service (82). Even though some CCRS practitioners only fulfil those roles part-time (18), it seems universal among these teams that they are dedicated to critical care transport, even if it is for that shift allocation, rather than being formed ad *hoc* when needed.

A study by Caffery et al. also advocates for Paramedic specialisation. They make reference to the fact that multiple other healthcare professions specialise due to an evident and apparent need, and then we can adapt some of their strategies where applicable (99). They also alluded to the fact that specialisation can help us elevate the levels of care we render in the field and generate practice standards(99). The above notion of having dedicated staff looking after those who are critically ill and indeed of the intensive case has been identified as one of the tools and practices informing and ensuring high-quality care (90)

The included studies used varied methodologies, including retrospective comparisons of evacuation outcomes, updated scoping reviews (90), online surveys (82,97), qualitative interviews and focus groups (18,101), and curriculum evaluations with pre-and post-testing (99).

3.5.5 Dedicated Equipment

In this study, dedicated equipment refers to specialised medical equipment essential for managing critically ill adult patients requiring critical care transfer. Four studies exploring this topic were undertaken across various countries, encompassing the United States (n=2) (102,103),

United Kingdom (n=1) (104) and South Africa (n=1) (18). One study used qualitative descriptive methods with thematic analysis of focus group discussions (18), while another conducted a prospective observational analysis of prehospital ultrasound in patients with respiratory distress (102).

Critically ill and injured patients often require more resources and specialised equipment (for diagnostic and therapeutic purposes) in their management compared to non-critically ill patients, irrespective of the in-hospital or the out-of-hospital environment (18,35). International literature suggests that specialised dedicated CCT equipment is essential (104). Similarly, a South African study evaluated the lived experiences of emergency care practitioners undertaking critical care transfers in the SA context and found that they are often ill-prepared and ill-equipped to undertake the CCTs safely (18) . These practitioners interviewed in Gauteng also firmly believe that CCTs are often conducted by inexperienced crews with inadequate equipment, resulting in ill-prepared practitioners facing the complexities of CCT, which in turn leads to an increase in adverse events. (18,56).

The function of CCRS, as outlined in international literature, is to provide a mobile intensive care unit that prevents patient deterioration by utilising dedicated providers, ICU-level equipment, and continuous education (104).

3.5.6 Quality Management

Continuous Quality Improvement (CQI) is a progressive incremental improvement of processes, safety, and patient care (105). Five studies exploring this topic were conducted across various countries, encompassing the United States (n = 4) (106–109) and Norway (n = 1) (106). The studies employed various methods, including pretest-post-test designs, literature searches, randomised intervention studies, parallel controlled trials, retrospective chart reviews (107), qualitative interviews, cross-sectional surveys (106), and performance assessments with pre- and post-intervention evaluations (108).

The past few decades have placed the spotlight on CQI in healthcare, and it has been no different in CCRS. The role of CQI in CCRS would be to create standardised practice, decrease variation,

increase adherence to evidence-based guidelines, monitor processes, and enable practitioners to measure patient outcomes, as these are critical for improving the quality of care (109).

CCRS clinicians should possess in-depth knowledge of CQI procedures and have enhanced clinical expertise compared to their counterparts, and the effects of this have been published (110). One such study demonstrated that monitoring an airway registry and reflecting on clinical decisions made on a case-by-case basis improved the overall first-pass success rate of intubations among critically ill patients (107). In addition to implementing quality improvement (QI) initiatives, it is recommended that QI-specific education be included in the curriculum of healthcare practitioners undertaking critical care training or specialisation, which can be done without affecting the overall complexity or duration of such dedicated programmes (110).

Benchmarking is crucial for ensuring quality management and promoting continuous improvement. Overall, benchmarking in healthcare is not just important for quality management but is essential for reducing costs, enhancing patient outcomes and satisfaction, and ensuring compliance with regulatory requirements (111). It provides valuable insights that enable healthcare organisations to make informed decisions and deliver high-quality, cost-effective care (111).

3.5.7 Continuing Medical Education

Emergency care providers need to be lifelong learners like other health professionals, and it is important for them to stay abreast of the latest evidence and standards (112). Continuous medical education (CME) is the traditional tool for learning and updating knowledge. Most CME activities include presentations, online courses, conferences, and workshops. However, these are primarily didactic sessions, and evidence suggests that this format is not effective in improving clinical skills and attitudes (113). Nevertheless, this does not diminish the importance of CME (112).

There is currently a paucity of CCRS-standardised ongoing medical education for practitioners; thus, developing a model of ongoing education to increase their knowledge regarding the CCRS patient population is of utmost importance (40,41).

Several pieces of literature examined the methodology used in teaching healthcare providers. A study by Wu et al. developed a clinical teaching blended learning (CTBL) programme with the aid of web-based pedagogy for teaching nurse preceptors. The study indicated that the clinical competencies and knowledge of the nurse preceptors increased through the use of the CTBL. Furthermore, they concluded that healthcare organisations should consider integrating flexible teaching and learning platforms (114). In addition to web-based learning, another study has shown that clinical course teaching improves capabilities, skills, and clinical competencies compared to teaching in a traditional lecture course (87).

Ongoing medical education is often neglected, and a deliberate focus should be maintained to ensure that CCRS practitioners and other emergency care providers stay up to date with the latest information in their practice (87,115). Properly developed ongoing medical education curricula could increase short-term knowledge, and such programmes could be used as an alternative model to develop standardised ongoing CCRS education (115). In addition, high-fidelity simulation (HFS) also plays a critical role in developing well-rounded practitioners in terms of clinical skills and soft skills, such as teamwork, communication, and patient interaction (108,116). Simulation training has been used in medical training, specifically paramedical training, for several decades already. However, its importance now lies in the regular inclusion of HFS training throughout the practitioner's career and even beyond specialisation, as this aligns with other professions (106).

In a study conducted by Stassen et al. examining the efficiency and efficacy of online learning platforms, they found that the online training programme could be effective in improving adherence to training guidelines among paramedics (117). They also demonstrated that online learning can successfully enhance compliance with medical protocols and improve the quality of care in prehospital settings while being cost-effective and underscores the advantages of online education in providing accessible, flexible training that leads to better adherence to established guidelines (117).

Tabled below is the curriculum content derived from the published and grey literature on critical care retrieval:

Table 1: Content derived from published literature

Curriculum Content derived from published literature
Teaching Additions
Advanced airway management
Arterial Blood Gas analysis
Arterial line insertion
Arterial line monitoring
Balloon Tamponade of gastroesophageal varices monitoring
Blood analysis of cardiac markers
Blood analysis of infection markers
Blood analysis of renal function
Cardiac ECG
Chest x-ray interpretation
Content to be patient/caseload-centred
CT & MRI interpretation
Doppler ultrasound assessment
Extracorporeal membrane oxygenation
Handover training
Non-technical skills
ICU medication administration/management
Initiation and monitoring of blood product transfusion
Initiation of tracheostomy
Intra-aortic balloon pump monitoring
Intracranial pressure monitoring
Invasive arterial pressure monitoring
Mechanical ventilation
Monitoring of chest drainage systems
Monitoring of tracheostomy
Monitoring of transvenous pacing
Multi-channel infusion pump/ syringe
Obstetric balloon initiation
Obstetric balloon monitoring
Placement of chest drainage systems
Pulmonary artery catheter removal
Resuscitative endovascular balloon occlusion of the aorta (REBOA)
RSI
Training Specific to the Equipment used in the ICU environment
Ultrasonography - **Lung** - **ET Tube Confirmation**
Vascular access – Arterial stab
Vascular access – Central venous catheter

Tabled below are the topics taught in various international critical care Paramedic programmes:

Table 2: Topics included in international critical care paramedic programmes

Topics included in Critical Care Paramedic Programmes	
Clinical Teaching Additions	**Non-Clinical Skills**
Additional diagnostic training	**Effective communication and decision-making skills**
Advanced airway training	**Ethical and professional behaviour**
Advanced Ventilation techniques	**Factors that influence safe care**
Chemotherapy	**Interprofessional teamwork**
Flight physiology	**Safe, effective, person-centred care**
Geriatric and Special needs patients	**Patient Advocacy**
ICU Medications and infusion	**How to practice evidence-based medicine**
Intra-aortic balloon pump	
Special monitoring/assessment techniques (Ultrasonography, ABG Analysis, Invasive Haemodynamic monitoring)	
Transport and packaging considerations	
Transport radiology	
(73,92,118–125)	

3.6 DISCUSSION

This study provides a comprehensive examination of existing adult critical care retrieval literature and training programmes, describing both local and international curricula to inform the development of a tailored South African Adult Critical Care Retrieval curriculum. Given the paucity of actual curriculum blueprints being published in the peer-reviewed literature, it necessitated analysing grey literature from relevant sources to be included.

During the data review, several topic domains emerged that appeared well-aligned with the existing proposed definition of Critical Care Retrieval in the South African context (26). The seven identified domains are additional skills and expanded scope, additional training, case selection, dedicated crew, dedicated equipment, quality management, and continuing medical education. These areas seem to be comprehensive and a good framework for exploring adult critical care retrieval training. It is therefore recommended that they be included and individually considered when developing the curriculum for critical care retrieval educational programmes. (26).

Patients requiring CCRS are usually physiologically compromised complex and does not necessarily mirror the patient population seen by the frontline EMS crew (52,93). For particularly

vulnerable patients, it might be imperative to advocate CCRS for those patients where the largest potential benefit lies. Examples would include patients with an advanced airway, with hemodynamic instability undergoing vasopressor therapy, extremes of age or organ failure requiring intense support (126) due to the unique nature of the South African pluralist health system. Public, private for-profit, private not-for-profit, and traditional healers, it is uncertain how the case mix and caseload would differ between private and public services. Venter et al. describe 3 143 diagnoses amongst 1839 patients transported in a private EMS sample(34). Thus, yielding an average of two diagnoses per patient with cardiovascular disease (n = 457, 25%), the most prevalent, followed by infection (n = 180, 10%) and head injury (n = 133, 7%) (34). It is also uncertain where the biggest geographic need for a CCRS currently exists, although it can be argued that this should preferably be in urban areas rather than rural. Urban areas often present a higher demand for critical care retrieval services due to their larger and more densely populated populations, resulting in a greater number of critically ill patients. These regions typically have more advanced healthcare infrastructure and resources, making them better positioned to support and benefit from specialised CCRS. Conversely, rural areas, while potentially underserved, may have fewer patients requiring such services and face logistical challenges that could complicate the implementation and operation of CCRS.

Given the high acuity of the patients conveyed by CCRS, these practitioners often use specialised equipment and resources (18,34,52). The equipment used during CCRS should be applicable to the patient population, and the training programme curriculum development should integrate hands-on training with the specialised equipment.

Despite the strong emphasis on additional training in international and local literature, it is interesting that many of these focus on essential non-clinical knowledge and skills. Training programmes often emphasise a broad spectrum of skills and knowledge, encompassing not only medical aspects but also logistical, communication, and nuanced cultural competencies (74,78,84). In response to increased demand for CCRS, sustained efforts to cultivate the necessary human resources, skills, vehicles, and equipment to deliver advanced therapeutic interventions in the CCT context have been seen in international and local EMS systems (102,103).

Dedicated training to practitioners involved in critical care retrieval and improvement projects have been shown to effectively mitigate the risk of adverse events and errors in patient care (127,128). The addition of specific clinical and non-clinical skills relevant to critical care features prominently in the critical care literature as discussed above (Tables 1 & 2). The SA ECP, as an independent practitioner, can already provide key advanced interventions, such as rapid sequence intubation, 12-lead ECG interpretation and thrombolysis for acute myocardial infarction. The specific skills required for CCRS, including those used during patient transport, and their impact on patient outcomes in South Africa are not yet well understood. However, It is evident in the published literature that SA practitioners currently feel ill-prepared to deal with the complexity of the CCRS patient (18).

Adult critical care retrieval training should address local needs; therefore, incorporating case-based learning scenarios that mirror the diverse clinical landscape preparing practitioners for critical care situations could be an effective adult learning tool (129). Simulation exercises are instrumental in preparing practitioners to navigate the challenges posed by CCR missions and in familiarising them with the equipment and environment (130).

As the bulk of CCRS literature stems from high-income settings, it is implied that over-triage is accepted as normal practice. This, therefore, places particular emphasis on accurate CCRS triage in SA and other LMICs, as the capacity to deal with high levels of over-triage would be minimal and unacceptable (94). Over-triage would further strain healthcare resources, leading to increased costs and reduced access to care for patients in need (94,131,132). Addressing this issue would require a multifaceted approach, including improving primary care access, enhancing triage protocols, and optimising resource allocation while balancing this with ensuring equitable access for all patients (133,134). Dedicated CCRS crew is well-described and central to most curricula (93,97). Curriculum development should not only prioritise individual development but also foster a cohesive, collaborative, and specialised team trained to function seamlessly during retrieval missions, which may even necessitate a multidisciplinary crew composition. In the context of South African EMS, CCRS crew members are often required to frequently attend low-acuity cases, which could lead to them being overburdened and fatigued. Frequent exposure to low-acuity cases may contribute to both physical and mental exhaustion, which could

significantly increase the risk of adverse events and malpractice when undertaking CCR cases (135).

Continuous quality improvement and clinical governance are at the backbone of dedicated CCRS and should be ingrained into systems providing critical care (26,109). The commitment to maintaining and enhancing the standard of care through quality management strategies should be integrated into the curriculum. This involves imparting knowledge and skills related to sustained professional development, such as continuous quality improvement, risk management, and the integration of feedback loops to refine retrieval practices.

Moreover, the discussion emphasises the ongoing evolution of critical care retrieval and the need for a flexible and adaptable curriculum to emerging trends and technologies (117). Incorporating traditional simulation-based training and utilising virtual platforms for distance learning, observed in some international programmes, provides a forward-looking perspective for developing CCRS training programmes in SA. Online learning has previously been shown to improve clinical guideline adherence in SA CCRS (117).

The primary gap identified in this scoping review is the lack of a standardised, tailored curriculum for adult critical care retrieval in South Africa that addresses the specific needs and complexities of the local healthcare environment. While existing literature highlights the importance of specialised training, many local programmes focus on critical care generically or in an unknown depth, which is deemed inadequate for managing complex critical care retrieval cases (24,57). There is a notable absence of curriculum blueprints that incorporate the unique aspects of the South African healthcare system, such as the diverse case mix and the need for dedicated equipment and specialised teams. Additionally, while international programmes emphasise continuous quality improvement and flexible training methods, including online learning, there is a need for a curriculum that effectively integrates these approaches to enhance adherence to clinical guidelines and improve patient outcomes in the South African context. Addressing these gaps is crucial to developing a comprehensive and contextually relevant critical care retrieval training programme.

Ensuring that the considerations of the seven identified domains allows the South African critical care retrieval curriculum to be contextual and aligned with international standards. Addressing specific challenges and nuances of the South African healthcare landscape, aligned with the patient population in South Africa and inclusive of the non-clinical aspects would be central to the curriculum

3.7 SUMMARY

In summary, this scoping review is a foundational step towards establishing dedicated CCRS training and a curriculum for SA CCRS. By examining local and international programmes, we have identified key components that should be incorporated into a comprehensive and contextually relevant curriculum. The discussion underscores the importance of flexibility, interprofessional collaboration, and cultural competence in shaping the future of critical care retrieval training in South Africa.

Further research into CCR within the South African context is essential to ensure the curriculum is appropriately contextualised. We plan to conduct a retrospective case review to gain a deeper understanding of the patient cohort undergoing CCT within our context, as well as both general and targeted needs assessments with EMS experts and learners. This will gather their input on the necessity of additional training and the specific concepts that should be included.

3.8 CONCLUSION

In conclusion, the evidence review presented in Chapter 3 offers a comprehensive assessment of the current state of CCR training and curricula. The findings reveal significant gaps in the standardisation and contextual relevance of existing programmes, particularly in addressing the complexities of the South African healthcare environment. Key components such as dedicated training for specialised skills, culturally sensitive education, and integrating quality management processes are essential for developing a robust curriculum. Furthermore, the review highlights the importance of continuous professional development and interprofessional collaboration in enhancing the competency and readiness of CCR practitioners. This chapter provides a critical foundation for the study's subsequent phases, guiding the development of a contextually relevant and globally aligned curriculum that meets the unique needs of South African CCRS. By addressing these gaps, the research aims to improve training outcomes, reduce variability in practice, and ultimately enhance patient care during critical care retrieval.

CHAPTER 4 - METHODOLOGY

4.1 INTRODUCTION

This chapter outlines the methodology underpinning all four phases of the study, providing a detailed description and defence of the overall design and methods selected to achieve the study's core aim and objectives. It begins by reminding the reader of the primary aim and objectives, as introduced in Chapter 1, followed by a justification of the chosen research design. Thereafter, each of the four phases is described in detail, with a clear articulation of the methods and approaches employed, along with an argument for their appropriateness in addressing the study objectives within the South African context. Where applicable, internationally recognised reporting standards—such as Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) (47), Reporting of studies Conducted using Observational Routinely-collected health Data (RECORD) (136), Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) (137), Consolidated Criteria for Reporting Qualitative Research (COREQ) (138) and Conducting and Reporting of Delphi Studies (CREDES) (139), were incorporated to strengthen transparency, enhance reproducibility, and ensure methodological rigour across the multi-methods approach.

4.2 RESEARCH AIM AND OBJECTIVES

As mentioned in Chapter 1, the core aim of this study was to develop a contextually relevant curriculum with course goals and learning outcomes for learning programmes that focus on the development of knowledge, skills and insights required to confidently and competently participate in CCRs in South African settings. In order to achieve this aim and, in so doing, address the research problem and answer the research question (see Chapter 1), the following objectives were derived:

- **To conduct a situational analysis to understand the current state of critical care transfers that are being conducted in the SA context.**

- **To explore the content and curricula of both local and international adult CCR training programmes.**

- **To assess the needs of both the EMS industry and its learners.**

- **To reflect on the insights and understandings that emerged from the completion of the above three objectives to inform the development and validation of a formal CCR curriculum tailored to the South African context**.

4.3 RESEARCH DESIGN

The research design is a structured procedural plan that guides a researcher in answering questions with validity and precision (140,141). It ensures objectivity and accuracy throughout the research process (140,141). The chosen research design determines the type of analysis required to achieve the desired outcomes.

This study adopted a multi-methods design to comprehensively address the complexities of developing a contextual curriculum for critical care retrieval in South Africa (32,33). This design was chosen because it allows for the systematic integration of quantitative and qualitative data, ensuring a holistic approach to addressing the research aims(33). The nature of the design enabled each phase's outcomes to inform and support the approach to the subsequent phase, promoting a logical and iterative development process. The combination of methods provided both breadth and depth, ensuring that the findings were both data-driven and contextually relevant (33).

Phase 1 involved a systematic scoping review of international critical care retrieval training programmes to identify best practices, curriculum content, delivery methods, and evaluation strategies. This phase ensured the study was grounded in globally recognised standards and practices, providing a strong foundation for subsequent phases (142,143).

Phase 2 focused on a retrospective case review of electronic patient care reports from Western Cape EMS to analyse the demographics, clinical conditions, and interventions of critically ill

patients requiring interfacility transfers, providing critical contextual insights. This phase represented the retrospective component of the study and was crucial in understanding the unique challenges and demands of the local EMS context (136).

Phase 3 utilised qualitative methods, including semi-structured interviews with experts and focus group discussions with EMS learners, to identify educational gaps and essential competencies for critical care retrieval. This phase, along with Phase 4, represented the prospective component of the study. By capturing diverse stakeholder perspectives, it ensured that the curriculum addressed real-world needs and expectations.

Finally, Phase 4 employed the Delphi methodology, achieving expert consensus through iterative rounds of feedback to finalise the curriculum's goals and objectives, ensuring alignment with local needs and international standards. This method was pivotal in validating the curriculum through a rigorous and structured approach, thereby fostering credibility and relevance (144–146).

As shown in Fig 1 above (see Chapter 1), the process began with Phase 1 and progressed through a systematic and structured approach to developing a tailored critical care retrieval curriculum. The insights from the earlier phases facilitated the creation of a draft curriculum, which underwent a Delphi process in Phase 4 to finalise its goals and structure.

4.4 METHODOLOGY AND APPROACH

The method and procedure for completing each of the four phases depicted in Fig 1 above (see Chapter 1) are described in the sequence in which they were conducted in the sections that follow.

4.4.1 Phase 1 – The scoping review

4.4.1.1 Method and Approach

The first phase involved a scoping review to align the curriculum with international standards and best practices. This review examined international adult critical care retrieval training

programmes and described their course goals and objectives, ensuring that the proposed curriculum met global benchmarks. This phase is wholly reported in Chapter 3.

4.4.2 Phase 2 – Analysis of critical care transfers.

4.4.2.1 Method and Approach

We conducted a retrospective descriptive analysis of ePCRs from the WC-EMS. All ePCRs of adult patients who were accompanied by ALS providers during transfer were sampled. Ethical approval was obtained from the Human Research Ethics Committee of the University of Cape Town (see Appendix 1 - Ref. No. HREC 407/2022), following which organisational approval from the Western Cape Department of Health & Wellness was obtained (see Appendix 2). This phase is reported in accordance with the Reporting of Studies Conducted using Observational Routinely collected health Data (RECORD) extension of the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist (137).

This ensured that the curriculum outcomes and objectives were contextually aligned with the types of patients commonly seen. Retrospective chart reviews and medical record reviews often reveal case trends, treatment effectiveness, disease progression, and the types of interventions patients undergo (136). The data generated from these reviews contribute significantly to the existing body of medical knowledge and support evidence-based practice (136,147). Furthermore, the results generated from these reviews can be utilised to tailor educational programmes and to ensure the patient-centeredness of training programmes.

The phase was conducted within the Western Cape province of SA. The Western Cape Province is situated in the southwest of South Africa and is a diverse province renowned for its cultural richness and stunning scenic beauty. With 11.9% of the national population, more than 7.2 million people live in the Western Cape on 129,462 square kilometres of land (148). As in the greater SA context, the healthcare system in the Western Cape is divided between the public and private sectors, each contributing differently to the overall health landscape. The public sector shoulders a substantial burden, providing healthcare services to the majority of the population, including those with limited financial means (14,149).

The service has a fleet of over 250 ambulances and provides primary emergency care, helicopter emergency services, inter-facility transport, and rescue services (150).

4.4.2.2 Population and Sampling Strategy

The data set consisted of ePCRs logged in the EMS's Computer-Aided Dispatch (CAD) database from January 2018 to December 2021. The focus then became to identify cases that were accompanied by ALS providers during the transfer.

Cases meeting the inclusion criteria for this phase include those transferred between January 2018 and December 2021 within the Western Cape government EMS. Specifically, Trauma and Medical inter-facility transfers (IFTs) are considered, with cases involving an ALS unit comprising Paramedics (ANT registered) and Emergency Care Practitioners (ECP registered) attached to service them. Additionally included are IFT instances where emergency care providers have requested ALS assistance/intervention.

Figure 3 illustrates the sampling method used to identify the call types that require ALS during transfer.

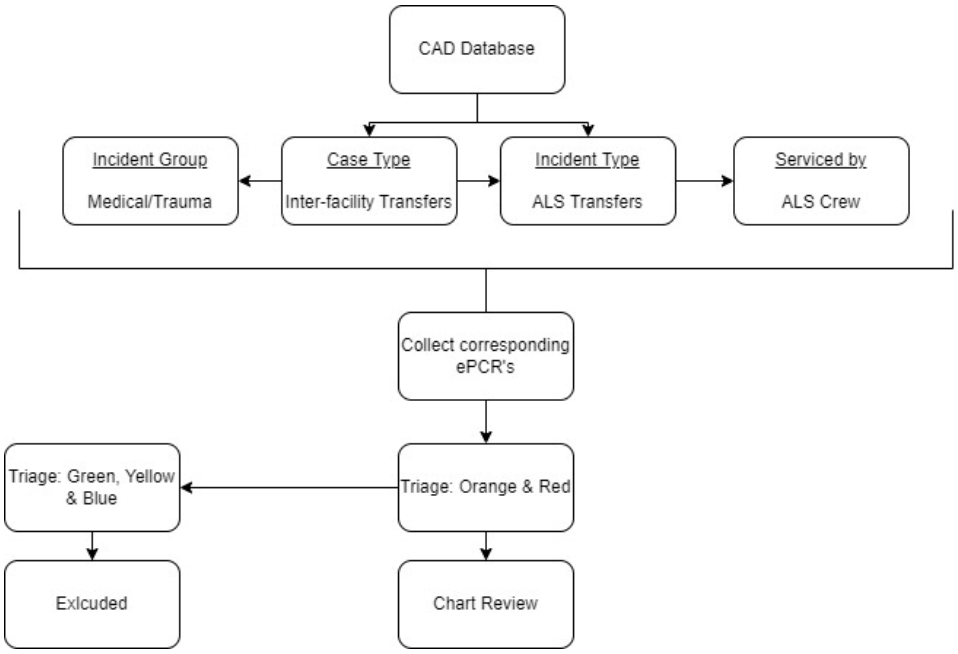

Figure 3: Sampling process for the retrospective case review

Cases that did not meet the inclusion criteria were excluded from consideration. Cases excluded include primary or emergency cases, patients triaged as green, yellow, or blue, IFTs conducted by emergency providers who are not ALS-qualified, cases lacking attachments reserved for ALS providers, and instances where critical variables are missing.

4.4.2.3 Variables

The following variables were described: patient demographics (age and gender), time intervals (response time, scene time, and transfer time), primary diagnosis (respiratory, cardiovascular, gastrointestinal, and others), attachments, and clinical or pharmacological interventions. Based on the extracted variables, we were able to describe the patient population's pathologies and needs during the transfer process. It is essential to keep in mind that, in all instances, more than one diagnosis, attachment, or medication is possible for a patient. Furthermore, we quantified the types of IFTs that required ALS for transfers in and between facilities and described them accordingly.

4.4.2.4 Data extraction

Data for this retrospective case review were extracted from the WCG-EMS CAD database. After familiarising the statistician with the research aims, objectives, data variables, and the contents of the WC-EMS CAD database, data from eligible cases were extracted. Regular meetings were held between the statistician and investigator to ensure credible and consistent extraction, following the guidance of Gilbert et al. on retrospective chart reviews in emergency care (147).

The data extraction focused on patient demographics (age and gender), mission times, primary diagnoses (e.g., respiratory, cardiovascular, gastrointestinal, and other categories), attachments, and clinical interventions. These variables were extracted and analysed in accordance with a pre-defined data dictionary developed a priori to ensure clarity and consistency in variable classification.

To ensure data integrity, extracted data were cross-checked and validated through regular consultations between the statistician and investigator. Cases with incomplete or inconsistent data were flagged for further review, and duplicate cases were identified and removed prior to analysis. All data were organised into a spreadsheet for further processing.

Categorical variables, such as gender, primary diagnoses, types of attachments, and clinical interventions, were recorded as frequencies and proportions. Continuous variables, such as age and mission times, were summarised as means and standard deviations for normally distributed data or as medians and interquartile ranges (IQR) for non-normally distributed data.

The extraction process adhered to the principles of transparency and reproducibility outlined in the RECORD-STROBE guidelines, ensuring robust and credible reporting of the findings (137). This rigorous approach provided a reliable dataset for subsequent analysis and interpretation.

4.4.2.5 Data analysis

The data were extracted onto a spreadsheet and analysed with the help of a Senior WCG-EMS Emergency Care Practitioner. The cases were categorised based on the diagnosis, attachments, and medications.

The phase followed the Gilbert and Lowenstein methods, which emphasise rigorous data extraction and validation processes to ensure data accuracy and completeness (147). This included detailed cross-checking of extracted information against original records. Furthermore, this phase's reporting adheres to the RECORD-STROBE guidelines, which provide a framework for ensuring transparency in observational studies, particularly in the use of routinely collected health data (137). Specific considerations, such as addressing missing data, ensuring reproducibility, and providing clear categorisation criteria, were prioritised during the analysis.

Categorical variables (Gender, Diagnosis, Types of Attachments, Types of Medications) are described as frequencies and proportions. Continuous variables (Age) are described as mean and standard deviation if normally distributed or as the median and interquartile range (IQR) if deviating markedly from a normal distribution. Data are presented in frequency (n) and proportion (%). Patient demographics are presented as both frequency and proportions (%) or as a range, depending on whether the data is continuous or categorical. Patient diagnoses are depicted as proportions (%). It is essential to note that, in all instances, more than one diagnosis, attachment, or medication may be possible for a single patient. The results of this section are to be presented in Chapter 5.

4.4.2.4 Ethical Considerations

This phase involved a retrospective review of WCEMS ePCRs. At WCEMS, it was standard practice for ePCRs to be reviewed to ensure that an acceptable standard of care had been delivered by the attending emergency care providers. Employees within WCEMS were aware of these procedures; thus, their inclusion did not pose any risk to them.

Furthermore, anonymising the ePCRs before data collection mitigated the risk of identifying families, patients, and practitioners. As a result, the only information available to the research team consisted of timelines, clinical parameters, and treatment regimens.

4.4.3 Phase 3 – Student and Educator Interviews

4.4.3.1 Methodology

The phase was qualitative in nature and was conducted in two phases. Initially, a general needs assessment was carried out through one-on-one interviews with CCR experts. Subsequently, a targeted needs assessment was conducted using focus group discussions involving EMS learners, specifically non-dedicated CCRS staff. Ethical approval was obtained from the Human Research Ethics Committee of the University of Cape Town (see Appendix 1 - Ref. No. HREC 311/2024). The phase aimed to unveil the perspectives of experienced EMS staff regarding CCR transfers, as well as those of emerging EMS providers, shedding light on their training requirements. Guided by Kern *et al*., I conducted the general and targeted needs assessments utilising semi-structured interviews and focus group discussions. Interviews and Focus Group Discussions are often used during qualitative research and are commonly used in the continuing health education field for needs assessments. (151). We opted to utilise these methods because they are well known for offering significant, meaningful insight into participants' experiences, beliefs and perspectives, which can help to inform our curriculum development process (151,152).

The design and reporting of this qualitative phase were guided by the COREQ (Consolidated Criteria for Reporting Qualitative Research) checklist (138). This 32-item framework informed the description of interviewer characteristics, study setting, data collection techniques, and reflexivity strategies to enhance transparency and credibility in qualitative reporting.

4.4.3.2 Research Team and Reflexivity

The research team consisted of the primary researcher and supervisors, ensuring robust methodological and analytical approaches. The team conducted regular discussions to maintain reflexivity and minimise potential biases during data collection and analysis. Member checking with supervisors enhanced credibility.

4.4.3.3 Participants

The phase participants were recruited using purposive and snowball sampling methods through email and telephonic correspondence.

CCRS & Industry Experts:

In order to ensure that the proposed curriculum content is relevant and applicable to the SA context, we invited CCRS experts to one-on-one semi-structured interviews. CCR experts are those actively working within healthcare environments, providing care for patients requiring critical care retrieval. The phase will focus on the following professional groups:

- Paramedics and Emergency Care Practitioners
- Emergency Medicine Physicians
- Intensive/Critical Care Physicians
- Emergency Nursing Staff
- Intensive/Critical Care Nursing Staff

To qualify as CCR experts for this phase, participants must have a minimum of 3 to 5 years of experience in a critical care or retrieval environment, as well as experience in managing critically ill and injured patients.

Industry experts in this phase were those with management and leadership experience of 3 – 5 years within the respective healthcare service:

- EMS management
- CCRS management
- Healthcare facility management

Sampling continued until saturation has occurred; this approach is in keeping with previous such studies and their recommendations (153). In this phase, data saturation is defined as informational redundancy, where no new data emerges (154).

Learners:

Learners were defined as those with no CCR experience and have been placed into the learner focus group discussion. These individuals are eligible to participate in the phase as long as they have 3 – 5 years of EMS experience.

4.4.3.4 Data Collection Instrument

The researchers developed a discussion schedule (see Appendix 5) collaboratively through constant discussion and revision. This schedule was used as a guide by the facilitator during the interviews and focus group discussions. The first section of the document was an introduction that provided participants with background information and the rationale for the phase.

The second section of the collection instrument consisted of prompts for obtaining information from the participants to determine their experiences. The third section of the document provided prompts for exploring the current limitations of education in adult critical care transfers within academic and health institutions in South Africa. The fourth section derived the objectives of a curriculum. The final section focused on the specific needs for teaching, learning, and assessment (TLA) in adult critical care transfer education.

4.4.3.5 Data Collection

The phase, encompassing one-on-one semi-structured interviews with the CCRS experts followed by focus group discussions with EMS learners, has been successfully concluded via MS Teams (Microsoft Corporation, Microsoft Teams, United States of America). The participants were equipped with pre-reading documents to enhance their understanding of the current CCRS landscape and facilitate meaningful contributions to the phase.

The pre-reading document for the expert group outlined the current landscape of adult critical care transfers based on retrospective studies in South African private (127) and government EMS (from Phase 1), as well as insights from a scoping literature review conducted, focusing on adult critical care curricula.

Similarly, the EMS learner group's pre-reading documents contained pertinent information, including details from the expert group's documents, suggested course content, methods of

delivery and assessment. Participants were explicitly invited to express personal opinions, detached from their roles within their respective employers or organisations.

Formulated questions served as a guide during the interviews, although participants were encouraged to share their perspectives on the topic freely. The interviews were audio-recorded, and data collection continued until the point of data saturation was reached, ensuring a comprehensive exploration of the subject matter. All sessions were recorded and transcribed into MS Word (Microsoft Corporation, Microsoft Word, United States of America) documents by a professional company. No clarification was needed from the participants during transcription.

4.4.3.6 Data analysis

The transcriptions were then analysed by the researcher; the transcripts were subjected to inductive, qualitative content analysis to the manifest level based on the methods described by Erlingson et al. (155).

Analyses were completed through coding by the primary investigator using NVivo 14 (QSR International Pty Ltd, Australia) and completed through four steps (155):

1. Identifying and condensing meaning units
2. Developing and Applying Codes
3. Identifying categories
4. Summarising and quantifying the data.

The coded categories are in consensus with the supervisors, and results have been reported using these categories.

Table 3: Category development process

Category Development Process		
Meaning unit	**Code**	**Main Category**
"Training is too minimal when it comes to retrieval side"	**Training is minimal**	**Insufficiencies in Undergraduate Training**
"challenging because it wasn't something that we were prepared for"	**Ill-Prepared**	**Graduate readiness to engage in CCR**
"nothing really at the moment that has guidelines for South African critical care retrieval"	**No Standard**	**Needs for Standardisation of CCR Education**
"intentionally went to go and learn new things"	**Self-learning undertaken**	**Bridging CCR Training Gaps**

4.4.3.7 Ethical Considerations

While conducting semi-structured interviews with experts and focus group discussions with EMS learners to identify educational gaps and essential competencies for critical care retrieval, we prioritised participant anonymity and the protection of their information.

All participants signed a declaration of consent (see Appendix 6) to indicate their willingness to participate in this phase. Each participant was assigned a unique identifier to track their progress. No additional personal information was recorded. Participants were also free to withdraw from the process at any stage if they felt it was necessary.

4.4.3.8 Trustworthiness

Establishing trustworthiness is critical in qualitative research to ensure the findings are credible, transferable, dependable, and confirmable. Unlike quantitative research, where validity and reliability are measured through statistical means, trustworthiness in qualitative studies relies on rigorous methodological and reflective practices (156).

In 1981, author Guba proposed four criteria that he believes should be considered by qualitative researchers in pursuit of trustworthiness in their studies; the criteria set out below proposed four key criteria to guide researchers in achieving trustworthiness (157):

- Credibility: Confidence in the truth of the findings, akin to internal validity.
- Transferability: The degree to which findings can be applied to other contexts, like generalizability.

- Dependability: Consistency of the findings over time, comparable to reliability.
- Confirmability: Neutrality of the findings, ensuring they are shaped by participants' views rather than researcher bias.

We ensured trustworthiness by using a well-defined phase methodology and approaches, as outlined by Guba et al. (157). The following strategies were employed to meet these criteria:

Credibility

Credibility was ensured through prolonged engagement with the data and iterative analysis. Regular member checking was conducted between the researcher and supervisors to validate interpretations. Triangulation was employed by comparing findings from different participant groups (e.g., experts and learners), thereby enhancing the robustness of the results (155,156).

Transferability

While transferability was not directly assessed, a rich and detailed description of the phase context, methodology, and findings was provided. This enables future researchers to determine whether the results apply to other settings (155,156). Thorough descriptions of the participant demographics, sampling methods, and data collection processes were included to support this.

Dependability

Dependability was achieved by following a clearly articulated and logically designed methodology for data collection and analysis. An audit trail was maintained, documenting every stage of the research process, including data collection instruments, coding frameworks, and analytical decisions. This ensures that the process can be scrutinised or replicated by future researchers (155,156).

Confirmability

To ensure confirmability, the researcher maintained a reflexive journal throughout the phase to document decisions, reflections, and potential biases. Cases identified and coded into categories were spot-checked by supervisors to confirm the accuracy and neutrality of the interpretations.

Additionally, the raw data were securely stored and could be reviewed to verify alignment with the phase findings(155,156).

By employing these strategies, this phase adhered to established principles for achieving trustworthiness, ensuring that the findings are both rigorous and reflective of the participants' perspectives.

4.4.4 Phase 4 – The Delphi

The PhD research initiated the development of a contextual adult CCR and transport education curriculum tailored to the SA context. This process was achieved through four interconnected studies, which systematically determined learner needs and derived course goals and objectives. Figure 1 outlines the sequential flow of these studies, culminating in the proposed curriculum provided to Delphi participants for validation.

The initial curriculum, including draft learning units and outcomes, was developed using information from the preceding studies. Key inputs included insights from the Scoping Review (ScR), which provided a foundation for aligning the curriculum with global best practices by examining local and international CCR training programmes. Feedback from interviews with CCR experts highlighted essential competencies, training gaps, and priorities for curriculum development. Additionally, focus group discussions with EMS learners provided valuable insights into educational challenges and practical training needs, ensuring that the curriculum addressed their specific requirements. Based on this evidence, initial learning units were derived to structure the curriculum, targeting cognitive, psychomotor, and affective competencies. Draft outcomes for these units were collaboratively developed with the researcher’s supervisors to ensure alignment with the phase objectives and industry expectations.

The curriculum presented to Delphi participants included:

- Learning Units: Structured to address foundational knowledge, applied skills, and professional attitudes required for CCR.
- Draft Outcomes: Clearly defined cognitive, psychomotor, and affective objectives aligned with identified needs and training priorities.

- Content Areas: Modules on transport physiology, advanced airway management, pharmacology, invasive monitoring, and ethical decision-making during high-pressure scenarios.
- Assessment Strategies: Proposed methods for evaluating learner competence, including case-based assessments and simulation training.

This draft underwent a Delphi process in Phase 4 to finalise the curriculum's goals and structure. These phases provided a systematic and structured approach to developing a tailored critical care retrieval curriculum.

4.4.4.1 Methodology

This phase employed a Delphi methodology to achieve consensus on the curriculum content for a dedicated training programme on critical care retrieval of critically ill or injured adults. Ethical approval was obtained from the Human Research Ethics Committee of the University of Cape Town (see Appendix 1 - Ref. No. HREC 313/2024). The Delphi method is a structured process involving a series of rounds where experts provide feedback, aiming to reach an agreement on complex or uncertain topics (144,145). Delphi studies have been recognised in the literature as a reliable empirical method for gathering expert opinions and achieving the highest possible consensus during curriculum and core syllabus development across various fields (144).

The Delphi process was reported in alignment with the CREDES (Conducting and Reporting of Delphi Studies) guidance developed by Jünger et al. (139). This ensured consistent documentation of expert panel composition, feedback rounds, response rates, consensus thresholds, and mechanisms to manage attrition and bias across multiple iterations.

The results of the previous three studies were combined. The course outcomes were then derived and proposed to a group of experts. These experts consisted of various medical personnel and managers involved in the clinical or managerial aspects of critical care transportation in South Africa, representing both the public and private sectors. Specialised critical care medical professionals in the hospital were also included to draw on their experiences. The Delphi method is particularly suitable for this purpose as it allows for iterative rounds of data

collection and feedback, enabling the refinement and convergence of expert opinions over multiple rounds (144,146). The approach is particularly useful in educational and healthcare research for developing curricula grounded in expert opinion (144,145). The phase was conducted over three rounds.

4.4.4.2 The participants

The participants in the phase were identified using snowball sampling, in line with the Delphi phase research methodology (144,146). The phase aimed for a minimum of approximately 60 participants, aligning with established Delphi methodology and similar studies (144,145). This number also accounted for potential attrition, a common consideration in online methods, to ensure sufficient participation throughout all rounds (146,158). The participants included pre-hospital critical care professionals, healthcare workers from other spheres involved in critical care transfers or patient management, and health professions educators.

The following inclusion and exclusion criteria were adhered to when selecting and approaching possible participants for the phase.

- Inclusion Criteria:

- Advanced life support providers (Paramedics and Emergency Care Practitioners) working in the critical care retrieval field
- Registered professional nurses working in the adult critical care environment
- Doctors working in the adult critical care retrieval environment, rotating ICU, and in-hospital critical care units.
- Health Professions Educators with appropriate educational experience

These professionals were included if they had a minimum of 3 – 5 years of clinical experience in the field.

- Exclusion Criteria:

- Paramedics or ECPs with no experience in a dedicated critical care transport service

- Individuals who did not respond to an electronic invite to the phase
- Individuals who did not meet the minimum 3 – 5 years of clinical experience required

4.4.4.3 Recruitment & Enrolment

The phase commenced by engaging healthcare workers within the critical care retrieval environment of Western Cape Government Health. Subsequently, collaboration was extended to various Critical Care groups on platforms such as Facebook and WhatsApp, which facilitated the distribution of the Delphi survey link to their members. To further broaden the participant base, a snowball sampling technique was employed, wherein the initial participants were requested to refer other suitable candidates, enhancing the diversity and representativeness of the expert panel (158). The interested participants were required to fill in and agree to the declaration of consent, indicating their willingness to participate in the phase. After this, a unique identifier was assigned to the participants to track their progress through the phase. No other participant-related information was recorded. The online platform enabled anonymous feedback, which helped reduce bias and allowed for open expression of opinions.

4.4.4.4 Data Collection

Round One

The draft curriculum, including 164 individual items consisting of course modules, learning units, and specific outcomes, was distributed to the identified panel of experts using MS Forms (Microsoft Corporation, Microsoft Forms, United States of America). In this round, participants were asked to respond to each Module and its respective learning units, as outlined by previous research, with binary responses: "Yes, Include this" or "No, Exclude this." Their responses were evaluated to determine support for the inclusion or exclusion of each outcome.

Participants were also encouraged to justify their answers through free-text motivations and to suggest additional objectives or recommendations based on the findings from studies 1-3. Consensus was set at 75%. Curriculum items that did not achieve the 75% consensus threshold were moved to a second round, which included the collated or summarised comments from the

participants. Any additional criteria proposed by the participants were also incorporated into this subsequent round.

Round Two

In the second round, participants reviewed the revised curriculum, which incorporated their feedback from Round One. Items that did not achieve the 75% consensus threshold in Round One were presented for reevaluation, along with participant comments and suggested revisions.

Participants reassessed these items using the same binary response format. Items achieving 75% consensus in this round were included in the final curriculum draft. Items failing to reach consensus were carried forward to Round Three, which incorporated further refinements based on additional feedback.

Round Three

In Round Three, items that had not reached the 75% consensus threshold in Round Two were revisited with further refinements. Participants were provided with a summary of prior responses and justifications to guide their decision-making process. They were asked to reassess the unresolved items using binary responses ("Yes, Include this" or "No, Exclude this") and to provide additional feedback or justifications through free-text fields. The primary objective of this round was to achieve consensus on the remaining items or to document their exclusion if consensus could not be reached. Items that attained the 75% consensus threshold in this round were incorporated into the final curriculum draft; those failing to meet the threshold were excluded, along with accompanying documentation of the reasons for their rejection.

4.4.4.5 Data analysis

In this phase, data analysis was conducted through a structured, iterative process involving multiple rounds of feedback and refinement.

For each round of the Delphi phase, the data were systematically reviewed and analysed. The following steps were taken:

1. Round One Analysis: Participant responses to the 164 individual curriculum items were collected and analysed for inclusion or exclusion based on a binary response format ("Yes, Include this" or "No, Exclude this"). Items achieving a consensus threshold of 75% or more were marked for inclusion in the curriculum. For items that did not meet this threshold, free-text justifications and suggestions provided by participants were reviewed qualitatively to identify key themes, motivations, and potential areas for revision. These insights were used to refine and revise the items for presentation in Round Two. All data were systematically organised into categories: accepted, revised, or rejected.

2. Round Two Analysis: In Round Two, participants re-evaluated items that had not achieved the 75% consensus threshold in the first round. Revised items were presented alongside a summary of participant comments and justifications from Round One. Quantitative analysis focused on calculating the proportion of participants agreeing to include each item. Items meeting or exceeding the 75% consensus threshold were incorporated into the curriculum draft, while unresolved items were further refined based on additional feedback for inclusion in Round Three. The qualitative data from free-text responses were reviewed to ensure that all suggested modifications were addressed comprehensively.

3. Round Three Analysis: Round Three focused on the remaining unresolved items from Round Two. Participants were provided with a summary of prior feedback, justifications, and any refinements made to the items. They reassessed these items using the same binary response format and provided additional feedback or justifications through free-text fields. Items that reached the 75% consensus threshold in this round were added to the final curriculum draft. Items that failed to meet the consensus threshold after this round were excluded, with detailed documentation of the reasons for their rejection to maintain transparency.

Throughout the analysis, quantitative data were summarised as frequencies and proportions to determine consensus levels. In contrast, qualitative data from free-text responses were thematically analysed to ensure expert perspectives were fully integrated into the curriculum

development process. While the primary goal was to achieve consensus, all data, including discrepant responses, were documented to maintain transparency and accuracy. However, only outcomes and objectives that met the 75% consensus threshold were included in the final proposed curriculum, with responses that did not meet this threshold excluded from the final draft. This iterative approach ensured a comprehensive evaluation, resulting in a robust and well-informed curriculum reflective of expert consensus. The results of this phase are presented in Chapter 7.

4.4.4.6 Ethical Considerations

The interested participants filled in and agreed to the declaration of consent, indicating their willingness to participate in the phase. After this, the participants were assigned a unique identifier to track their progress through the phase. No other participant-related information was recorded. The online platform enabled anonymous feedback, which reduced bias and allowed for the open expression of opinions.

4.5 CONCLUSION

Chapter 4 detailed the comprehensive methodology employed to develop a contextual curriculum for Critical Care Retrieval Services (CCRS) tailored to the South African healthcare context. The complete study utilised a rigorous, phased approach to ensure that the curriculum was evidence-based, contextually relevant, and aligned with global best practices.

Phase 1 involved a scoping review that identified international standards and practices, establishing a strong foundation for curriculum development. Phase 2 incorporated a retrospective case review, highlighting the specific clinical demands, patient profiles, and intervention trends in the South African EMS setting. Phase 3 employed qualitative needs assessments, using semi-structured interviews with CCR experts and focus group discussions with EMS learners to capture insights into educational gaps and training priorities. Finally, Phase 4 implemented a Delphi process, enabling a consensus-driven refinement of the curriculum's structure, goals, and learning outcomes.

Completing these phases resulted in a robust, contextually relevant curriculum designed to meet the unique needs of South African CCR practitioners while adhering to international benchmarks. This systematic methodology ensured that the curriculum addressed real-world challenges, filled existing gaps in education and training, and incorporated the diverse perspectives of key stakeholders. The findings and outcomes from this methodological process are presented in the subsequent chapters, culminating in a proposed curriculum that aims to enhance the capabilities of EMS providers and improve critical care retrieval outcomes across South Africa.

CHAPTER 5 – A REVIEW OF CRITICAL CARE TRANSFERS CONDUCTED IN THE WESTERN CAPE

5.1 INTRODUCTION

This chapter focuses on Phase 2 of the research, which examines ALS interfacility transfers within the Western Cape EMS system. The retrospective study evaluates patients' demographic and clinical characteristics, the logistical aspects of transfers, and the equipment and medications used during these critical care transports. The aim of this phase was to establish a detailed understanding of the interfacility transfer landscape, shedding light on the challenges and opportunities in managing critically ill and injured patients during transit. A critical analysis of findings emerging from the data gathered during this phase formed the foundation for shaping the proposed curriculum, ensuring it aligned with and addressed real-world practices and patient needs within a South African CCR context.

As mentioned in the preceding methodology chapter, data was extracted from an existing database containing information on EMS incidents and callouts, including interfacility CCR transfers. The number of entries in the database over the study period (2011-2021) was 41,588. Through a filtering process described in Chapter Three, and indicated in Figure 4 below, a total of 25635 cases were found to meet the inclusion criteria for analysis. This chapter presents the results and summary of this analysis.

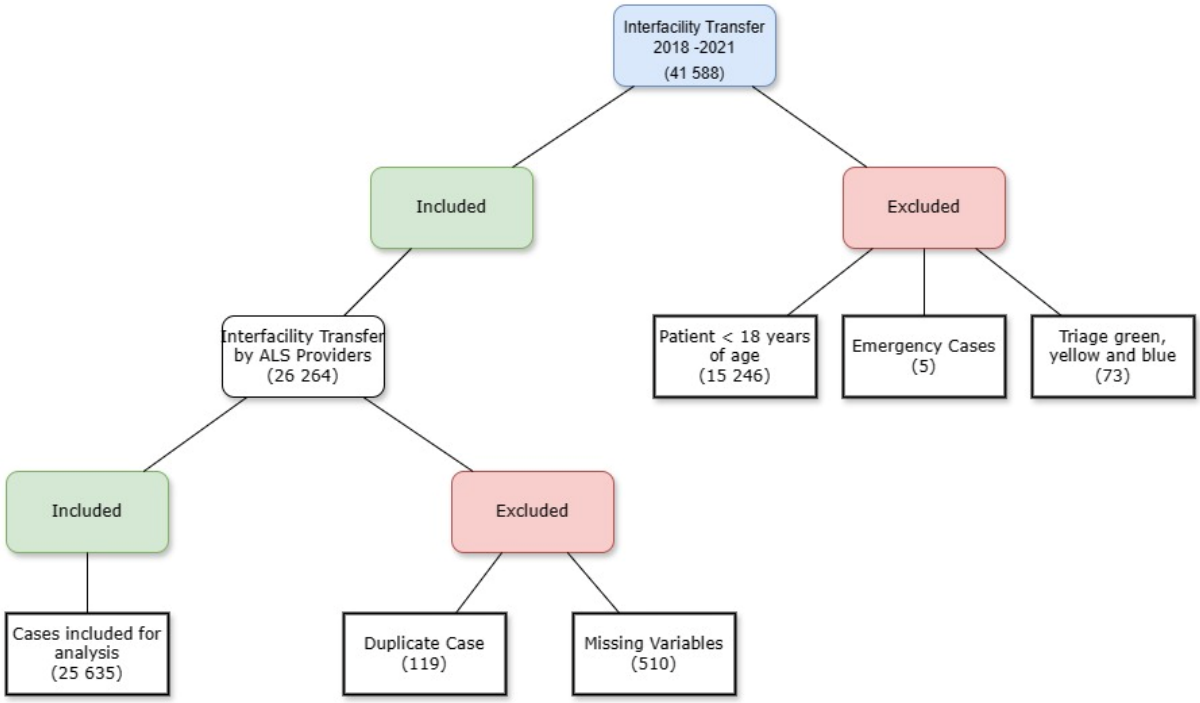

Figure 4: Summary of the raw case data extracted

5.2 RESULTS

5.2.1 Demographics

Of the 25,635 adult patients transferred 12 892 (50.3%) were male and 12 718 (49.7%) female. Of the 41,588 recorded transfers, 26,264 ALS-led transfers were considered, excluding 15,246 paediatric cases, 5 emergency cases, and 73 triage cases classified as green, yellow, or blue. Further exclusions included 119 duplicates and 510 cases with missing data, leaving 25,635 cases for analysis. This process ensured a focused dataset for the study.

The median age of the patients was 40 years, with a range of 18 to 101 years, after excluding outliers with ages between 102 and 221 years.

A total of n = 15 379 (60%) were triaged as orange (for very urgent management) upon arrival at the receiving facility and the remainder as red (for emergency or immediate management) n = 10231 (40%).

Comments:

- A total of 25,635 adult patients were transferred between 2018 and 2021, with a near-equal gender distribution (50.3% male, 49.7% female).
- The median age of patients was 40 years (range: 18–101 years), with outliers (ages 102–221) excluded for analysis.
- Most patients were triaged as orange (requiring very urgent management) upon arrival (60%, n = 15,379), while the remainder were categorised as red (requiring emergency management) (40%, n = 10,231).

5.2.2 Response, Preparation, and Transport Times for the Patient Transfers

The key time intervals (response time, scene time, transfer time) involved in patient transfers were also analysed. The mean (standard deviation (SD)) time spent (mm:ss) response time from the crew being dispatched to the arrival at the receiving facility was 07:10 (11:00). Once at the receiving facility, the mean (SD) time spent (mm:ss) to prepare the patient for transfer was 16:58 (23:25). Finally, the mean (SD) duration of transport from departure to the final destination was 12:56 (18:26), highlighting the overall time taken for patient relocation.

Comments:

- Response time: Mean of 7:10 minutes (SD = 11:00) from the dispatch to crew arrival.
- Preparation time: Mean of 16:58 minutes (SD = 23:25) at the sending facility to prepare the patient for transfer.
- Transport time: Mean of 12:56 minutes (SD = 18:26) from departure to final destination.

5.2.3 Clinical Condition

Table 4 outlines the clinical condition of the patients transferred for the above-mentioned period. The most prevalent diagnosis was respiratory disease (n=4605, 17.9%), followed by cardiovascular disease (n=3141, 12.2%) and central nervous system disorders (n=3078, 12%).

Comments:

- The most prevalent conditions among transferred patients included:
    - Respiratory disease (17.9%, n = 4,605)
    - Cardiovascular disease (12.2%, n = 3,141)
    - Central nervous system disorders (12%, n = 3,078)
    - Obstetric emergencies (10.7%, n = 2,729)
    - Head injuries (6.4%, n = 1,649)

5.2.4 Presence of Indwelling Devices & Attachments

Table 5 presents the indwelling devices and attachments used during transfer. In total 72 061 attachments were reported (an average of 3 per patient). The most used device or attachment was non-invasive blood pressure monitors (n=25 112, 98%) and pulse oximeters (n=24 600, 96%). A total of 4 693 (18.3%) of patients were mechanically ventilated and 3 365 (13.1%) received support with passive oxygenation devices.

Peripheral intravenous access was noted as the most commonly used route for vascular access (n= 4434, 17.3%). The predominant indwelling catheter was an intercostal drain (n= 470, 1.8%), followed by a nasogastric/orogastric tube (n= 210, 0.8%).

Comments:

- Non-invasive blood pressure monitors were the most commonly used device (98%, n = 25,112), followed by pulse oximeters (96%, n = 24,600).
- Mechanical ventilation was used in 18.3% of cases (n = 4,693), and passive oxygen devices in 13.1% (n = 3,365).
- Peripheral intravenous access was the most frequent vascular access route (17.3%, n = 4,434), while intercostal drains (1.8%, n = 470) and nasogastric/orogastric tubes (0.8%, n = 210) were the predominant indwelling catheters.

5.2.5 Medications and infusions

A total of 5 564 medications were recorded as being given either as bolus doses or as infusions. The overall prevalence of patients receiving medications during the transfer was 5640 (22%). The most common route of administration was intravenous injection (n=1944, 7.5%%), followed by continuous infusion (n=1752, 6.7%). A list of the medications recorded is presented in Table 6. They were further divided into analgesics, where morphine was found to be the predominant analgesic administered (n=1107, 4.3%%), followed by fentanyl (n=46, 0.18%%). The medications were categorised as CNS depressants, and the sedative agent most commonly used was midazolam (n=1651, 6.4%). Adrenaline (n=514, 2.0%) was the most commonly used medication for inotropic support during transport.

Comments:

- A total of 5,564 medications were administered during transfers:
    - Analgesics: Morphine was the most frequently used analgesic (4.3%, n = 1,107), followed by fentanyl (0.18%, n = 46).
    - CNS depressants: Midazolam was the most common sedative (6.4%, n = 1,651).
    - Vasoactive medications: Adrenaline was used in 2% of cases (n = 514).
    - Other medications included anticoagulants, electrolytes, bronchodilators, neuromuscular blockers, and antibiotics, with detailed proportions outlined in Table 6.

Table 4: Clinical Conditions of the patients undergoing transfers

Clinical Conditions of the patients undergoing transfers (n = 25635)		
Clinical Conditions	**n**	**%**
Respiratory Disease	**4606**	**17,98%**
Cardiovascular Disease	**3142**	**12,27%**
Central Nervous System Disorder	**3127**	**12,21%**
Obstetric Emergency	**2729**	**10,66%**
Head Injury	**1649**	**6,44%**
Soft Tissue Injury	**1459**	**5,70%**
Infection	**1224**	**4,78%**
Gunshot Injury	**1106**	**4,32%**
Endocrine Disorder	**1043**	**4,07%**
Overdose	**869**	**3,39%**
Gynaecological Emergency	**496**	**1,94%**
Other	**475**	**1,85%**
Conduction Disorder	**446**	**1,74%**
Polytrauma	**417**	**1,63%**
Burns	**383**	**1,50%**
Renal Failure	**317**	**1,24%**
Poisoning	**236**	**0,92%**
Gastrointestinal Bleed	**226**	**0,88%**
Mental & Behavioural Disorders	**186**	**0,73%**
Preterm Labour	**184**	**0,72%**
Post-Cardiac Arrest	**183**	**0,71%**
Acute Pain	**180**	**0,70%**
Spinal Injury	**174**	**0,68%**
Extremity Fracture	**140**	**0,55%**
Pulmonary Embolism	**127**	**0,50%**
Bowel Obstruction	**122**	**0,48%**
Central Nervous System Disease	**119**	**0,46%**
Diagnosis Unspecified	**82**	**0,32%**
Neoplasm	**70**	**0,27%**
Pelvic Fracture	**62**	**0,24%**
Post-Surgery	**52**	**0,20%**
Trunk Fracture	**2**	**0,01%**
Congenital Defect	**1**	**0,00%**
Submersion Injury	**1**	**0,00%**
Total	**25635**	**100,00%**

Table 5: Indwelling Devices & Attachments of patients undergoing transfers

Indwelling Devices & Attachments of patients undergoing transfers (n = 72061)		
Description	**N**	**%**
Patient Monitoring		
Non-Invasive Blood Pressure	25112	97,96%
SpO2 monitoring	24600	95,96%
Capnography	4236	16,52%
Electrocardiography	637	2,48%
ABG's	347	1,35%
Vascular Access		
Peripheral Intravenous Line	4434	17,30%
Central Venous Line	260	1,01%
Other, n<100	86	0,34%
IO	17	0,07%
Ventilation & Oxygenation		
Mechanical Ventilation (unspecified)	4693	18,31%
Passive oxygen devices	3365	13,13%
BVM Ventilation	247	0,96%
Indwelling attachments		
IC Drain	470	1,83%
Orogastric/Nasogastric Tube	210	0,82%
Urinary Catheter	203	0,79%
Medication Infusion Devices		
Infusion Device	1733	6,76%
Artificial Airways		
ET Tube	1597	6,23%
Oropharyngeal Airway	578	2,25%
Supraglottic Device	18	0,07%
Surgical Cric	14	0,05%
Circulation		
Transcutaneous Pacing	29	0,11%
Synchronised Cardioversion	5	0,02%
Total	72061	100,00%

Table 6: Medications administered during CCT

Medications administered during CCT (n=5564)		
Description	**n**	**%**
Analgesics		
Morphine Sulphate	**1107**	**4,32%**
Fentanyl	**46**	**0,18%**
Paracetamol	**3**	**0,01%**
CNS Depressants		
Midazolam	**1651**	**6,44%**
Ketamine	**267**	**1,04%**
Diazepam	**111**	**0,43%**
Propofol	**89**	**0,35%**
Lorazepam	**34**	**0,13%**
Etomidate	**28**	**0,11%**
Phenytoin	**16**	**0,06%**
Sodium Valproate	**10**	**0,04%**
Vasoactive/Inotropes		
Adrenaline	**514**	**2,01%**
Isordil	**96**	**0,37%**
Atropine	**64**	**0,25%**
Nitroglycerin IV	**34**	**0,13%**
Labetalol	**33**	**0,13%**
Phenylephedrine	**2**	**0,01%**
Anticoagulants or Thrombolytics		
Aspirin	**25**	**0,10%**
Clopidogrel	**13**	**0,05%**
Streptokinase	**10**	**0,04%**
Enoxaparin	**1**	**0,00%**
Electrolytes		
Magnesium Sulphate	**187**	**0,73%**
Sodium Bicarbonate	**10**	**0,04%**
Potassium Chloride	**8**	**0,03%**
Calcium Chloride	**4**	**0,02%**
Anti Emetics		
Metoclopramide	**66**	**0,26%**
Neuromuscular Blockers		
Rocuronium Bromide	**391**	**1,53%**
Suxamethonium	**9**	**0,04%**
Cisatracurium	**6**	**0,02%**
Antiarrythimitics		
Amiodarone	**29**	**0,11%**
Adenosine	**3**	**0,01%**

Continuation of Table 6

Bronchodilators		
Beta 2 Stimulants	**135**	**2,42%**
Ipratropium Bromide	**55**	**0,99%**
Aminophylline	**1**	**0,02%**
Steroids		
Corticosteroids	**28**	**0,11%**
Dexamethasone	**2**	**0,01%**
Betamethasone	**1**	**0,00%**
Furosemide	**56**	**0,22%**
Glucose	**216**	**0,84%**
Insulin	**112**	**0,44%**
TXA	**11**	**0,04%**
Antibiotics	**12**	**0,05%**
Other	**68**	**0,27%**
Total	**5564**	**100%**

5.3 DISCUSSION

This study described the sample of adult patients who underwent transfer by ALS emergency care providers within Western Cape Government EMS in SA from Jan 2018 to Dec 2021. A total of 25 635 transfers were conducted during the study period, with 72 061 unique interventions or attachments needing monitoring in place.

Clinical Conditions

Despite trauma being one of the leading causes of death in South Africa and being described as an epidemic in our country (159), the majority of patients (n = 20241) who underwent ALS transfers in this sample suffered medical pathologies. Trauma and violence remain a concern, but it can be argued that many of those patients never make it to the hospital or the stage where they require CCT, often because they succumb to their injuries before reaching advanced care (160). A study by Finn et al. in the Western Cape, South Africa, reported 2,418 deaths, primarily among young men, with most (2,274, 94.0%) occurring on-scene. Firearms were the leading cause of death (32.6%), followed by road traffic collisions (17.8%). On-scene deaths were more often linked to firearm injuries (33.2%) compared to healthcare system deaths (23.6%). Among healthcare system deaths within 4-24 hours post-injury, most occurred in hospital emergency centres, with half dying in the emergency unit (160). This highlights the need for interventions to reduce on-scene fatalities and improve trauma care/referral systems (160). Cardiovascular diseases, cancer, diabetes, and chronic respiratory conditions represent a significant portion of NCDs, posing a growing public health challenge. In South Africa, deaths from these major NCDs have increased sharply by 58.7% over two decades, rising from 103,428 in 1997 to 164,205 in 2018 (161). Challenging socioeconomic conditions, lifestyle changes, and rapid urbanisation in specific settings primarily drive this shift in disease burden (161,162).

The two most common clinical conditions were respiratory (n = 4606; 17,98%) and cardiovascular diseases (n = 3142; 12.27%). The disease prevalence seen in this sample comes as no anomaly, as LMICs such as SA have been seeing a significant epidemiological shift with more patients presenting with non-communicable diseases than communicable diseases influenced by broader demographic, socioeconomic, technological, political, and cultural changes and urbanisation

(163). It is important to note that a subset of our data derives from the COVID-19 pandemic, particularly during the first and second waves in SA, which likely inflated the number of patients presenting with respiratory emergencies or complications. This could explain the predominance of respiratory-related illnesses among patients undergoing ALS transfers (164,165).

Disease Burden

Cardiovascular diseases are the second most common clinical condition requiring critical care transfers in South Africa. This further highlights the epidemiological shift and the impact non-communicable diseases have on the healthcare system (161,166). It underscores the critical need to enhance healthcare facilities, implement robust preventive measures, and establish efficient patient referral pathways, including the role of patient transfers as a vital component of these pathways. Transfers, when timely and effectively managed, serve as a cornerstone of a functional referral system, ensuring patients receive the appropriate level of care without delay (167). Furthermore, the text highlights broader public health challenges, such as addressing lifestyle-related risk factors and ensuring equitable access to timely medical care (168,169). Prioritising these areas is essential to reducing the burden of cardiovascular diseases in SA, alleviating the need for unnecessary transfers, and mitigating deaths and long-term health complications associated with these conditions (170).

Improving these areas is essential for reducing the number of patients requiring transfers and those suffering deaths and continuous health issues related to cardiovascular diseases in South Africa.

The case distribution observed in this study aligns with data from Statistics South Africa (the national statistical service responsible for collecting and disseminating official statistics). Their reports similarly indicate a significant increase in deaths associated with a caseload shift toward non-communicable diseases (161). This significant shift towards non-communicable diseases can be indicative of the need for the healthcare system to adapt to managing more chronic conditions, requiring long-term care and resource reallocation.

Challenges in Managing Critically Ill Patients

Caring for critically ill and injured patients is complex, as they often have multiple conditions requiring various treatment regimens. This complexity underscores the importance of specialised training and advanced equipment for healthcare practitioners. Providing them with the right skills and tools ensures effective care at the appropriate level for better patient outcomes (52,171,172). In a study done by Wiegersma et al. comparing adverse events and level of care, they found that Mobile Intensive Care Unit (MICU) transfers (specialised CCR practitioners staff these units) had fewer adverse events (12.5%) compared to standard ambulances (34%), with most MICU incidents being technical rather than medical (172).

Notably, patient monitoring was the most common patient attachment in the study, with non-invasive blood pressure and pulse oximetry monitoring occurring in > 95% of the ALS transfers. This finding is encouraging, given that related research has argued that continuous patient monitoring is of utmost importance in reducing adverse effects and ensuring continuous patient safety during transport (173,174). Transport monitoring during inter- and intrahospital transfers enhances patient care by enabling healthcare providers to mitigate the effects of transport-related stress on patients and EMS personnel (175). By offering real-time information and support it ensures smoother, more efficient transfers and significantly improves the overall quality of patient care (175). The implementation of routine monitoring is of paramount importance in risk mitigation and early detection of deterioration in critically ill and injured patients.

Second to non-invasive blood pressure and pulse oximetry monitoring, ventilation and vascular access were the most common attachments during transport. The high usage of mechanical ventilators comes as no surprise, given that part of the sampling frame for the given study fell within the first and second waves of the COVID-19 pandemic in South Africa, where increased usage of mechanical ventilators was prevalent (176). The pandemic not only posed a challenge to the system and healthcare providers due to increased patient loads but also due to abnormal management regimens and unique ventilation strategies. The pandemic underscored the complexity of mechanical ventilation, highlighting the need for specialised training to navigate

unique challenges. Managing patients during this time required healthcare providers to adapt quickly to abnormal ventilation regimens, including using high oxygen concentrations and unconventional strategies. These demands emphasised the critical importance of comprehensive training in mechanical ventilation, equipping providers with the skills to ensure patient safety and optimise outcomes during even the most unprecedented scenarios.

To see that 90% of the patients undergoing mechanical ventilation during transport had ETCO2 monitoring in place during transport is a positive and encouraging trend. These results concur with a study done in the South African private sector, but they have also shown that knowledge around capnography and its usage was found to be good in most areas but often lacking when dealing with more complicated patients and suggested the need for improved and ongoing training, as well as incorporation into curricula (177).

ETCO2 serves as a valuable indicator of the effectiveness of ventilation and provides crucial information about a patient's respiratory status (178). In the transport environment, where patients may be particularly vulnerable, continuous monitoring of ETCO2 helps healthcare providers assess the adequacy of ventilation, detect potential complications, and make timely adjustments to the ventilatory and haemodynamic support (179). This proactive approach enhances patient safety and contributes to better outcomes during the critical period of transport (179). The integration of ETCO2 monitoring into routine practice reflects a commitment to delivering high-quality care in dynamic and challenging settings, ultimately fostering confidence in the management of ventilated patients during transport (29).

Practitioners who conducted these transfers used a wide variety of medications, the most commonly used being midazolam (n = 1651) and morphine (n = 1107). While 18.31% of the patients underwent mechanical ventilation, only 4.5% of them received some analgesia during care, which indicates a clear underutilisation or an error in reporting practices. Critical illness and injury frequently cause pain, stemming from both the underlying condition and essential medical procedures conducted for patient monitoring and care. It is imperative to ensure good analgesic and sedation practices (180). Accurate assessment and management of pain remain crucial

considerations in the care of critically ill patients, particularly among those unable to self-report, as pain is often overlooked and undertreated in this population (181).

When looking at analgesia and sedation in relation to mechanical ventilation, it is clear that only 4,51% of the patients received some analgesic, and 8,62% received some form of sedation. Given the fact that mechanical ventilation itself is uncomfortable, the use of analgesia and sedation in patients receiving mechanical ventilation is crucial for patient comfort, safety, and overall outcomes (182). The clear underutilisation can be an indication of several issues. Firstly, assessing pain in critically ill, intubated patients can be challenging, leading to under-recognition and inadequate analgesic administration (183). Variability in adherence to protocols and guidelines for analgesia and sedation also contributes to inconsistent practice (184). Additionally, practitioner judgment and variability in practice, with differing thresholds for administering analgesia and sedation based on individual assessments, further exacerbate the discrepancy in providing adequate pain relief to mechanically ventilated patients (185). These findings align with the work of de Kock et al., who investigated post-intubation analgesia and sedation (PISA) practices in SA (186). Their study revealed significant gaps in PISA administration, notably that 31% of intubated patients did not receive sedation (186). This underscores the urgent need for clear, evidence-based guidelines tailored to the South African EMS setting to ensure consistency in practice (186). Implementing standardised protocols is crucial to addressing disparities in sedation practices, ultimately improving patient outcomes and the overall quality of pre-hospital care. Despite routine patient monitoring being commonplace, the utilisation and reporting of ECGs appear to be inadequate. This deficiency can be ascribed to various factors, including equipment availability, under-reporting, under-utilisation, practitioner attitudes, or motion artefacts induced by transport stressors resulting in unreliability (187,188). Given the prevalence of cardiovascular conditions among patients, the underreporting of ECGs may reflect clinical oversight. Critical diagnostic procedures are unintentionally overlooked in this scenario due to competing priorities, high patient loads, or resource limitations in busy clinical environments (189,190). This issue can be compounded by recall bias, where healthcare providers, relying on memory rather than thorough documentation, may fail to accurately report all procedures performed (189,190).

Furthermore, documentation errors—ranging from incomplete recording and mislabelling of procedures to systemic issues like inadequate training in proper record-keeping—play a significant role in underreporting (189,190). These factors collectively obscure the frequency and importance of ECG utilisation in detecting and managing cardiovascular conditions, potentially impacting patient outcomes and care quality. In addition to the above, the lack of localised standards for patient monitoring could also contribute to the non-usage of ECGs, and additional training might also be required to ensure optimal cardiac monitoring for patients undergoing CCTs (191).

It was evident that there is no standard for the parameters that should be monitored and recorded during transport, as the monitored and reported parameters vary greatly among healthcare providers responsible for transporting these patients. Internationally monitoring respiratory and cardiac function during transport is routinely done during prehospital, intrahospital, and interhospital transport (174). No literature regarding localised standards for patient monitoring during transfer could be found. However, current international guidelines provide a framework for required monitoring, but they vary slightly and need to be updated (192). Advancements in medical technology and a deeper understanding of patient physiology have introduced new monitoring tools and techniques, highlighting the need for revisions to standardise practices and incorporate these innovations for optimal patient outcomes (193,194). In mechanically ventilated patients, oximetry, ECG, blood pressure, and capnography are integral to the standards of care (174). The variation in monitoring standards among practitioners and patients indicates a critical need for standardising protocols in healthcare to ensure consistent, high-quality patient care during CCTs (36,37).

While most medications used during CCT fall within the current scope of practice for ALS practitioners, several examples, including Phenytoin, Propofol, Labetalol, Phenylephrine, Potassium Chloride, Cisatracurium, and Aminophylline, are primarily intended for the continuation of care rather than the initiation of treatment. The fact that 21.70% of patients received one or a combination of medications during these transfers highlights the complexity of care, emphasising the need for additional equipment, such as infusion devices, to ensure safe and effective medication administration (195,196). This underscores findings from other

research indicating a widespread lack of essential equipment in pre-hospital settings, which can significantly impact the quality and safety of critical care transfers (18,19). Furthermore, the medications administered during CCTs are often weight-based, requiring complex calculations under high pressure (196).

EMS training in the current South African context is heavily guided by the scope of practice, skills and capabilities of the various cadres as outlined by the HPCSA (197). Due to the variation in training and the scope-driven nature of EMS training, ALS practitioners often receive limited or no training on medications that are not listed for initiation of care within their current scope of practice (19,34). Medications such as propofol, phenytoin, phenylephrine, cisatracurium, and antibiotics are used during some ALS transfers; however, practitioners may not have received training on their usage, as these medications do not form part of the standard scope of practice. Furthermore, EMS practitioners are typically trained only on specific medications rather than classes of medications, as is the case in other professions. Practitioners handling these transfers require additional training and have limited exposure and experience with certain medications crucial for the care of critically ill and injured patients (198,199). Research in this field consistently highlights the substantial safety risks associated with performing procedures or administering medications when practitioners lack regular exposure to these skills or medications (200,201).

Previous work has explored the capabilities and scope-of-practice requirements for South African ALS practitioners undertaking critical care transfers, and a positive consensus has been gained for many of the medications reported in this study, thus highlighting the need for structured training for CCRS practitioners (19,34). In addition to dedicated training, it is recommended that a dedicated crew be assigned to undertake all transfers to ensure competency is maintained (26).

A recent study scrutinising the BEMC degree offerings at various South African universities revealed that upon comparing all components, the universities offering BEMC displayed more similarities than differences (24). Whether the contents and components being taught are applicable to the South African patient population and healthcare system or if the students are sufficiently equipped for clinical practice remains uncertain. The majority of the patients transferred by ALS in this study population align with the concepts and or modules being taught

in the critical care transportation modules across South African bachelor's degrees; however, it is uncertain whether all the content is covered with the adequate depths to meet patient needs and complexity since prehospital providers consistently feel underprepared and ill-equipped to undertake CCTs (18,26)

5.4 CONCLUSION

The findings from Phase 2 provide valuable insights into the complex demands of ALS interfacility transfers in the Western Cape EMS system. With a focus on patient demographics, clinical conditions, logistical elements, and the utilisation of equipment and medications, this study highlights the nuanced challenges faced by EMS providers. The prevalence of respiratory and cardiovascular conditions among transferred patients underscores the shifting disease burden in South Africa. At the same time, the variability in monitoring practices and medication use reveals gaps in standardisation and training. These findings reinforce the need for a dedicated, contextually relevant curriculum for critical care retrieval. By addressing the gaps identified in this study, the proposed curriculum can enhance the preparedness of EMS practitioners, ensuring safer and more efficient patient transfers and ultimately improving patient outcomes.

CHAPTER 6 – THE INTERVIEWS

6.1 INTRODUCTION

As mentioned in Chapters 1 and 4, the third phase of the study focuses on understanding the needs and gaps in CCR education through qualitative input from expert practitioners and prospective learners. By conducting semi-structured interviews and focus group discussions, the researcher identified key insights into the reported shortcomings of existing undergraduate programmes, readiness for CCR roles, the need for standardisation in CCR education, and strategies to address these deficiencies. The findings from this phase contribute significantly to developing a contextual and evidence-based CCR curriculum tailored to the South African healthcare landscape, ensuring that both theoretical knowledge and practical skills are integrated to meet the complex demands of CCR. This chapter focuses on presenting and discussing the categories. The structure and reporting of this chapter were informed by the COREQ checklist to ensure completeness and methodological transparency.

As described in Chapter 4, the researchers developed a discussion schedule to guide interviews and focus group discussions (see Appendix 3), which included an introduction, prompts for participant experiences, exploration of education limitations in adult critical care transfers, curriculum objectives, and teaching, learning, and assessment needs. Data collection involved semi-structured interviews with critical care retrieval system experts and FGDs with EMS learners conducted via MS Teams (Microsoft Corporation, Microsoft Teams, United States of America) . Participants received pre-reading materials (see Appendix 5) tailored to enhance their understanding of the CCRS landscape, including findings from retrospective studies, literature reviews, and proposed course content.

The interviews and FGDs were audio-recorded and transcribed by a professional service, with data saturation achieved. The transcriptions underwent inductive qualitative content analysis, guided by Erlingson et al.'s methods (155), and were coded using NVivo 14 (QSR International Pty Ltd, Australia). The study included identifying meaning units, developing and applying codes, categorising data, and summarising results to comprehensively understand the subject.

6.2 THE PARTICIPANTS

6.2.1 Expert Group

The first group of participants interviewed consisted of the expert group, which included ten participants with extensive critical care and critical care retrieval and management experience. Table 7 describes the participants' demographic information.

Table 7: Demographics of expert group participants in semi-structured interviews

Participant	Gender	Qualification	Job Title	CCR Expert	Industry Expert	Educational Experience	Years of Experience
E1	Male	CCA PgDip - EC (Candidate)	Paramedic	✓	✓		10 years +
E2	Male	MbChb MMed Fellowship in Critical Care	Intensive/Critical Care Physician	✓		✓	10 years +
E3	Male	BEMC IBSC CCR	Emergency Care Practitioner	✓	✓	✓	9 years
E4	Female	NDip – EMC BTech - EMC	Emergency Care Practitioner	✓		✓	10 years +
E5	Female	RPN BTech – OHNP CCA PgDip - EC, Reg CCP (IBSC)	Registered Nurse/Paramedic	✓			10 years +
E6	Male	MbChb MPhil EM Dip RTM EM Registrar	Emergency Medicine Physician	✓			9 years
E7	Male	NDip – EMC BTech – EMC MPhil EM	Emergency Care Practitioner	✓		✓	10 years +
E8	Male	BSS Nurs Hons BCur Hons Crit Care PGDip Nurs Ed Cert Med Law	Intensive/Critical Care Nursing	✓	✓	✓	10 years +
E9	Female	CCA, PgDip - EC	Paramedic	✓		✓	7 years +
E10	Female	NDip – EMC	Paramedic	✓	✓		6 years +

1. BCur Hons Crit Care - Bachelor Curationis Honors Critical Care Nursing Science
2. BCurr - Bachelor of Nursing Science
3. BEMC - Bachelor of Emergency Medical Care
4. BSS Nurs Hons - Bachelor Social Sciences Nursing Honors (General Nursing, Community Nursing, Primary Healthcare Nursing, Psychiatry, Midwifery)
5. BTech EMC - Bachelor of Technology in Emergency Medical Care

Continuation of Table 7

6. **BTech OHNP - Bachelor of Technology in Occupational Health Nursing Practice**
7. **CCA - Critical Care Assistant**
8. **Cert Med Law - Certificate in Medicine and Law**
9. **Dip RTM - Diploma in Retrieval and Transfer Medicine**
10. **EM Registrar - Emergency medicine registrar**
11. **IBSC CCR - International Board of Specialty Certification Critical Care Retrieval**
12. **MbChb - Bachelor of Medicine and Surgery**
13. **MMed - Master of Medicine**
14. **MPhil EM – Masters of Philosophy Emergency Medicine**
15. **NDip EMC – National Diploma in Emergency Medical Care**
16. **PGDip EC – Postgraduate Diploma Emergency Care**
17. **PGDip Nurs Ed - Postgraduate Diploma Nursing Science Nursing Education**

6.2.2 Learner Group

The second group of participants included nine prospective learners registered with HPCSA on the ECP or ANT registers. The participants' demographic information is presented in Table 8 Given the South African context, these participants allowed for fair representation of the ALS cadre who commonly undertakes CCR within the South African setting as permitted by the HPCSA.

Table 8: Demographics of prospective student group participants in focus group discussion

Participant	Gender	Registration Category	Area of employment	Sector of employment	English first language
L1	M	ANT	Eastern Cape	Public Sector EMS - Rural	No
L2	F	ECP	Western Cape	Public Sector EMS - Urban	No
L3	M	ECP	Gauteng	Private Sector – Urban	Yes
L4	M	ECP	Gauteng	Private Sector - Urban	No
L5	M	ANT	KwaZulu Natal	Private Sector - Rural	No
L6	F	ANT	Western Cape	Private Sector - Urban	Yes

L7	**M**	**ECP**	**Eastern Cape**	**Private Sector - Rural**	**No**

Continuation of Table 8

L8	**M**	**ANT**	**Western Cape**	**Public Sector - Rural**	**No**
L9	**M**	**ECP**	**Gauteng**	**Private Sector - Urban**	**No**

1. **ANT Ambulans Nood Tegnikus**
2. **ECP Emergency Care Practitioner**

The semi-structured expert group interviews had a mean duration of approximately 48 minutes (38 - 75 minutes), and the focus group discussion lasted 106 minutes.

The interview recordings were transcribed and analysed, and 400 codes were extracted. The audio recording from the learners' focus group discussion was transcribed and analysed, and 73 codes were extracted.

6.3 RESULTS

Four main categories emerged from the analysis of participants' feedback, each highlighting critical aspects of CCR education and practice. These categories were *Insufficiencies in Undergraduate Training, Graduate readiness to engage in CCR, Needs for Standardisation of CCR Education, and Bridging CCR Training Gaps*. Together, these categories provide a nuanced understanding of the challenges faced by CCR professionals and identify actionable strategies for improvement.

The following narratives delve into these categories, integrating participants' voices to present a comprehensive picture of the current state of CCR training. Their reflections offer valuable insights into the need for enhanced educational frameworks, practical learning opportunities, and standardised approaches to better prepare professionals for the complexities of CCR.

6.3.1 Category One: Insufficiencies in Undergraduate Training

This category highlights the gaps in undergraduate training for emergency care providers, as perceived by participants, and was made up of the following subcategories: a **lack of practical**

exposure, particularly in critical care and emergency scenarios, and an **over-reliance on theoretical knowledge**; **insufficient hands-on experience**, including limited ICU rotations, which contribute to **fundamental knowledge gaps**; and a **need for comprehensive curriculum reviews** to better balance theoretical and practical learning. Participants also emphasised the importance of **improved instructor expertise**, suggesting that better-trained educators are essential to addressing these deficiencies and equipping students more effectively for their professional roles.

Reflecting on their training experiences, participants shared their perspectives on the shortcomings of current educational programmes. One participant noted,

"I think the time being spent even in today's training is too minimal when it comes to retrieval side, when it comes to neonates, when it comes to critical care in adulthood." (Participant – E1*, Paramedic*).

Others echoed these insights, highlighting the disconnect between the training provided and the practical skills required in the field.

"*So we are quite poorly equipped to deal with a lot of these things," explained another participant (Participant – E7, Emergency Care Practitioner).*

"It does not adequately address and prepare the students who ultimately then ends up as the emergency service providers, care providers, clinicians" (Participant – E8, Critical Care Nurse).

Similarly, an emergency medicine physician pointed to a gap between expectations and competence, saying,

"There's a disconnect between the amount of effort that goes into that training and what is expected or the level of competence that is" (Participant – E6, Emergency Medicine Physician).

These concerns were not limited to experienced professionals; learners also expressed dissatisfaction with their training.

"I can definitely say we did not have enough lectures and training regarding specific critical care retrieval, especially in the fixed wing setting or in rotor wing setting as well" (Participant – L9, ECP).

Furthermore, another learner mentioned that the training is sufficient for normal daily operations and not critical care retrieval by stating;

“Training was adequate for a standard paramedic, if I can put it like that.” (Participant – L1, ANT)

Furthermore, participants identified gaps in the current CCR curriculum and proposed an extensive range of topics that should be included in a dedicated critical care programme. These recommendations reflect the multifaceted nature of CCR, highlighting the need for a curriculum that integrates technical expertise, practical skills, and soft skills to equip professionals for the demands of the field.

The proposed topics span various domains, including *Clinical Skills and Training, ICU and Critical Care Integration, Management and Education, Pharmacology, Physiology and Pathophysiology, Special Populations and Care Settings,* and *Specialised Knowledge.* Additionally, participants stressed the importance of incorporating *Soft Skills* to enhance interpersonal interactions, leadership capabilities, and the overall quality of care.

Table 9 below presents a detailed overview of the suggested topics, organised into thematic areas, to guide the development of a comprehensive CCR training programme. These additions aim to bridge existing gaps, address the complexities of critical care, and prepare professionals to excel in diverse and challenging environments.

Table 9: Topics for inclusion in a dedicated Critical Care programme

Topics for inclusion in a dedicated Critical Care Programme	
Teaching Additions	**Soft Skills**
Clinical Skills and Training • Diagnostic Skills • Invasive Monitoring • Dedicated Handover training • Mechanical Ventilator operation/troubleshooting	• Confidence and Comfortability • Humility • Driven • Empathy and Compassion • Problem-Solving • Calmness Under Pressure • Self-Driven • Commitment to Education • Knowledgeable and Educated • Ethical Integrity • Patient-Centred Care • Genuineness and People Skills • Team Management and Leadership • Communication Skills • Trustworthiness • Collaboration and Advocacy • Assertiveness • Forward-thinking and Planning • Attention to Detail • Goal Setting • Cautious Problem-Solving
ICU & Critical Care Integration • ICU Systems • Clinical Decision Making • Mechanical Cardiovascular Support	
Management & Education • Disaster & Incident Management • Leadership and Education • Patient Advocacy • Staff retention strategies	
Pharmacology • ICU Medications • Analgesics • Fluids Management • Inotropes • Medications Management & Administration	
Physiology & Pathophysiology • Cardiorespiratory Physiology • General Physiology	
Special Populations & Care Settings • Anthropology & Society • End-of-Life Care • High Risk Patient populations • Stressors of Transport	
Specialised Knowledge • Biochemistry • Infection Prevention Control • ICU Nutrition & Dietetics • SEPSIS Management • Toxicology and Psychological Needs	

Continuation of Table 9

These combined perspectives paint a clear picture of the need for curriculum deficiencies and changes required in undergraduate training. Addressing these gaps is essential to ensuring that graduates are equipped with the practical skills and knowledge required to perform effectively in their roles.

6.3.2 Category Two: Graduate Readiness to Engage in CCR

This category highlights participants' concerns about emergency care providers feeling unprepared for CCR at the point of qualification and was made up of the following subcategories: **feeling ill-equipped** to manage the complexities of CCR due to significant gaps in undergraduate training, a **lack of confidence and skills**, stemming from insufficient exposure to realistic, hands-on experiences; and the **need for enhanced training**, with a stronger focus on practical applications to better prepare graduates for navigating critical care challenges effectively.

Reflecting on their educational backgrounds, participants were candid about their struggles transitioning into CCR roles. One paramedic acknowledged the difficulty, stating,

"It was challenging because it wasn't something that we were prepared for" (Participant – E1, Paramedic).

Another participant, an intensivist, shared a similar sentiment:

"Undergrad wise, I would say didn't prepare me at all" (Participant – E2, Intensivist/Critical Care Physician).

The lack of preparation often left professionals feeling overwhelmed, as highlighted by an emergency care practitioner:

"I found myself thrown into the deep end" (Participant – E3, Emergency Care Practitioner).

The sentiment of unpreparedness was echoed by a registered nurse and paramedic who stated emphatically,

"It's a categorical no. I mean, that's a no brainer. It's no for so many reasons" (Particiapnt – E5, Registered Nurse/Paramedic).

This perspective was shared by learners, who also felt inadequately prepared for the realities of CCR. One learner noted,

"You can never be completely comfortable coming out of university" (Participant -L4, ECP),

further illustrating the gap between educational training and practical readiness. The sentiment was shared by another who mentioned;

“Nothing really prepared us for what happens”. (Participant – L2, ECP)

The collective feedback underscores the need for a dedicated CCR curriculum and a review of the existing curricula to address these shortcomings. By integrating enhanced training methods and providing more realistic, hands-on learning opportunities, educational programmes can better equip graduates to meet the demands of critical care retrieval with competence and confidence.

6.3.3 Category Three: Needs for Standardisation of CCR Education

This category underscores the need for standardised CCR education due to significant discrepancies in training quality across institutions and is made up of the following subcategories: **variability in training quality**, resulting in inconsistent knowledge levels and practices; **undermined effectiveness of care**, as discrepancies impact the ability to manage CCR cases uniformly; and the **need for standardised training**, with clearly defined outcomes and core competencies to ensure all practitioners are adequately prepared for CCR.

Reflecting on their experiences, participants highlighted the absence of a dedicated curriculum for CCR education. One paramedic noted,

"That was lacking from a short course side and currently from a degree side is how do we standardise critical care" (Participant – E1, Paramedic).

This sentiment was reinforced by another paramedic, who remarked,

"Nothing really at the moment that has guidelines for South African critical care retrieval" (Participant - E9, Paramedic).

The need for uniform outcomes was a recurring theme in the feedback.

An emergency care practitioner observed, "It just needs to be a set base of or set of outcomes" (Participant – E3, Emergency Care Practitioner).

Similarly, a registered nurse and paramedic highlighted the variability in critical care training across institutions, stating,

"As the critical care side of it, I think it varies from institution to institution" (Participant – E5, Registered Nurse/Paramedic).

Learners echoed these concerns, emphasising the absence of a clear, standardised definition of critical care within the sector. One learner noted,

"I don't think there's necessarily a standardised definition of critical care in our sector in terms of transportation" (Participant – L2, Emergency Care Practitioner).

The feedback underscores the urgent need for a cohesive and standardised CCR education framework. By implementing consistent guidelines and establishing uniform educational outcomes, the disparities in training can be addressed, ensuring that practitioners have the necessary skills and knowledge to deliver high-quality care across diverse contexts.

6.3.4 Category Four: Bridging CCR Training Gaps

This category highlights strategies to address training deficiencies in CCR and is made up of the following subcategories: **intentional learning**, focusing on proactive approaches to education; **practical experience**, including increased hands-on practice in critical care modules; **expert guidance**, such as consulting mentors for support and advice; and **self-directed learning**, where participants emphasised the value of internships, trial-and-error approaches, and independent efforts to bridge educational gaps. These strategies are essential for better preparing professionals to manage the complexities of CCR.

Reflecting on their efforts to overcome training gaps, participants shared insights into the proactive steps they took to prepare for CCR. One paramedic explained how they deliberately tackled challenging situations:

"Intentionally went to face the discomfort" (Participant – E1, Paramedic).

Similarly, an intensivist highlighted the value of self-directed learning, saying,

"Doing my own kind of reading in the fields" (Participant – E2, Intensivist/Critical Care Physician).

Building professional networks and seeking expert advice also emerged as key strategies. An emergency care practitioner shared,

"Reaching out to the people that were subject experts" (Participant – E3, Emergency Care Practitioner),

while another emphasised collaboration, stating,

"Reaching out to colleagues in emergency medicine" (Participant – E4, Emergency Care Practitioner).

Learners echoed these approaches, recognising the importance of mentorship and leveraging the expertise of others to improve their skills. One learner explained,

"Consulting with people that you confide in, people that have the exposure and experience, some of them being surgeons, some of them being doctors" (Participant – L4, Emergency Care Practitioner).

This was echoed by another emphasising the importance of self-development;

That and I've spent every moment where I had the capacity to, in my off time, to keep learning, to keep up to date and to do additional short courses (Participant – L9, ECP)

These proactive strategies underscore the resilience and resourcefulness of both learners and professionals in addressing training deficiencies. By fostering intentional learning, building mentorship networks, and increasing opportunities for hands-on practice, the gaps in CCR preparation can be effectively bridged, enabling practitioners to meet the demands of their roles with greater confidence and competence.

6.4 DISCUSSION

This study assessed the views and opinions of a sample of purposefully selected discipline experts and students relating to gaps in education as they relate to CCR within the South African context. A group of 10 experts in critical care or intensive care and critical care retrieval participated in online semi-structured interviews and a second group of 9 prospective learners participated in an online focus group discussion.

Upon analysis of the data gathered during expert and learner consultations, four main categories were derived: Insufficiencies in undergraduate training, Graduate readiness to engage in CCR , Needs for standardisation of CCR education, and Bridging CCR training gaps. In an additional analysis of the suggested curriculum items and learning needs that were highlighted, a curriculum was developed.

Participants in the study highlighted significant gaps in the design of the undergraduate programmes and reported a lack of appropriate exposure and significant curriculum or knowledge gaps. A similar finding has been found in work done in Gauteng, South Africa, which explored the experience of paramedics involved in CCR (18). In this study, paramedics reported feeling poorly capacitated and supported and that they had received insufficient training during their undergraduate studies to safely conduct CCR. In a similar study conducted in KwaZulu-Natal, South Africa, which aimed to understand the experiences and the challenges faced by advanced life support (ALS) paramedics during neonatal transfers, they found that paramedics face significant challenges in neonatal transfers, including inadequate preparation, equipment issues, lack of support, and insufficient training, rendering them unprepared to manage these transfers effectively(202). The need for additional training is also well established in international literature, and a study done in Finland also highlighted the need for additional training and competencies required for the teams undertaking CCR (203).

Participants from the expert group and the learners indicate significant concern about their readiness to undertake CCR safely after initially qualifying. Once again, they alluded to a mismatch between reality and actual knowledge acquired, being ill-prepared despite obtaining ALS certification. In a study conducted in the Western Cape, South Africa, looking at the

preparedness of Western Cape ALS to undertake CCR, only 14.5% (n = 21) of the respondents felt “well-prepared” to manage critically ill neonates post-initial training (204). In two separate Australian studies, the level of operational readiness came into question, with employers saying that graduates aren’t ready for independent practice upon qualifying, and the other participants felt "somewhat adequately" prepared for entering the workforce. Further, the study showed that graduates ranged from being unprepared to apply knowledge to being partially prepared to feeling generally prepared but aware that significant on-the-job learning was still needed(205,206).

The lack of standards for CCR from a clinical perspective and the lack of standardised teaching concepts have been highlighted at various times. The apparent lack of uniformity leads to varied knowledge depths and practices within the CCR setting. The finding has been echoed in work done by Conradie et al., who found that although the modules were similar, there was a lack of clarity regarding relevance to the SA population, the depth at which these modules are covered and that programmes may not adequately prepare students (24,57).

The importance of having a contextual curriculum which prepares the graduate and serves the needs of the population has been demonstrated several times. A South African study on the Emergency Medicine curriculum in Cape Town emphasised the necessity of conducting a needs analysis during curriculum development (207). The research revealed gaps where certain diseases and procedures encountered in practice were not included in the curriculum, while some conditions covered in the curriculum were rarely seen in practice (207). Work done in KwaZulu Natal, South Africa, by Mariano et al., also highlighted the need for standardisation and indicated that there is no doubt that the development of and compliance with minimum competency standards will be the cornerstone for more effective and efficient training in emergency medical care (208). Without these standards, there is a risk that learning outcomes, content, teaching strategies, assessments, alignment, educational philosophy, and standardisation might not adequately address the needs of the SA population and graduates(208).

Participants also highlighted strategies for addressing these gaps, supported by evidence in broader educational literature. Proactive approaches such as intentional learning, practical experience, and mentorship have been well-documented as effective methods for bridging training deficiencies (209). Self-directed learning, where practitioners take the initiative in their education, aligns with Adult Learning Theory, which emphasises the value of autonomous, goal-oriented learning for adult learners (42,43). Practical experience, including internships and simulation-based training, has enhanced clinical readiness and confidence in handling complex medical scenarios (210,211).

Mentorship and collaboration emerged as critical components of professional development in this study. Participants noted the importance of building professional networks and seeking expert advice. This aligns with evidence that mentorship improves competence and career satisfaction in healthcare professionals (38,209) (207). Moreover, collaboration with colleagues and subject matter experts enhances problem-solving and skill acquisition, which is critical for effective CCR practice (38).

Personal initiative was also emphasised as a key driver in overcoming educational gaps. Continuous professional development (CPD) activities, such as attending short courses and workshops, have been identified as essential for staying current in critical care practices. This aligns with literature advocating CPD as a cornerstone of healthcare education and practice (212,213).

These strategies reflect resilience and determination among learners and professionals to overcome training deficiencies. By fostering a culture of intentional learning, mentorship, and practical engagement, the gaps in CCR education can be addressed effectively. This approach enhances practitioner competence and ensures that CCR services are delivered with confidence and skill, meeting the needs of patients and the broader South African healthcare system.

Participants felt that CCR should be a postgraduate qualification in addition to training received at the undergraduate level. They highlighted the complexity of CCR and the amount of knowledge needed to undertake these transfers safely. They suggested that the course should comprise a number of advanced clinical additions and soft skills perceived to be vital for the CCR provider.

Recent studies done in the SA context have also supported the notion and identified the need for specialisation and dedicated training (26,34,214). According to the SA NECET policy, new qualifications or alternations to existing EMS qualifications need to be approved by the HPCSA and the National Department of Health (NDoH) and will only be considered if there is clear evidence of a need within the South African context (17). This study and the preceding work done as part of this PhD significantly contribute to the growing body of evidence endorsing the need for additional critical care retrieval training for South African paramedics.

Participants suggested a 12-month course duration using a blended learning model, which integrates online teaching, classroom-based education, and practical, experiential learning. They felt this model would effectively target and engage students across various learning environments. Internationally, the value of blended online training has been shown in critical care training. A study conducted in India showed remarkable improvement in the knowledge regarding critical care management after virtual training by assessing Medical Officers (MO) pre and post-test; none of the MOs scored more than 80% in the pre-test; however, 153 MOs scored more than 80% in the post-test (215). Similar studies among nursing colleagues have demonstrated that digital platforms offer learners a significant degree of independence, while virtual learning environments enhance the application and utility of theoretical knowledge (216).

The value of online and blended modules has also been shown in South Africa, with a study done by Stassen et al. showing that online learning platforms can be implemented at little to no cost and aid in ensuring that patients get the best care (117). The study demonstrated an improvement in adherence to clinical guidelines for head-injured patients after the helicopter medical crew attended a series of online lectures and quizzes.

The blended learning delivery method offers several advantages, such as broader accessibility for a larger number of learners, cost-effectiveness, standardised training, and the convenience of self-paced study (217). However, it also has limitations, including the inability to realistically simulate patient care, insufficient practical skills development, and a lack of in-person interaction. These limitations may contribute to feelings of isolation among learners, but this

could be overcome by the inclusion of practical sessions and dedicated contact time, which can be accommodated in a blended learning module (217,218).

Participants highlighted the lack of exposure to critical care/intensive care patients during training. Participants felt that while theoretical knowledge is essential, hands-on experience is crucial for developing the skills necessary to manage complex and high-pressure situations effectively. Enhanced practical training would allow learners to apply theoretical concepts in real-world scenarios, refine their technical skills, and gain valuable insights into patient management, ultimately improving their readiness and competency in critical care environments (219,220).

The study highlights that while the 12-month blended learning model, incorporating online, classroom-based, and practical training, may address some gaps, challenges remain, including the inability to simulate patient care realistically and the potential for learner isolation. Participants advocated for postgraduate qualifications and advanced clinical training to ensure effective and safe management of critical care transfers.

6.5 CONCLUSION

Both experts and learners highlighted feeling underprepared for the complexities of CCR roles, stressing the urgent need for training reforms to bridge the gap between academic preparation and real-world demands. Participants emphasised the importance of standardising CCR education to ensure consistency and quality across institutions. Key recommendations included adopting blended learning models, enhancing practical training mentorship, and integrating modules on diagnostic skills, invasive monitoring, and soft skills such as communication, empathy, and leadership.

Phase 3 of the research reveals critical deficiencies in the current undergraduate EMC curricula, particularly in preparing graduates for CCR roles in South Africa. Participants identified significant gaps in training that leave graduates feeling unprepared for the demands of CCR practice. Suggestions for addressing these gaps included standardising CCR education, incorporating blended learning approaches, increasing hands-on training opportunities, and embedding soft skills and advanced clinical knowledge into the curriculum.

The insights gained from this phase strongly support the development of a dedicated postgraduate CCR qualification tailored to the needs of South African EMS professionals and the diverse patient populations they serve. This qualitative analysis reinforces the academic merit of the study and provides a robust foundation for designing a curriculum that addresses existing gaps, equipping practitioners with the competencies required to deliver high-quality care in CCR settings. The themes and recommendations from this phase are pivotal in shaping the proposed CCR curriculum, aiming to raise education and practice standards within the field.

CHAPTER 7 – THE DELPHI

7.1 INTRODUCTION

Chapter 7 focuses on presenting the results and findings that merged from the final phase of the study. In this final phase, the researcher made use of a Delphi study in an attempt to obtain expert opinion and consensus on the curriculum that was developed for CCR in the South African healthcare context. The statements relating to the structure and format of the draft curriculum that was put to Delphi panellists were constructed using the insights that emerged from the completion of the preceding phases—namely the scoping review (see chapter 3), retrospective case review (see chapter 5), and focus group interviews (see chapter 6). By engaging a diverse panel of experts through iterative rounds, the outcomes of the Delphi were used to refine and validate the content, structure, and objectives of the proposed CCR curriculum, which is presented in Chapter 8 that follows.

The reporting of this Delphi consensus process follows the CREDES guidelines to enhance methodological clarity and reproducibility.

7.2 RESULTS

7.2.1 Overview of the Delphi Process

This Delphi study aimed to achieve consensus among experts on curriculum items, modules, learning units, and specific outcomes outlined in the curriculum for the dedicated Adult CCR training programme. The curriculum content presented to the expert panels was derived from the Retrospective Case Review, Scoping Review, and Needs Analysis studies integral to this PhD project. The Delphi process involved three iterative rounds, allowing for binary decisions on including or excluding elements and providing opportunities for expert commentary. Findings are structured by Delphi rounds, culminating in the finalised curriculum framework.

Results of Round 1:

The study included eligible participants across various professions within the adult critical care environment. In Round 1, 104 participants were reached, of whom 83 met the eligibility criteria. The remaining were excluded due to insufficient professional experience (fewer than 3–5 years) or unrelated practice settings. Eligible participants represented a wide range of professional backgrounds in adult critical care, with 44 from the public sector and 39 from the private sector.

Advanced Life Support providers, including paramedics and Emergency Care Practitioners, constituted the largest group of 59 participants, followed by health professions educators 12, registered professional nurses specialising in adult critical care 7, and doctors engaged in critical care retrieval, rotating ICU, or in-hospital critical care units 5. This diverse composition provided comprehensive insights into the curriculum's demands.

Table 10 explicitly indicates the years of experience of the expert participants.

Table 10: Participant's Years of Experience

Years of Experience	No Eligible Participants
3 – 5 Years	10
5 – 10 Years	28
10 – 15 Years	24
More than 15 Years	21

The 83 participants completed the Delphi in full and voted on 6 Modules with their respective Learning Units and Specific Outcomes, totalling 164 individual items. Participants were invited to suggest additional content and provide comments. All comments and inputs received were consolidated, but no new additions were made.

During the first round, one Learning Unit in Module 5, “5.1 Patients with Nutritional Needs,” did not reach 75% consensus, but all the other Modules and Learning Units received >90% consensus for inclusion. Except for one unit, Module 1: Approaches to the provision of Intensive and Critical

Care services, Learning Unit 1.2—Generic structure and functioning of in-hospital intensive care units, achieved> 80% consensus for inclusion.

Despite no additions, much feedback was related to content items within each module or learning unit, e.g., specific skills and procedures. We outline some of the suggested content topics to be included in each learning unit. However, we remain generic so that the unit standards presented for the curriculum have longevity as changes occur in the field.

Table 11 below indicates the percentages of consensus achieved per learning unit and module for each round of the Delphi and whether consensus for inclusion has been achieved:

Table 11: Delphi Rounds & Consensus Status Round 1 -3

Delphi Rounds & Consensus Status Round 1 -3				
	"Yes, Include this"	"No, Exclude this"	Votes for inclusion (%)	Consensus Achieved
Module 1: Approaches to the provision of Intensive and Critical Care services (6 Credits)	**83**	**0**	**100,00%**	**Round 1**
Learning Unit 1.1 - The role, structure and function of Intensive and Critical Care services within the South African Health Care System	**76**	**5**	**91,57%**	**Round 1**
Learning Unit 1.2 - Generic structure and functioning of in-hospital intensive care units.	**69**	**12**	**83,13%**	**Round 1**
Learning Unit 1.3 - Approaches Hospital and EMS systems to facilitate the retrieval and transfer of patients between healthcare facilities.	**83**	**0**	**100,00%**	**Round 1**
Module 2: Physiological Effects of Movement and Transportation (6 Credits)	**83**	**0**	**100,00%**	**Round 1**
Learning Unit 2.1 - Selected Pathophysiology behind the high dependency of the critical patient.	**83**	**0**	**100,00%**	**Round 1**
Learning Unit 2.2 - Physiological effects and Stressors linked to transportation.	**81**	**2**	**97,59%**	**Round 1**
Learning Unit 2.3 - Risk mitigation strategies.	**81**	**2**	**97,59%**	**Round 1**
Module 3: Patient Care and Monitoring in Critical Care Retrieval Contexts (40 Credits)	**81**	**1**	**97,59%**	**Round 1**
Learning Unit 3.1 - General patient assessment and diagnostic procedures.	**82**	**1**	**98,80%**	**Round 1**
Learning Unit 3.2 - Airway assessments and related interventions.	**80**	**3**	**96,39%**	**Round 1**
Learning Unit 3.3 - Mechanical Ventilation	**83**	**0**	**100,00%**	**Round 1**
Learning Unit 3.4 - Cardiovascular support, including approaches to maintaining blood pressure, hydration, and related fluid management strategies.	**82**	**1**	**98,80%**	**Round 1**
Learning Unit 3.5 - Critical Care Pharmacology and Pharmacodynamics	**80**	**3**	**96,39%**	**Round 1**
Learning Unit 3.6 - Patient reception and preparation for transport at sending facilities.	**78**	**5**	**93,98%**	**Round 1**
Learning Unit 3.7 - Monitoring strategies and approaches to providing ongoing care.	**81**	**2**	**97,59%**	**Round 1**
Learning Unit 3.8 - Patient handover and at the receiving facility.	**82**	**1**	**98,80%**	**Round 1**

Learning Unit 3.9 - Approaches to disinfection and infection control.	**81**	**2**	**97,59%**	**Round 1**
Module 4: Leadership, Education and Management in Critical Care Contexts (20 Credits)	**79**	**3**	**95,18%**	**Round 1**
Learning Unit 4.1 - Clinical reasoning and decision-making around patient care and the patient pathway.	**82**	**1**	**98,80%**	**Round 1**
Learning Unit 4.2 - Mental Health, Wellness and Retention Strategies for team members.	**80**	**3**	**96,39%**	**Round 1**

Continuation of Table 11

Learning Unit 4.3 - Approaches to measuring and managing quality.	**81**	**2**	**97,59%**	**Round 1**
Learning Unit 4.4 - Clinical Governance and Practitioner Support.	**83**	**0**	**100,00%**	**Round 1**
Learning Unit 4.5 - Role of the practitioner in patient advocacy.	**78**	**5**	**93,98%**	**Round 1**
Learning Unit 4.6 - Approaches to education and maintenance of competence.	**78**	**5**	**93,98%**	**Round 1**
Module 5: Critical Care in Specialized Contexts (8 Credits)	**78**	**5**	**93,98%**	**Round 1**
Learning Unit 5.1 - Patients with Nutritional needs.	**52 (Round 1)**	**31 (Round 1)**	**62,65% (Round 1)**	**Not Achieved**
Learning Unit 5.2 - Managing the septic patient.	**80**	**3**	**96,39%**	**Round 1**
Learning Unit 5.3 - Managing patients who have been exposed to toxins.	**77**	**6**	**92,77%**	**Round 1**
Learning Unit 5.4 - Palliative end-of-life care.	**75**	**8**	**90,36%**	**Round 1**
Module 6: Clinical Practice (40 Credits)	**80**	**2**	**96,39%**	**Round 1**
Learning Unit 6.1 - Clinical Practice	**82**	**1**	**98,80%**	**Round 1**

Results of Round 2:

In Round 2 of the Delphi study, the survey was distributed to all 83 participants from Round 1 to refine the curriculum content based on their initial input. A total of 53 experts responded, resulting in a response rate of 63.8% and an attrition rate of approximately 36.14%. Given the methodology used for data collection, the attrition rate is common and is expected (145,221). Despite some evidence suggesting that in-mail Delphi's has less attrition than electronic Delphi's, the evidence is dated, and the in-mail method is not really feasible in today's reality (221).

Once again, consensus was not achieved for Learning Unit 5.1: "Patients with Nutritional Needs" within Module 5. This unit had initially fallen short of the required 75% threshold in Round 1, prompting its re-evaluation. During Round 2, only 43.4% (23 of 53 respondents) supported its inclusion, while 56.6% (30 respondents) opposed it, failing to meet the required consensus level. Feedback highlighted differing opinions on the unit's relevance, emphasising the need for further examination in a third round to solidify perspectives.

Despite the attrition, the remaining participants represented a balanced mix of expertise across critical care and retrieval contexts. The ongoing review of "Patients with Nutritional Needs" aligns with the study's objective to ensure robust expert support for all curriculum elements included in the Adult Critical Care Retrieval training programme.

Table 12 below indicates the percentages of consensus achieved per learning unit and module for round 2 of the Delphi and whether or not consensus for inclusion has been achieved:

Table 1212: Delphi Rounds & Consensus Status Round 2

Delphi Rounds & Consensus Status Round 2				
	"Yes, Include this"	"No, Exclude this"	Votes for inclusion (%)	Consensus Achieved
Module 5: Critical Care in Specialized Contexts				
Learning Unit 5.1 - Patients with Nutritional needs.	**23 (Round 2)**	**30 (Round 2)**	**43.40% (Round 2)**	**Not Achieved**

Results of Round 3:

In Round 3 of the Delphi study, the survey was sent to all 53 experts who participated in Round 2 to refine the curriculum content further. This round focused on reaching a definitive decision regarding the inclusion of Learning Unit 5.1: "Patients with Nutritional Needs" within Module 5, aiming to achieve the required 75% consensus threshold for inclusion or exclusion. Respondents were asked to consider prior feedback and provide their final stance, contributing to the development of a robust, well-supported curriculum framework for the Adult Critical Care Retrieval training programme.

Out of the 33 experts who responded, 20 supported the inclusion of the learning unit, resulting in 60.6% agreement—short of the 75% threshold required for definitive inclusion. With this outcome, the decision was made to exclude Learning Unit 5.1 from the final curriculum. This ensures the curriculum remains focused on content areas where more substantial consensus was achieved, aligning with the study's objective to create a well-defined and widely supported training programme.

Round 3 achieved a response rate of 62.3% (33 participants), reflecting sustained engagement despite attrition. The exclusion of Learning Unit 5.1 underscores the study's commitment to a robust and representative expert consensus curriculum, focusing on critical areas of content essential to Adult Critical Care Retrieval training.

Table 13 below indicates the percentages of consensus achieved per learning unit and module for round 3 of the Delphi and whether or not consensus for inclusion has been achieved:

Table 13 13: Delphi Rounds & Consensus Status Round 3

Delphi Rounds & Consensus Status Round 3				
	"Yes, Include this"	"No, Exclude this"	Votes for inclusion (%)	Consensus Achieved
Module 5: Critical Care in Specialized Contexts				
Learning Unit 5.1 - Patients with Nutritional needs.	**20 (Round 3)**	**10 (Round 3)**	**60.6% (Round 3)**	**Not Achieved**

The agreed structure for the CCR curriculum results from a consensus-based process informed by prior research conducted within the PhD, including a Retrospective Case Review, Scoping Review, and Needs Analysis. The course design, delivery methods, and duration have been carefully derived from this process, ensuring that all included elements reflect a comprehensive, evidence-based approach.

This Delphi study successfully identified and validated the core components of the Adult CCR curriculum, establishing a robust framework for a postgraduate diploma aimed at equipping healthcare professionals with essential knowledge, skills, and competencies. The content was refined through three rounds of expert consultation, enabling in-depth review and consensus-building on curriculum items, modules, learning units, and specific outcomes.

In addition to the clearly defined curriculum items, the skills, topics, and teaching additions previously outlined in Table 9 should be thoughtfully integrated into the proposed curriculum where applicable. This table provides a detailed overview of the suggested topics identified by experts and learners in Study 3, organised into thematic areas, to guide the development of a

comprehensive CCR training programme. These additions aim to bridge existing gaps, address the complexities of critical care, and prepare professionals to excel in diverse and challenging environments.

7.3 DISCUSSION

This Delphi study represents a significant milestone in developing a patient-centric adult critical care curriculum, the first of its kind in South Africa and across the African continent. By examining caseloads, international and local standards, and incorporating the insights of experts and learners, this study has successfully established a structured curriculum for adult CCR training. The curriculum comprises foundational modules and learning units critical to pre-hospital providers, reflecting the contextual demands of the South African healthcare system.

The Delphi process, central to this study, provided a rigorous framework for achieving consensus among a diverse panel of experts. Over multiple rounds, the methodology ensured high levels of agreement, with over 90% consensus on key modules and learning units. This level of concord underscores a shared understanding of the essential knowledge and skills required for CCR practice. The expert panel included balanced representation from clinical and non-clinical perspectives, further enhancing the comprehensiveness and validity of the findings.

The resulting curriculum is designed to be adaptable across various training systems and contexts where critical care specialisation is required. It comprises six modules, each detailing learning units, exit-level outcomes, and specific objectives for each unit. While this curriculum is grounded in the Delphi process and provides suggested content topics for the learning units, it intentionally remains generic to ensure its longevity and adaptability as the field evolves (222,223). As a living document, the curriculum must be refined and modified by stakeholders responsible for training emergency care providers, accommodating emerging knowledge and shifting priorities (224).

Despite its comprehensive design, some aspects of the curriculum overlap with topics already included in the current undergraduate ALS training. However, as highlighted in this study, the standards for ALS training are inconsistent, and the depth of coverage varies significantly (57). Furthermore, the varying levels of ALS providers authorised to undertake critical care transfers

in SA, as outlined by the HPCSA, necessitate a more uniform and specialised training approach (225)

The curriculum not only aligns with but also diverges from existing international CCR curricula. Universal competencies, such as understanding the physiological impacts of movement and transportation and strategies for risk mitigation, are integrated into modules like "Physiological Effects of Movement and Transportation" and "Patient Care and Monitoring" (92,118,121). These topics underscore core competencies essential for all CCR providers (226). However, the curriculum also addresses unique South African needs, such as incorporating mental health and wellness strategies for team members. This inclusion reflects the importance of resilience and practitioner retention in a high-stress healthcare environment (227,228). Additionally, the integration of ICU and EMS structures highlights the necessity for CCR providers to effectively transition patients across fragmented healthcare systems, a critical consideration in the SA context (229).

Notably, this curriculum emphasises not only clinical expertise but also the soft skills required for effective practice. Empathy, communication, and ethical integrity are woven into the curriculum, emphasising the adaptability needed to deliver CCR services across diverse regions and communities. By equipping providers with both technical skills and interpersonal competencies, the curriculum fosters a foundation for compassionate, patient-centred care. This approach aligns with broader commitments to health equity and accessibility in critical care.

While the curriculum provides a strong foundation for CCR training, its practical application remains to be tested. Implementing the curriculum in training settings will allow for the assessment of its real-world relevance and impact on patient care outcomes, practitioner satisfaction, and retention. Pilot studies could serve as an initial step in this process, offering valuable insights into areas for refinement. Additionally, further research should explore long-term outcomes for CCR practitioners trained under this curriculum, evaluating its effectiveness and identifying region-specific adjustments to optimise its utility.

Developing this curriculum required a comprehensive understanding of the pre-hospital environment, transported patients, available resources, and educational standards both

nationally and internationally. Through a collaborative and iterative Delphi process, this study has laid a strong foundation for CCR training in South Africa, offering a blueprint that may inspire similar initiatives in other low- and middle-income countries.

The proposed curriculum provides a strong foundation for CCR training in South Africa, but its practical application requires further investigation. Implementing the curriculum in training settings could help assess the real-world relevance of the content and inform necessary refinements.

7.4 CONCLUSION

This chapter represents a significant achievement in the development of a dedicated Adult CCR curriculum, marking the first structured training framework of its kind in South Africa. Through a rigorous Delphi process involving three iterative rounds and contributions from a diverse expert panel, the study successfully validated key curriculum components, modules, and learning outcomes. The resulting curriculum integrates international best practices while addressing the unique challenges of the South African healthcare system, ensuring its relevance and applicability.

Despite the high level of consensus achieved, the process also highlighted the complexity of CCR education, particularly in aligning diverse perspectives and bridging existing gaps in training. The finalised curriculum emphasises a balance of technical expertise and soft skills, providing a foundation for compassionate, patient-centred care in diverse and resource-limited settings. As a living document, the curriculum invites future refinement and adaptation to evolving healthcare needs and practices. Moving forward, its implementation and assessment in real-world training contexts will be critical to ensuring its effectiveness and long-term impact on both practitioner preparedness and patient outcomes.

CHAPTER 8 - THE PROPOSED CRITICAL CARE RETRIEVAL CURRICULUM & THESIS DISCUSSION

8.1 INTRODUCTION

Chapter 8 focuses on a presentation and defence of the adult critical care retrieval (CCR) curriculum that was designed for the South African context. Grounded in evidence and shaped by expert consensus, the curriculum presented in this penultimate chapter was developed by the researcher as his unique contribution flowing from the completion of this doctoral study. It is argued that engagement with this curriculum could provide graduates with the necessary knowledge, skills, attitudes, and insights to better manage the complexities associated with critical care transport and retrieval in the SA context.

The flow and structure of the curriculum that has been developed reflects the complex nature of critical care, incorporating diverse perspectives and expertise to meet the unique challenges encountered in these high-stakes environments.

8.2. METHOD AND APPROACH TO THE DESIGN

During the curriculum design process and setting of the Exit Level Outcomes (ELOs) and Specific Outcomes (SOs), Bloom's Taxonomy (see Figure 5), which is commonly used to assist in developing learning outcomes (230,231), was consulted. Bloom's Taxonomy has since been reviewed, but it still provides a shared framework for educators to discuss and refine teaching and assessment strategies, which allows for the formulation of specific outcomes and is widely utilised to evaluate learning across multiple cognitive levels (230,231). The taxonomy displayed below categorises cognitive levels from higher-order to lower-order thinking skills:

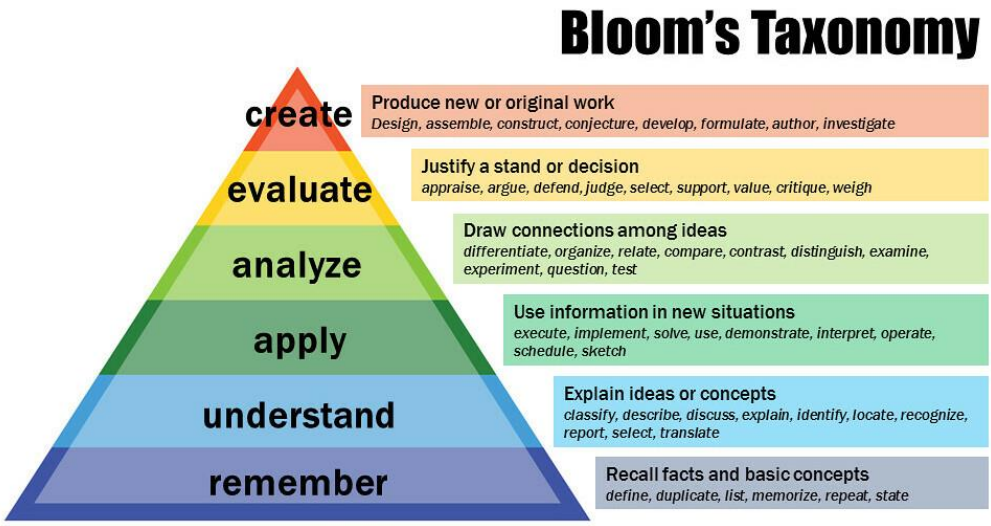

Figure 5: Bloom's Taxonomy

(232)

This enabled the development of the ELOs and SOs as outlined in the curriculum, which were then subject to the Delphi process. During the curriculum design process, the taxonomy served as a guide for integrating its principles into the broader educational objectives and standards of the proposed CCR programme.

Through his deep engagement in this study, the researcher came to appreciate and understand that a curriculum does not stand alone. Rather, it exists in an educational context that includes not just the content that should be covered but also how such content is best offered and packaged into a qualification and learning programme. The content and narrative included in this chapter were therefore informed and defended against scientific inquiries and critical consideration of:

a) Educational theory, including local and international approaches to CCR and related curricula. (see chapter 3)

b) The complex nature of CCR (see chapters 4-7))

c) The characteristics of patients transported in the SA context (see Chapter 5)

d) The views and opinions of experiences emergency care providers and subject matter experts (see chapters 6 and 7)

His deep engagement with the subject matter allowed the researcher to propose a contextually relevant, logical, and pragmatic way in which the developed curriculum could and should be interpreted, taking into account the shape and structure of the South African Higher Education Qualifications Framework (233), existing NQF-aligned Emergency Care Education and Training Qualifications (17), and the local Emergency Care Profession.

8.3 THE CURRICULUM

The Adult Critical Care Retrieval CCR Postgraduate Qualification presented here is a specialised, high-level program designed to equip healthcare professionals with the advanced clinical expertise, decision-making capabilities, and leadership skills necessary to manage critically ill or injured patients in transit. The qualification holds a strong emphasis on systems integration, clinical governance, and patient safety. This qualification ensures that graduates are not only competent in bedside critical care but also adept at navigating the complexities of retrieval medicine within diverse and resource-variable environments.

CCR requires precision, adaptability, and a deep understanding of both intensive care and emergency medicine (19,71). This curriculum integrates evidence-based clinical interventions, transport physiology, and advanced patient monitoring, ensuring that practitioners can operate effectively under pressure while making rapid, life-saving decisions. The structured learning pathway bridges the gap between prehospital emergency care, interfacility transport, and ICU-level treatment, reinforcing the continuity of care from the point of retrieval to definitive management.

Beyond the technical and procedural competencies, the program fosters a culture of leadership, resilience, and interdisciplinary collaboration. Graduates will be well-versed in quality improvement, clinical governance, and education, empowering them to drive systemic change, enhance operational efficiency, and advocate for the evolution of critical care retrieval services within the broader healthcare system.

This postgraduate qualification is more than a training program—it is a strategic initiative to elevate the standard of retrieval medicine, ensuring that every critically ill patient receives the right care at the right time in the right place. By producing highly skilled, forward-thinking professionals, the program contributes to strengthening critical care systems, workforce sustainability, and the future of emergency medicine in South Africa and beyond.

The curriculum components, outlined in the following section, illustrate how academic and experiential learning converge to cultivate highly skilled professionals in critical care. Table 14 presents the detailed framework for the postgraduate qualification in Adult Critical Care Retrieval. It includes the program's core purpose, delivery model, target audience, and comprehensive module breakdown, with an emphasis on learning units, exit-level outcomes, specific outcomes, and proposed assessment methods. This curriculum serves as a blueprint for advancing professional practice and fostering excellence in the specialised field of critical care retrieval.

Table 14: Proposed Adult CCR Curriculum

A Curriculum for the -Adult Critical Care Retrieval Postgraduate Qualification		
Course Purpose Statement: **The postgraduate diploma in critical care retrieval aims to provide healthcare professionals with the knowledge, skills, attitudes and insights required to deliver evidence-based best-practice patient care in various intensive and critical care contexts with a focus on transportation and retrieval.**		
Core Modules for the Adult Critical Care Postgraduate Qualification		
Module 1: Approaches to the provision of Intensive and Critical Care services (6 Credits) **The purpose of module 1 is to provide students with a holistic view, and a comprehensive understanding of the systemic nature and context of intensive care services in local healthcare settings.**		
Learning Units	**Exit Level Outcomes**	**Specific Outcomes**

• ***Learning unit 1.1***
  ○ **The role, structure and function of Intensive and Critical Care services within the South African Health Care System.**[7]
• ***Learning Unit 1.2***
  ○ **Generic structure and functioning of in-hospital intensive care units.**[9]
• ***Learning Unit 1.3***
  ○ **Approaches Hospital and EMS systems to facilitate the retrieval and transfer of patients between healthcare facilities.**[8]
	• Demonstrate a comprehensive understanding of the role, structure, and function of Intensive and Critical Care services within the South African healthcare system, including their integration and impact on patient outcomes.
	• Critically analyse the generic structure and functioning of in-hospital intensive care units (ICUs), understanding their operational dynamics, resource management, and patient care protocols.
	• Evaluate and apply different approaches hospital and EMS systems use to facilitate the safe and efficient retrieval and transfer of critically ill patients between healthcare facilities, ensuring continuity of care.
	• Identify and assess the challenges related to resource availability, capacity, and workforce in delivering critical care services, proposing solutions to optimise service provision.
	• Understand and interpret key legislation, policies, and guidelines that govern the delivery of Intensive and Critical Care services in South Africa, with particular attention to ethical considerations and patient rights**.**
		Learning Unit 1.1:
		1.1.1 Explain the role of Intensive and Critical Care services within the broader South African healthcare system, highlighting their contribution to patient care and outcomes.
		1.1.2 Identify the key components that define the structure of Intensive and Critical Care services, including facility design, staffing models, and technological infrastructure.
		1.1.3 Discuss the functions and responsibilities of Intensive and Critical Care units, focusing on how they support acute and complex patient care across varying levels of healthcare.
		1.1.4 Analyse the integration of Intensive and Critical Care services within both public and private healthcare sectors in South Africa, recognising disparities and commonalities in service provision.
		1.1.5 Evaluate the impact of socio-economic factors on the accessibility and quality of Intensive and Critical Care services, with attention to urban and rural healthcare delivery.
		1.1.6 Interpret the relevant national healthcare policies and frameworks that guide the delivery of Intensive and Critical Care services, ensuring alignment with South African healthcare goals and legal standards.
		1.1.7 Critically assess the challenges facing the provision of Intensive and Critical Care services in South Africa, including resource limitations, workforce issues, and patient care demands, and propose feasible solutions.

		Learning Unit 1.2: 1.2.1 Describe the standard organisational structure of in-hospital intensive care units (ICUs), including key roles, responsibilities, and hierarchical relationships among healthcare professionals. 1.2.2 Identify the core components of ICU functioning, such as patient admission criteria, care protocols, and multidisciplinary team involvement in critical patient management. 1.2.3 Analyse the resource requirements for effective ICU operation, including medical equipment, staffing ratios, and environmental controls (e.g., infection prevention measures). 1.2.4 Discuss the management and coordination of care in the ICU, including communication strategies, shift structures, and collaboration among healthcare professionals. 1.2.5 Evaluate patient flow processes in the ICU, focusing on admission, monitoring, treatment plans, and discharge or transfer protocols to ensure optimal patient outcomes. 1.2.6 Critically assess the impact of ICU-specific challenges, such as high patient acuity, resource constraints, and staff burnout, on service delivery and patient care. 1.2.7 Interpret ICU-specific performance indicators and quality assurance measures, understanding how these metrics contribute to continuous improvement in patient care and operational efficiency. 1.2.8 Examine ICU management's ethical and legal considerations, particularly concerning patient autonomy, end-of-life care, and decision-making in critical scenarios. ***Learning Unit 1.3:*** 1.3.1 Explain the fundamental principles and processes of patient retrieval and transfer between healthcare facilities, emphasising hospital-EMS collaboration. 1.3.2 Identify the criteria for selecting appropriate transport modes (ground or air) based on patient conditions and logistics. 1.3.3 Describe the roles and responsibilities of EMS and hospital personnel in coordinating patient transfers. 1.3.4 Evaluate the challenges in patient transfers, including clinical, logistical, and environmental factors, and propose solutions to ensure safe transfers.

		1.3.5 Understand the legal and ethical considerations governing patient transfers, including patient safety, consent, and regulatory compliance.
Proposed Assessment Methods: • **Practical Assessment: Demonstrations of skills in simulated environments.** • **Portfolio of Evidence: Documenting skills and competencies achieved.** • **Ongoing Assessment: Continuous evaluation through supervised practice and real-life scenarios.**		
Module 2: Physiological Effects of Movement and Transportation (6 Credits) **The purpose of module 2 is to provide students with an understanding of the physiological effects and related stressors that could pose a risk to the health of patients being transported, including strategies to limit such risks.**		
Learning Units	**Exit Level Outcomes**	**Specific Outcomes**

• ***Learning Unit 2.1***
  ○ **Selected Pathophysiology behind the fragile nature of the critically ill patient.[23,24, 26]**
• ***Learning Unit 2.2***
  ○ **Physiological effects and Stressors linked to transportation.[30]**
• ***Learning Unit 2.3***
  ○ **Risk mitigation strategies.**
	• Understand and analyse the pathophysiological changes in critically ill patients, focusing on their fragile condition and how it impacts treatment during transport.
	• Evaluate the physiological effects and stressors associated with movement and transportation in critically ill patients, including altitude, vibration, and environmental factors, and their impact on patient stability.
	• Demonstrate knowledge of risk mitigation strategies to minimise the adverse effects of transportation on critically ill patients, ensuring patient safety and care continuity.
	• Apply principles of clinical decision-making when planning and executing patient transportation, emphasising adapting interventions based on the patient's physiological response.
	• Critically assess the integration of monitoring systems and equipment during patient transport to manage stressors effectively and ensure timely intervention in case of patient deterioration.
		Learning Unit 2.1
		2.1.1 Identify and describe common pathophysiological conditions affecting critically ill patients, including sepsis, respiratory failure, and multi-organ dysfunction.
		2.1.2 Analyse the mechanisms of disease that contribute to the fragile nature of critically ill patients, focusing on how these mechanisms influence patient stability during transport.
		2.1.3 Discuss the impact of comorbidities on the pathophysiological state of critically ill patients and how these comorbidities complicate management and transport.
		2.1.4 Examine the physiological responses to stress that critically ill patients may experience during movement and transportation, including cardiovascular, respiratory, and neurological responses.
		2.1.5 Evaluate the implications of pathophysiological changes for clinical practice, including monitoring needs, interventions, and patient care strategies during transport.
		2.1.6 Integrate knowledge of pathophysiology into clinical decision-making regarding the planning and execution of safe transportation for critically ill patients.
		
		Learning Unit 2.2:
		2.2.1 Describe the physiological effects of movement on critically ill patients, including changes in vital signs, hemodynamic, and respiratory function during transport.

		2.2.2 Identify and analyse the stressors associated with transportation, such as noise, vibration, and environmental factors, and their potential impact on patient physiology. 2.2.3 Evaluate the impact of different modes of transport (e.g., ground vs. air) on critically ill patients, considering each mode's unique physiological challenges. 2.2.4 Discuss the implications of patient positioning and movement during transport on physiological stability, including strategies to minimise adverse effects. 2.2.5 Apply principles of monitoring and assessment to identify and respond to physiological changes and stress responses during transportation, ensuring timely interventions. ***Learning Unit 2.3:*** 2.3.1 Identify and assess potential risks associated with the transportation of critically ill patients, including physiological, environmental, and logistical factors. 2.3.2 Develop and implement risk mitigation strategies to minimise adverse effects during patient transport, focusing on both pre-transport planning and in-transit care. 2.3.3 Analyse case scenarios to determine appropriate interventions for mitigating identified risks during transportation, emphasising critical thinking and decision-making skills. 2.3.4 Discuss the importance of communication and teamwork among healthcare providers in implementing risk mitigation strategies during patient transport. 2.3.5 Evaluate the effectiveness of monitoring systems and protocols designed to detect and address complications arising during transportation, ensuring patient safety. 2.3.6 Examine the role of training and education in enhancing the skills and knowledge of EMS and hospital staff in managing risks associated with transporting critically ill patients.
Proposed Assessment Methods: • **Simulation: Reenactment of critical care scenarios to assess practical skills.** • **Written Exam: Testing theoretical knowledge related to ICU and critical care.** • **Portfolio of Evidence: Documenting experience and competencies in critical care.**		
Module 3: Patient Care and Monitoring in Critical Care Retrieval Contexts (40 Credits) **The purpose of module 3 is to provide students with the knowledge, clinical skills, attitudes and insights required to deliver optimal patient care in a variety of critical care contexts.**		
Learning Units	**Exit Level Outcomes**	**Specific Outcomes**

• ***Learning Unit 3.1***
  ○ **General patient assessment and diagnostic procedures.** [3]
• ***Learning Unit 3.2***
  ○ **Airway assessments and related interventions.**[1]
• ***Learning Unit 3.3***
  ○ **Mechanical Ventilation**[5]
• ***Learning Unit 3.4***
  ○ **Cardiovascular support, including approaches to maintaining blood pressure, hydration, and related fluid management strategies.**
• ***Learning Unit 3.5***
  ○ **Critical Care Pharmacology and Pharmacodynamics**[18,19,20,21,22]
• ***Learning Unit 3.6***
  ○ **Patient reception and preparation for transport at sending facilities.**[2]
• ***Learning Unit 3.7***
  ○ **Monitoring strategies and approaches to providing ongoing care.**[3]
• ***Learning Unit 3.8***
  ○ **Patient handover and at the receiving facility.**[2]
• ***Learning Unit 3.9***
  ○ **Approaches to disinfection and infection control.**[34]
	• Demonstrate comprehensive knowledge of general patient assessment and diagnostic procedures in critical care contexts, ensuring practical evaluation and prioritisation of patient needs.
	• Evaluate and apply airway assessment techniques and interventions necessary for maintaining airway patency in critically ill patients during transport.
	• Understand the principles and application of mechanical ventilation for critically ill patients, including indications, settings, and management strategies.
	• Implement cardiovascular support strategies to maintain blood pressure, hydration, and fluid management in critically ill patients, recognising the importance of hemodynamic stability.
	• Analyse critical care pharmacology and pharmacodynamics, applying knowledge of medications to optimise patient care during transport.
	• Prepare and receive patients for transport at sending facilities, ensuring that all necessary assessments and interventions are completed to facilitate safe and effective transfer.
	• Develop and implement monitoring strategies and ongoing care approaches during transportation, emphasising patient safety and response to changes in condition.
	• Facilitate effective patient handover processes at receiving facilities, ensuring continuity of care and clear communication among healthcare providers.
	• Apply infection control and disinfection practices in critical care retrieval contexts to minimise the risk of infection and ensure patient safety.
		Learning Unit 3.1:
		3.1.1 Conduct a comprehensive patient assessment to identify critical care needs, including history taking, physical examination, and vital sign monitoring.
		3.1.2 Utilize appropriate diagnostic procedures, including laboratory tests, imaging studies, and other relevant assessments, to evaluate the clinical status of critically ill patients.
		3.1.3 Interpret assessment findings to identify acute and chronic conditions affecting the critically ill patient and prioritise interventions based on clinical judgment.
		3.1.4 Apply standardised assessment tools and protocols to ensure consistency and accuracy in evaluating critically ill patients.
		3.1.5 Demonstrate practical communication skills in gathering patient history and interacting with patients, families, and other healthcare providers during the assessment process.
		3.1.6 Develop individualised care plans based on assessment findings, addressing the unique needs of each critically ill patient and ensuring continuity of care.
		3.1.7 Recognise and respond to patient condition changes during assessment, utilising critical thinking skills to adapt care strategies as needed.
		Learning Unit 3.2:
		3.2.1 Perform comprehensive airway assessments to evaluate patency, including visual inspection, auscultation, and evaluation of respiratory effort.
		3.2.2 Based on patient assessment findings, Identify indications for airway interventions, such as intubation, advanced airway management, and supplemental oxygenation.
		3.2.3 Demonstrate proficiency in various airway management techniques, including bag-valve-mask ventilation, oropharyngeal and nasopharyngeal airway insertion, and endotracheal intubation.
		3.2.3 Evaluate the effectiveness of airway interventions through ongoing assessment of respiratory parameters, including oxygen saturation, end-tidal carbon dioxide levels, and breath sounds.
		3.2.4 Apply appropriate emergency interventions for airway compromise, including managing foreign body obstruction and recognising respiratory distress.
		3.2.5 Communicate effectively with the healthcare team regarding airway assessment findings and interventions, ensuring collaborative decision-making and continuity of care.

		3.2.6 Understand the potential complications associated with airway interventions and demonstrate skills in managing these complications, including recognising signs of hypoxia and aspiration. 3.2.7 Integrate knowledge of anatomy and physiology related to airway structures to inform assessment and intervention strategies for critically ill patients. ***Learning Unit 3.3:*** 3.3.1 Understand the principles and objectives of mechanical ventilation, including indications, contraindications, and goals for critically ill patients. 3.3.2 Identify the different modes of mechanical ventilation (e.g., assist-control, SIMV, pressure support) and their appropriate clinical applications based on patient needs. 3.3.3 Demonstrate proficiency in setting up and operating mechanical ventilators, ensuring proper parameters are established for patient-specific requirements. 3.3.4 Assess and interpret ventilator settings and patient responses, including tidal volume, respiratory rate, and arterial blood gas results, to optimise ventilatory support. 3.3.5 Recognize and manage common complications associated with mechanical ventilation, such as ventilator-induced lung injury, barotrauma, and pneumonia. 3.3.6 Implement strategies for weaning patients from mechanical ventilation, utilising clinical indicators and patient readiness to guide the process. 3.3.7 Communicate effectively with the healthcare team about mechanical ventilation plans, progress, and any changes in patient status to ensure coordinated care. 3.3.8 Integrate evidence-based practices and protocols related to mechanical ventilation into clinical decision-making to enhance patient outcomes during transport. ***Learning Unit 3.4:*** 3.4.1 Assess cardiovascular status by monitoring blood pressure, heart rate, and other hemodynamic parameters to evaluate the patient's circulatory condition. 3.4.2 Apply evidence-based interventions to manage blood pressure and maintain adequate perfusion, including fluids, vasopressors, and inotropes.

		3.4.3 Develop and implement fluid management strategies tailored to the patient's clinical needs, balancing hydration, electrolyte levels, and overall fluid balance. 3.4.4 Monitor and adjust interventions based on the patient's response to therapy, ensuring that cardiovascular support is optimised in both stable and dynamic critical care situations. 3.4.5 Educate patients and families on the importance of cardiovascular support measures, providing clear explanations of treatment goals and strategies. ***Learning Unit 3.5:*** 3.5.1 Demonstrate an understanding of pharmacological principles relevant to critical care, including pharmacokinetics, pharmacodynamics, and drug interactions. 3.5.2 Identify common medications used in critical care settings, including indications, contraindications, and potential side effects for each class of drugs. 3.5.3 Apply knowledge of critical care pharmacology to develop appropriate medication management plans for critically ill patients, considering individual patient needs and conditions. 3.5.4 Assess the effects of medications on critically ill patients, including therapeutic effects, adverse reactions, and the impact on physiological parameters. 3.5.5 Demonstrate competency in medication administration techniques, ensuring safe and accurate delivery of pharmacological therapies in a transport environment. 3.5.6 Evaluate and interpret laboratory results and clinical parameters to guide medication adjustments and optimise pharmacological interventions. 3.5.7 Communicate effectively with the healthcare team regarding medication plans, changes, and patient responses to ensure coordinated and safe patient care. 3.5.8 Incorporate evidence-based guidelines and protocols related to critical care pharmacology into clinical practice to enhance patient outcomes and safety. ***Learning Unit 3.6:*** 3.6.1 Conduct a thorough patient assessment, including history and physical examination, prior to transport to determine the patient's readiness for transfer.

		3.6.2 Demonstrate practical communication skills with healthcare team members during the handover process, ensuring accurate transmission of critical information. 3.6.3 Prepare the patient for transport by stabilising their condition and ensuring all necessary medical equipment and supplies are available. 3.6.4 Coordinate with receiving facilities to ensure appropriate arrangements are made for the patient's arrival, including any specialised care requirements. 3.6.5 Implement safety protocols to protect the patient during transfer preparations, including infection control measures and verification of patient identity. ***Learning Unit 3.7:*** 3.7.1 Identify appropriate monitoring parameters for critically ill patients during transport, including vital signs, oxygen saturation, and neurological status. 3.7.2 Implement continuous monitoring techniques and tools to assess the patient's condition in real-time, ensuring timely detection of changes. 3.7.3 Evaluate and interpret monitoring data to inform clinical decision-making and modify care plans as necessary during transport. 3.7.4 Demonstrate effective communication of monitoring findings to the healthcare team to ensure coordinated and responsive patient care. 3.7.5 Apply interventions based on monitoring results to maintain patient stability and address any emerging complications during transport. ***Learning Unit 3.8:*** 3.8.1 Perform a structured handover process that includes a comprehensive review of the patient's medical history, current status, and ongoing treatment needs. 3.8.2 Communicate effectively with the receiving healthcare team, ensuring clarity and accuracy in conveying critical information about the patient. 3.8.3 Accurately document the handover details, including any significant changes observed during transport and recommendations for continued care.

		3.8.4 Facilitate a collaborative approach during the handover to ensure all team members are informed and prepared to provide appropriate care for the patient. 3.8.5 Address any questions or concerns from the receiving team and provide additional information as needed to ensure a smooth transition of care. ***Learning Unit 3.9:*** *3.9.1* Identify and describe key infection control principles relevant to critical care retrieval environments, including standard and transmission-based precautions. *3.9.2* Demonstrate effective disinfection techniques for medical equipment and surfaces to minimise the risk of infection during patient transport. *3.9.3* Implement infection control protocols during patient handling and care to prevent cross-contamination and ensure patient safety. *3.9.4* Assess and evaluate infection risks in the transport environment, applying strategies to mitigate these risks effectively. *3.9.5* Communicate infection control practices to the healthcare team, ensuring a coordinated approach to maintaining a safe care environment.
Proposed Assessment Methods: • **Simulation: Role play and management scenarios to assess the practical application of skills.** • **Written Exam: Testing theoretical understanding of management and educational principles.** • **Assignments: Practical assignments related to management and educational strategies.**		
Module 4: Leadership, Education and Management in Critical Care Contexts (20 Credits) **The purpose of module 4 is to provide students with the knowledge, clinical skills, attitudes and insights required to provide management, leadership and education in the field of critical care retrieval.**		
Learning Units	**Exit Level Outcomes**	**Specific Outcomes**

• ***Learning Unit 4.1***
  ○ **Clinical reasoning and decision-making around patient care and the patient pathway.[6]**
• ***Learning Unit 4.2***
  ○ **Mental Health, Wellness and Retention Strategies for team members.[11,15,17,29]**
• ***Learning Unit 4.3***
  ○ **Approaches to measuring and managing quality. [16]**
• ***Learning Unit 4.4***
	• Demonstrate effective clinical reasoning and decision-making skills in managing patient care and the patient pathway within critical care contexts.
	• Develop and implement strategies for promoting mental health and wellness among team members, enhancing retention and job satisfaction in high-stress environments.
	• Assess and apply quality management approaches to evaluate and improve care delivery in critical care settings, ensuring compliance with established standards and protocols.
		Learning Unit 4.1:
		4.1.1. Apply clinical reasoning frameworks to assess patient conditions and make informed decisions regarding the patient pathway in critical care.
		4.1.2. Analyse patient data and clinical indicators to determine appropriate interventions and prioritise care based on individual patient needs.
		4.1.3. Demonstrate practical problem-solving skills in complex clinical scenarios, utilising evidence-based guidelines to guide decision-making.

○ **Clinical Governance and Practitioner Support.** • ***Learning Unit 4.5*** ○ **Role of the practitioner in patient advocacy.[14]** • ***Learning Unit 4.6*** ○ **Approaches to education and maintenance of competence.[13]**	• Understand and apply principles of clinical governance to support practitioners and enhance patient safety and care quality in critical care environments. • Advocate for patients' rights and needs through effective communication and engagement with patients, families, and the healthcare team. • Design and implement educational programs that ensure ongoing professional development and maintenance of competence for critical care practitioners.	*4.1.4.* Integrate interdisciplinary collaboration into the decision-making process, effectively communicating with team members to optimise patient care pathways. *4.1.5.* Evaluate the outcomes of clinical decisions to inform future practice, using reflective practice to continuously enhance clinical reasoning skills. ***Learning Unit 4.2:*** 4.2.1 Identify the impact of mental health on team performance and patient care within critical care environments, recognising signs of stress and burnout among team members. 4.2.2 Develop and implement wellness programs that promote mental health and resilience among team members, fostering a supportive work environment. 4.2.3 Evaluate retention strategies to improve job satisfaction and reduce turnover rates within critical care teams. 4.2.4 Communicate effectively with team members about mental health resources and support systems, encouraging open discussions about well-being. 4.2.5 Implement strategies to foster a culture of wellness within the team, promoting collaboration and support to enhance overall team functioning. ***Learning Unit 4.3:*** 4.3.1 Identify key quality indicators relevant to critical care services and understand their significance in evaluating patient outcomes and care processes. 4.3.2 Implement quality measurement tools and methodologies to assess the effectiveness of care delivery in critical care settings. 4.3.3 Analyse quality data to identify trends, areas for improvement, and opportunities for enhancing patient care and safety 4.3.4 Develop and execute quality improvement initiatives to address identified gaps in care and ensure alignment with best practices and regulatory standards. 4.3.5 Foster a culture of quality improvement within the team, encouraging collaboration and engagement in quality management processes. ***Learning Unit 4.4:***

		4.4.1 Describe the principles of clinical governance and their application in ensuring high patient care and safety standards in critical care settings. 4.4.2 Evaluate the role of leadership in fostering a culture of accountability and continuous improvement within healthcare teams. 4.4.3 Identify support mechanisms available to practitioners, including mentorship, supervision, and access to professional development resources. 4.4.4 Implement strategies for risk management that enhance patient safety and promote a culture of transparency and reporting. 4.4.5 Engage in reflective practice to assess personal and team performance, using feedback and clinical audits to inform professional development and improve care delivery. ***Learning Unit 4.5:*** 4.5.1 Identify the principles of patient advocacy and their importance in ensuring patients' rights and needs are respected within critical care settings. 4.5.2 Demonstrate practical communication skills to represent and advocate for patients' interests and preferences in healthcare decisions. 4.5.3 Assess patients' situations and needs to identify opportunities for advocacy and ensure equitable access to care and resources. 4.5.4 Collaborate with interdisciplinary teams to facilitate patient-centred care and promote a culture of advocacy within the healthcare environment. 4.5.5 Evaluate the impact of advocacy efforts on patient outcomes and satisfaction, using feedback to improve advocacy strategies and practices. ***Learning Unit 4.6:*** 4.6.1 Identify essential competencies required for practitioners in critical care contexts, emphasising the need for ongoing education and skills development. 4.6.2 Develop and implement educational programs that address team members' knowledge gaps and training needs, promoting continuous professional growth. 4.6.3 Evaluate the effectiveness of educational initiatives in enhancing practitioner competence and improving patient care outcomes.

		4.6.4 Utilize various teaching and learning methodologies to cater to different learning styles and promote effective knowledge transfer within the team. 4.6.5 Foster a culture of lifelong learning by encouraging practitioners to engage in professional development opportunities and reflect on their practice regularly.
Proposed Assessment Methods: • **Written Exam: Assessing theoretical knowledge of pharmacology.** • **Practical Assessment: Application of pharmacological principles in simulated settings.** • **Case Studies: Analysing pharmacological scenarios to demonstrate understanding.**		
Module 5: Critical Care in Specialized Contexts (8 Credits) **The purpose of module 5 is to provide students with the knowledge, clinical skills, attitudes and insights required to provide critical care to patients in specific contexts and/or who may have special needs**		
Learning Units	**Exit Level Outcomes**	**Specific Outcomes**

• ***Learning Unit 5.1***
  ○ **Managing the septic patient.[36]**
• ***Learning Unit 5.2***
  ○ **Managing patients who have been exposed to toxins[37]**
• ***Learning Unit 5.3***
  ○ **Palliative end of life care[27,28]**
	• Apply evidence-based practices for managing septic patients, including recognising septic shock and initiating timely interventions.
	• Evaluate and manage patients exposed to toxins, utilising appropriate decontamination and treatment protocols to mitigate risks and enhance patient outcomes.
	• Provide compassionate and effective palliative care for patients at the end of life, ensuring their physical, emotional, and spiritual needs are met.
	• Integrate a multidisciplinary approach to care for specialised patient populations, collaborating effectively with healthcare team members to optimise patient outcomes.
		Learning Unit 5.1:
		5.1.1. Recognize the early signs and symptoms of sepsis in critically ill patients and understand the importance of prompt identification for effective management.
		5.1.2. Apply evidence-based guidelines for managing sepsis, including fluid resuscitation, vasopressors, and antimicrobial therapy.
		5.1.3. Assess and monitor septic patients' hemodynamic status and vital signs, utilising appropriate tools and technologies to guide treatment decisions.
		5.1.4. Implement infection control measures to prevent secondary infections and reduce the risk of complications in septic patients.
		5.1.5. Evaluate the effectiveness of interventions for managing sepsis, using clinical outcomes and patient responses to inform future practice.
		
		Learning Unit 5.2:
		5.2.1 Identify common toxins and their associated clinical manifestations, understanding the signs and symptoms of toxicity in critically ill patients.
		5.2.2 Perform a thorough assessment of patients with suspected toxin exposure, including history-taking and physical examination, to determine the appropriate course of action.

		5.2.3 Implement appropriate decontamination procedures based on the type of toxin and mode of exposure, ensuring patient safety and minimising complications. 5.2.4 Administer specific antidotes or treatments as indicated, applying evidence-based protocols for toxin management in critical care settings. 5.2.5 Educate patients and families on prevention strategies and the importance of timely intervention in cases of toxin exposure, reinforcing safety practices. ***Learning Unit 5.3:*** 5.3.1 Recognize the principles of palliative care, understanding the importance of addressing patients' physical, emotional, and spiritual needs at the end of life. 5.3.2 Use appropriate interventions to Assess and manage symptoms commonly associated with end-of-life care, including pain, dyspnoea, and psychosocial distress. 5.3.3 Develop individualised care plans that incorporate the preferences and values of patients and their families, ensuring a patient-centred approach to end-of-life care. 5.3.4 Facilitate open and compassionate communication with patients and families about goals of care, advanced directives, and the dying process. 5.3.5 Support families and caregivers through the grieving process, providing resources and emotional support to assist them during and after the patient's death.
<u>Proposed Assessment Methods:</u> • **Written Exam: Testing theoretical understanding of physiology and pathophysiology.** • **Practical Assessment: Application of knowledge in practical scenarios.** • **Case Studies: Analysis of physiological and pathological cases.**		
Module 6: Clinical Practice (40 Credits) **The purpose of module 6 is to provide students with an opportunity to, under supervision put into practice their taught knowledge skills and insights within a simulated and/or authentic critical care retrieval context.**		
Learning Units	**Exit Level Outcomes**	**Specific Outcomes**
• ***Learning Unit 6.1*** ○ **Clinical Practice**	• Demonstrate the application of theoretical knowledge and skills acquired in previous modules within a simulated or authentic critical care retrieval context.	***Learning Unit 6.1:*** 6.1.1. Perform comprehensive patient assessments in a clinical setting, utilising appropriate tools and techniques to gather relevant data for critically ill patients.

	• Integrate comprehensive assessment and management strategies for critically ill patients, considering their unique needs and the complexity of their conditions. • Collaborate effectively with interdisciplinary teams to provide holistic patient care in critical situations, enhancing teamwork and communication skills. • Implement clinical decision-making processes that reflect evidence-based practices and adhere to professional standards in critical care retrieval. • Reflect on clinical experiences to identify personal and professional growth areas, using feedback and self-assessment to enhance future practice.	6.1.2. Implement evidence-based interventions for patient management in critical care retrieval, demonstrating the ability to respond effectively to evolving clinical situations. 6.1.3. Demonstrate proficiency in clinical skills necessary for critical care, including airway management, intravenous access, and monitoring vital signs. 6.1.4. Utilize effective communication strategies with patients, families, and team members to ensure clarity and collaboration in care delivery. 6.1.5. Reflect on clinical practice experiences to identify strengths and areas for improvement, integrating feedback to enhance future performance in critical care settings.

Proposed Assessment Methods:

- **Simulation: Scenarios involving special populations to assess practical skills.**

Assessment Criteria for each of the modules' specific outcomes:

To compile Assessment Criteria for each module's specific outcomes, clearly define the learning outcomes and required competencies using a verb, noun, and qualifier. Develop measurable indicators with diverse assessment methods and ensure alignment with teaching strategies and professional standards. Validate and refine the criteria through expert review and feedback for continuous improvement. This structure ensures that criteria are specific, measurable, and aligned with the learning outcomes.

For example: *"Demonstrate advanced clinical skills in managing complex patient scenarios with a high level of accuracy and efficiency."*

- **Verb: "Demonstrate"**
- **Noun: "advanced clinical skills"**
- **Qualifier: "in managing complex patient scenarios"**

Topic examples provided by participants during the interviews and focus group discussions:

1. ***"Advanced airway training, that I think goes without saying because there are many, many, many things that are covered in ICU"***
2. ***"Training, with handovers"***
3. ***"Additional diagnostic training"***
4. ***"Invasive blood pressure monitoring, but I can't remember seeing that. So arterial blood pressure monitoring."***
5. ***"Different types of ventilation and how to work that machinery itself"***
6. ***"Course needs to have sort of a sense of integrated clinical decision making"***
7. ***"Understand the South African healthcare setting"***
8. ***"General ICU care of the patient"***
9. ***"Understanding how ICUs operate in general"***
10. ***"Should know how to deal with mechanical cardiovascular support."***
11. ***"So, debriefing in fact I feel that we should debrief with everyone"***
12. ***"a bit of disaster management and incident management as well."***
13. ***"a little bit of leadership"***
14. ***"Patient advocacy one is actually really, really big because"***

Continuation of Table 15

15. ***"People management skills"***
16. ***"I think quality management"***
17. ***"Formal development and staff retention"***
18. ***"Drugs that they use in ICU"***
19. ***"Analgesia"***
20. ***"Firm understanding about your basic skills of fluid management"***
21. ***"Inotropes"***
22. ***"Dilution and actually delivering the correct amount of medication"***
23. ***"Firm basic understanding anatomy, physiology"***
24. ***"Something regarding cardiorespiratory physiology as well"***
25. ***"Poor knowledge on endocrinology and metabolite differences"***
26. ***"I would mainly say, the physiology and deeper understanding of certain of the physiological, pathological process that drive a lot of the critical ill pathologies"***
27. ***"Palliation of patients and end of life care"***
28. ***"Special populations & high-risk pregnancies"***
29. ***"See something related to the psychological effect on the practitioner as well."***
30. ***"The stresses, because it's a longer time."***
31. ***"Teaching the anthropology of our society"***
32. ***"Additional training on things like biochemistry especially"***
33. ***"Nutrition is a biggie with all your ICU patients, clinical nutrition"***
34. ***"IPC needs to be somewhere at the top"***
35. ***"Psychological needs of the ICU patient"***
36. ***"Sepsis is a big thing that we deal with"***
37. ***"And then toxicology"***

The agreed structure for the CCR curriculum is the result of a rigorous consensus-based process underpinned by prior research conducted as part of the PhD. This structured approach ensured that the course design, delivery methods, and duration were meticulously aligned with the evidence, creating a comprehensive and contextually relevant curriculum.

Furthermore, the skills, topics, and teaching enhancements outlined in Table 9 should seamlessly integrate into the curriculum where applicable. This table provides a detailed thematic guide to the suggested additions identified during Phase Three by experts and learners, ensuring the program addresses key gaps and reflects the complexities of critical care. By incorporating these elements, the curriculum will prepare professionals to excel in diverse and high-pressure environments, fostering excellence in critical care retrieval and advancing the quality of patient care.

8.4 PACKAGING AND DELIVERY

This section outlines the structure and academic level of the adult CCR Postgraduate Diploma. It details the NQF Level 8 classification, the blended learning approach, and the target audience, ensuring alignment with national educational frameworks.

8.4.1 Alignment to the NQF

Given that the Diploma in Emergency Medical Care is classified as NQF Level 6 and the Degree as NQF Level 7 & 8, the CCR program should be pitched at an appropriate NQF level that reflects its advanced nature and specialised focus. Given the fact that the dedicated CCR program aims to equate to specialisation, it is recommended that the CCR program be pitched at an NQF Level 8 (Postgraduate Diploma), as it is intended to be more advanced and is aimed at individuals with significant experience.

When looking at the ELOs presented in the curriculum and the depth to which each of the modules covers the content, it equates to that of the NQF level 8 as outlined by SAQA (234). Below in Table 16, we depict the various NQF levels and how they equate to the level of academic qualification (NQF 8, the level we propose for the CCR programme, is highlighted):

Table 15: South African National Qualifications Framework Level Descriptors

South African NQF Level Descriptors			
NQF Level	**Qualification Type**	**Equates To**	**Description**
1	General Education and Training Certificate (GETC)	Grade 9 or ABET Level 4	Foundational level focusing on basic knowledge and skills, including literacy, numeracy, and simple problem-solving.
2	National Certificate	Grade 10 or first year of vocational training	Intermediate level, building on foundational skills with a focus on understanding and applying basic concepts in familiar contexts.
3	National Certificate	Grade 11 or further vocational training	Develops knowledge and skills needed for more complex tasks; emphasises deeper understanding and the ability to interpret and apply information.
4	National Senior Certificate (NSC) or Further Education and Training Certificate (FETC)	Grade 12 (Matric) or equivalent	Completion of secondary education; focuses on analysing information, solving moderately complex problems, and applying skills in varied contexts.
5	Higher Certificate or Advanced National Certificate	First year of post-secondary education	Involves specialised knowledge and practical skills in a particular field, preparing for technical or support roles; operates independently in familiar contexts.
6	Diploma or Advanced Certificate	Second or third year of post-secondary education	Focuses on applying knowledge and skills in more complex and unfamiliar contexts; includes critical thinking, problem-solving, and decision-making abilities.
7	Bachelor's Degree or Advanced Diploma	Bachelor's degree or equivalent	Acquires comprehensive theoretical and practical knowledge in a specific field; emphasises independent learning, critical analysis, and research capabilities.
8	Honours Degree, *Postgraduate Diploma*, or Professional Qualification	Honours degree or *Postgraduate Diploma*	Focuses on *advanced academic* and *professional skills*, including *specialised knowledge* and *research capabilities*; *critically engages with current knowledge*.
9	Master's Degree	Master's degree	Involves advanced, specialised, and research-based knowledge; evaluates complex problems; synthesises information; and emphasises research methods and independent study.
10	Doctoral Degree	Doctoral degree (PhD)	Represents the highest level of academic and professional achievement; involves creating new knowledge or significant original research with advanced skills.

As seen above, learners undertaking a program pitched at NQF level 8 would demonstrate advanced knowledge and engagement in a specialised field, including a thorough understanding of theories and techniques and their application in specific contexts (233–235). Furthermore, they should be adept at working within and managing systems, continuously applying self-critical learning strategies to meet their professional and ongoing development needs, which would be required in the ever-changing field of critical care (234,236).

The Adult CCR PGDip aligns with SAQA & HEQSF at NQF Level 8, positioning it as an advanced, specialised qualification for health care providers in critical care transport and retrieval. Given its complexity, depth and target audience, an NQF Level 8 classification is essential.

According to SAQA, NQF Level 8 qualifications require specialised knowledge, critical thinking, and independent learning, with high-order problem-solving for unpredictable environments (234). It is argued that the CCR PGDip meets these criteria, equipping practitioners with advanced clinical, leadership, and systems-based skills essential for high-acuity retrieval and transport. Its curriculum ensures competence in resource-variable settings with evidence-based interventions under pressure.

The CCR PGDip surpasses NQF Level 6 and Level 7 qualifications because the CCR program is more advanced, requiring prior experience and engaging with higher-level clinical reasoning, systems integration, and interprofessional leadership. It emphasises critical evaluation and application of advanced CCR concepts, ensuring clear academic and professional progression beyond existing EMS qualifications.

Per HEQSF, PGDips serve as advanced, practice-oriented qualifications that foster expertise in niche fields (233,234). Given CCR's specialised nature, the PGDip aligns with NQF Level 8, bridging undergraduate and master's studies while promoting leadership and innovation. Additionally, this thesis advocates for a specialist register with HPCSA, recognising CCR-trained HCP within a defined scope of practice, reinforcing NQF Level 8 classification.

Positioning the CCR PGDip at NQF Level 8 ensures academic rigour, professional relevance, and SAQA/HEQSF compliance. Designed for experienced EMS professionals, the qualifications provide a pathway for career progression, specialist expertise, and leadership, contributing to the development of CCR systems and improved patient outcomes within SA's healthcare landscape.

Furthermore, we argue that pitching the CCR program at an NQF level 8 would be in line with international standards for similar programs abroad universities. For example, Monash University (Australia) and the University of Edinburgh (UK) offer postgraduate diplomas in critical care medicine or retrieval that are classified at Level 8 (237,238). The programs also require graduates to have advanced clinical knowledge and decision-making skills. This level would be appropriate for a Postgraduate Diploma, reflecting the advanced competencies and critical thinking required during CCR. It would also facilitate recognition and accreditation within the existing qualifications

framework, ensuring coherence and relevance to the career progression of emergency care providers.

8.4.2 Entry Criteria

The minimum admission requirements for the Postgraduate Diploma in Critical Care Retrieval (PGDip CCR) ensure that candidates have the qualifications and experience to succeed in this specialised program as stipulated within the HEQSF (233). Applicants must hold an appropriate Bachelor's Degree in a relevant healthcare field, such as emergency care, nursing, or medicine, or an Advanced Diploma in a related discipline. These requirements ensure that candidates possess the foundational knowledge and professional background essential for advanced study in critical care retrieval. Additionally, professional experience in emergency or critical care settings may be considered as part of the selection process, ensuring that applicants are prepared for the program's rigorous academic and practical demands.

While these criteria align with the requirements set out in the HEQSF, there is an argument for expanding access to include a broader range of suitably qualified and experienced emergency care providers. Given the resource constraints and the current realities of EMS in South Africa (6), it is important to consider mechanisms that support inclusivity without compromising academic and professional standards.

Task shifting is a critical strategy in resource-constrained healthcare settings (239). It allows for the redistribution of responsibilities among healthcare workers to optimise the use of available resources and improve service delivery (239). In settings where shortages of highly skilled professionals, such as doctors or specialists, are common, specific tasks can be delegated to other trained health workers, including nurses, paramedics, or community health workers. This approach addresses workforce gaps and enhances access to essential services, particularly in underserved areas.

In the context of critical care retrieval, task shifting plays a pivotal role by enabling healthcare providers with appropriate training to perform advanced clinical tasks traditionally carried out by higher-level professionals (240,241). For instance, Paramedics trained through programs like the PGDip CCR can manage critical care interventions during patient transport, alleviating the burden

on ECP and hospital-based intensive care units. This allows specialised clinicians to focus on more complex cases while maintaining high-quality care during retrieval and transport.

By incorporating evidence-based practices and task-shifting principles, programs like the PGDip CCR contribute to the development of resilient healthcare systems and can empower a range of healthcare providers to operate at the top of their competencies, improving efficiency, reducing critical care delays, and addressing the challenges posed by resource limitations. This approach elevates the standard of care and ensures that critical care retrieval services are accessible to patients across diverse and resource-constrained settings.

8.4.3 Duration and Modes of Delivery

It is envisaged that the postgraduate diploma in critical care retrieval will be delivered through a blended learning model, combining multiple education modalities to provide flexibility and accessibility while maintaining rigorous academic and practical training. This approach integrates online teaching for convenience and resource access, classroom-based education for interactive learning and theoretical grounding, and useful and experiential training, including clinical placements, to develop hands-on proficiency in critical care retrieval. By leveraging the strengths of both in-person and online formats, the program offers a flexible schedule, enhances resource accessibility, and supports a comprehensive learning experience.

The above model is best suited for emergency care providers who wish to undertake the course given their busy work schedule and the nature of shift work often seen in the healthcare environment (242,243). The program's blended learning structure and specialised focus ensure graduates are well-prepared to navigate the complexities of critical care transport and retrieval, ultimately enhancing the quality and accessibility of healthcare in diverse and resource-constrained environments.

Key features of the program include its NQF Level 8 classification, 12-month duration, and 120-credit curriculum, reflecting the advanced and specialised nature of the qualification with the potential to offer this as a 2-year programme taking 60 credits a year to accommodate the working professional. Resources required to support effective learning include internet access,

electronic computing devices, access to subject and industry experts, and clinical placement opportunities, ensuring students gain practical exposure alongside theoretical knowledge.

8.5 INDUSTRY IMPLICATIONS

8.5.1 EMS the Profession

Despite having a robust and well-developed EMS system in South Africa, its current state appears to be constrained. Greater leadership and governance are required to improve poorly functioning components of the EMS system (6).

EMS is not only constrained due to poor leadership and management but it is also plagued by significant challenges seen in the greater healthcare sector. These include resource constraints, such as shortages of medical equipment and ambulances, and staffing issues, like high turnover and insufficient training (166,244). Geographic and infrastructure challenges, especially in rural areas, delay response times (6,245). Safety concerns due to violence, operational inefficiencies, and inadequate public awareness and engagement exacerbate the situation, hindering the effectiveness of EMS and compromising patient care across the country (166,244).

The implementation and adoption of the dedicated CCR program will be the first of its kind in SA EMS. Not only will it be the first specialisation qualification, but it will also be one of the first programmes developed contextually to ensure we address the needs of practitioners as well as the critical care patient subset. Not only will we be able to elevate the training and care our patients receive, but one might argue that it might be the start of a career pathing for emergency care providers (246,247). Despite formal master's and doctoral opportunities, no form of specialisation exists, and the majority of EMS organisations in SA only offer roles in operational, managerial, and educational capacities, thus significantly hampering clinicians' development potential.

8.5.2 Professional Recognition

Thus, this qualification might open the door to clinician career pathing, which historically did not exist. Career pathing is of the utmost importance and is crucial not only for developing skilled and motivated professionals but also for enhancing employee retention and happiness (248). With clear progression routes, EMS personnel can advance their careers while acquiring specialised knowledge and skills, fostering a sense of purpose and fulfilment. Additionally, job satisfaction increases when employees see opportunities for growth and leadership, leading to higher retention rates (249,250). A well-defined career path helps create a more engaged and committed workforce, resulting in better patient care and a more resilient EMS system (251). The aforementioned is of particular importance in the SA context given the ongoing migration of paramedics driven by factors such as limited career progression, inadequate working conditions, and a lack of recognition within the healthcare system, resulting in a "brain drain" that threatens the country's EMS capacity, sustainability and future development (252–254). The addition of such a dedicated pathway might not be the complete solution to the problem at hand, but it is a step in the right direction by allowing employees alternative career paths (255). Despite the potential benefits of introducing the CCR qualification, questions need to be asked about implementing and adopting these graduates into everyday EMS. As mentioned above, many challenges hamper EMS, and one of them is significant financial constraints (256). This means that the inclusion of dedicated CCR resources (specialised ambulances and dedicated ICU equipment) and specialised providers to staff these units might be a far-fetched dream given the fact that it calls for extra financial investment, which in many cases might be almost impossible for some of the EMS organisations (257).

8.5.3 Financial Aspects

Despite the apparent potential benefits of introducing the CCR qualification, questions need to be asked about implementing and adopting these graduates into everyday EMS. As mentioned above, many challenges hamper EMS, with one of the most significant being financial constraints (256). Similarly, high-intensity ICU staffing models, which have been shown to improve patient outcomes, also face barriers related to cost and resource availability (258–260). These models, involving dedicated personnel and specialised equipment, are proven to reduce ICU and hospital mortality, shorten lengths of stay, and enhance care delivery, which in effect reduces costs (258–260).

In a hospital-based study by Cartin-Ceba et al., introducing 24-hour on-site specialist personnel coverage has been associated with improved patient outcomes, reduced complications, and better resource utilisation (259). Yet, the cost of staffing dedicated CCR teams and equipping specialised ambulances could mirror the challenges faced in implementing high-intensity ICU models. While evidence underscores the cost-effectiveness of such approaches over time, the initial investment often seems unattainable for many EMS organisations.

A critical factor in the employability of CCR-qualified practitioners is the role of the Occupation-Specific Dispensation (OSD) for EMS personnel. The current OSD structure, which dictates salaries and career progression, is effectively closed, meaning new roles and specialisations, such as CCR, do not have an established place within the framework. This creates a significant barrier to formal employment and remuneration for advanced EMS practitioners. Without adjustments to the OSD framework, CCR practitioners may face limited employment opportunities, stagnant career progression, or inadequate remuneration, undermining the attractiveness and viability of the qualification.

To navigate this challenge, alternative strategies must be considered, such as conducting external job evaluations to justify the inclusion of CCR roles within EMS structures. Engaging with professional bodies, policymakers, and unions to advocate for an expanded OSD framework could help establish recognition for specialised EMS roles. Additionally, exploring employment models outside traditional government-funded EMS—such as private sector partnerships,

academic institutions, or hybrid funding models—may provide viable pathways for CCR-qualified practitioners to contribute meaningfully while appropriately compensated.

As EMS systems transition and evolve with the rest of the healthcare system, weighing the long-term benefits against immediate financial constraints is crucial. While including CCR-qualified practitioners and resources holds transformative potential, financial realities, workforce planning, and OSD reforms must be addressed to ensure the sustainability and feasibility of such advancements in resource-limited EMS contexts.

8.5.4 Clinical Practice

The adoption and inclusion of the CCR program can significantly enhance EMS clinical practice by providing advanced skills and knowledge for managing critically ill or injured patients during transport.

This PhD and previous research (18–20,57) have further highlighted that practitioners are inadequately prepared to undertake CCR due to insufficient training or training that is not contextual, and prior calls have been made for specialisation in this field (18,19). Adopting and including the curriculum developed during this PhD will equip EMS professionals with contextual expertise to perform high-level interventions, monitor complex medical conditions, and make critical decisions under pressure.

This curriculum covers a wide array of advanced clinical skills and techniques, evidence-based practices and essential soft skills required to manage the patient subset (261). It is also developed based on the patient subset we see in the SA environment, making it one of the only patient-centric curricula; hence, it ensures a higher standard of care in pre-hospital settings.

Adverse events are seen quite regularly, especially when dealing with the critically ill and injured, and they often get exacerbated when these patients undergo CCR or when managed by ill-prepared practitioners (173,262). Including the CCR program can increase patient safety and reduce adverse events whilst improving practitioners' readiness and confidence (173,262).

In addition, specialisation has been shown to produce better outcomes for patients (263). The relationship between volume and outcome has long been documented, with higher

specialisation and greater experience correlating to improved patient care (263). By tailoring the CCR curriculum to the specific needs of SA patients and emphasising specialised care, this program aims to deliver similarly impactful results, ensuring practitioners are well-prepared to manage the complexities of critical care retrieval effectively.

8.5.5 Towards a Patient-Centric EMS: Challenges and Opportunities

Despite the critical role EMS plays in extended healthcare services, the system is not known for being patient-centric (264). Challenges such as limited resources, inadequate staffing, and systemic inefficiencies often result in a focus on operational targets rather than patient outcomes. Response times, resource allocation, and logistical constraints frequently take precedence over individual patient needs and holistic care approaches (264,265).

The strain of these operational demands and the lack of specialised training and career development pathways for EMS personnel often divert attention from patient-centred care practices. Additionally, in areas facing high rates of violence or geographic challenges, safety and logistical considerations can overshadow the primary goal of providing timely and appropriate care. As a result, the patient experience can be compromised, and the system's effectiveness in addressing diverse patient needs is often limited.

The proposed specialisation program represents a significant step forward by contextualising the curriculum around the specific needs of patients and practitioners. This focus has the potential to drive the industry towards a more patient-centric approach, signalling a positive shift in the field. When considering the push towards universal healthcare (UHC) in SA to ensure that all individuals have access to necessary healthcare services without financial hardship it aligns with the goals of improving EMS coverage and patient care (266).

However, achieving UHC in a constrained EMS system would require addressing the existing challenges highlighted earlier. Integrating specialised CCR programs in EMS could aid the UHC initiative by promoting equitable access to advanced care, particularly for critically ill patients, but it would necessitate substantial financial investment and governance reform to overcome the current barriers.

8.5.6 Community and Stakeholder Engagement:

The proposed specialised CCR curriculum has the potential to transform critical care training, delivering significant benefits across multiple stakeholder groups identified within the 7Ps Framework (267). By addressing the unique needs of underserved areas with limited access to advanced healthcare, the program enhances the capabilities of emergency care providers, improving outcomes for patients and positively impacting the broader healthcare system (240,268).

Patients and the Public are the most immediate beneficiaries of a well-structured CCR curriculum. The program increases the likelihood of effectively managing critically ill patients by equipping EMS providers with advanced, context-specific skills. This translates to safer, more effective care during transport, ultimately improving survival rates and patient safety. Additionally, the program builds community trust as communities gain confidence in their local EMS providers' ability to handle complex medical emergencies (259,260).

Providers benefit from advanced training tailored to the realities of their working environment. This boosts their clinical decision-making capabilities, empowering them to deliver high-quality care. Furthermore, this specialised education supports professional growth and job satisfaction, helping to reduce staff turnover, especially in rural areas where retention is a persistent challenge. The additional expertise also strengthens local EMS systems, increasing their capacity to address critical healthcare needs in underserved regions (240,268).

Payers gain from the program's ability to improve EMS provider competencies and reduce disparities in care, leading to more cost-effective healthcare delivery. The curriculum empowers local providers to deliver specialised care, improving patient outcomes, lowering costs, and enhancing overall efficiency in healthcare delivery, thereby reducing the financial burden on healthcare funders.

Policymakers will see the program aligning with the goals of Universal Healthcare (UHC) by addressing healthcare inequities and enhancing access to critical care in underserved regions (240,268). This initiative supports equitable healthcare delivery and resource optimisation,

furthering national and global health objectives. The program's outcomes can serve as evidence for policy improvements and resource allocation, showcasing progress toward healthcare equity.

Product Makers, including medical device manufacturers and technology developers, will benefit from the curriculum's focus on equipping EMS providers with specialised skills. The program would encourage the adoption of innovative tools and technologies tailored to critical care retrieval, fostering collaboration with the industry to improve equipment accessibility and usability in resource-limited settings.

The curriculum supports **Principal Investigators (Researchers)** as it contributes to the growing body of research in emergency medicine and critical care retrieval. By addressing gaps in training and examining its impact, the researchers can generate valuable evidence to refine best practices and expand the curriculum's application across diverse settings. This fosters an environment of continuous learning and innovation in the field.

Purchasers, such as employers and organisations that procure healthcare services, benefit from the enhanced capabilities of EMS providers. The program supports a more resilient local healthcare system, reducing reliance on urban facilities and creating a stable workforce committed to delivering high-quality care in their communities. This further strengthens healthcare systems by ensuring that advanced training remains accessible and relevant to the regions that need it most.

Building community trust is another crucial outcome of the proposed CCR curriculum. When communities observe that their local EMS providers are well-trained and capable of managing complex situations, they gain confidence in the healthcare system's ability to address critical needs effectively (269). This trust strengthens the bond between providers and the public and fosters a collaborative environment where communities are more likely to engage with and support their local healthcare systems. Moreover, this initiative underscores the importance of stakeholder engagement in patient-centred care. By aligning the curriculum with the needs and perspectives of patients, providers, and other key stakeholders, the program ensures that its impact extends beyond individual outcomes to shape a more inclusive, responsive, and equitable healthcare system (267,270).

8.6 REGULATORY IMPLICATIONS

8.6.1 Health Professions Council of South Africa

The HPCSA is mandated to regulate and guide registered healthcare professions and protect the public (271). All emergency care providers, regardless of level of practice, are mandated to register with the PBEC to practice in SA (225). The board also regulates practice by setting the scope of practice for each level of practice in the form of evidence-based Clinical Practice Guidelines (CPGs) (197). The CPGs also aim to standardise the level of care rendered by providers regardless of their level of qualifications and area of practice.

As part of the board's regulatory and standard-setting role, they are mandated to ensure that all programs meet specific national and professional standards. This includes aligning with the NQF and adhering to the Department of Higher Education and Training requirements.

This critical care retrieval curriculum is envisaged to lead to a specialisation qualification in addition to the standard undergraduate emergency medical care training. The HPCSA needs to approve this qualification. This on its own might pose a significant challenge, as bureaucratic practices, conservatism, and a lack of innovation in the past have hampered the board (272,273).

The board used this approach historically to maintain quality and safety in the profession, but despite the above, if the HPCSA and the PBEC can recognise the CCR program, it would be a trailblazer in the field of EMS education and a significant advancement for EMS in South Africa. This recognition would ensure that the CCR program meets rigorous national standards, aligning it with the highest levels of clinical practice and education while contextualising it to the patients our providers see. For EMS, this means that practitioners trained under the CCR program are equipped with specialised skills to safely and effectively manage critically ill or injured patients during CCR.

The formal accreditation by the HPCSA also enhances the credibility and professional standing of EMS personnel, promoting the development of advanced competencies that are essential in critical care scenarios. Ultimately, this recognition will likely improve patient outcomes, foster

continuous professional development, and elevate the country's overall quality of emergency medical care.

8.6.2 NECET policy

EMS education in SA is guided by the NECET policy, which is designed to standardise and enhance the education and training of emergency care professionals (17). NECET currently outlines a three-tiered EMS system, and education also falls into these three levels: Higher Certificate (NQF 5), Diploma (NQF 6), and Degree (NQF 8) (17).

The current NCET policy, which is under review, does not allow for the inclusion of additional or postgraduate qualifications within its framework. While this permits the development of purely theoretical master's or doctorate programmes, it does not accommodate clinical specialisation pathways. For the CCR programme to be fully adopted and recognised within the profession, it would need to be integrated into the NECET framework and aligned with the NQF.

Recognising the CCR programme within the NECET is crucial, as it would not only formally acknowledge its importance but also ensure alignment with national educational standards, fostering consistency, credibility, and professional growth within the EMS sector. The adoption and alignment of the CCR programme with the NECET and NQF would represent a significant advancement for South Africa’s EMS educational system. Such recognition would ensure that the CCR qualification is nationally standardised and widely recognised, enhancing professional credibility, mobility, and development opportunities for practitioners in this specialised field.

However, while inclusion in the NECET and alignment with the NQF bring undeniable benefits, such as improved standardisation and credibility, it is essential to address potential barriers to access. Ensuring that the correct subset of providers can participate in the programme will be one of the key challenges, requiring careful planning to balance inclusivity with maintaining high professional standards.

Entry requirements imposed by the NQF might further restrict access for those who do not meet specific criteria but are otherwise interested. Historically, EMS providers have faced challenges accessing higher education, even at the undergraduate level, due to many not meeting the

minimum requirements and the inconsistent application of Recognition of Prior Learning (RPL) policies by academic institutions (274).

Despite wanting to open access to most emergency care providers, it is vital to ensure that emergency care providers who see critical care patient subsets can access the program. The transfer of critical care patients in SAI is performed by ALS providers as mandated by the HPCSA and stipulated in the CPGs for the ANT and ECP registries; ultimately, the Diploma (NQF 6) and Degree (NQF 7/8) graduates.

8.7 CONCLUSION

Chapter 8 presents a pivotal milestone in this PhD research, culminating in a rigorously developed curriculum tailored to South Africa's EMS landscape. The proposed postgraduate diploma in CCR, designed as an NQF Level 8 qualification, aims to equip EMS practitioners with advanced clinical, technical, and non-technical competencies required for high-acuity patient transport and care. The curriculum adopts a blended learning model to address accessibility and equity challenges, ensuring practitioners across diverse regions can benefit from this transformative education.

This chapter underscores the curriculum's potential to enhance patient outcomes, support practitioner development, and elevate EMS standards. It also highlights the systemic barriers that must be navigated, including regulatory approvals, resource limitations, and policy alignment. By fostering collaboration among healthcare providers, educators, policymakers, and communities, the curriculum offers a blueprint for advancing critical care retrieval education and practice in South Africa. The curriculum offers a blueprint for advancing critical care retrieval education and practice in South Africa by fostering collaboration among healthcare providers, educators, policymakers, and communities. The integration of innovative teaching methodologies and continuous improvement mechanisms ensures the program remains responsive to the evolving demands of modern healthcare, ultimately contributing to a more resilient and equitable EMS system.

CHAPTER 9 - RECOMMENDATIONS, LIMITATIONS AND CONCLUSION

9.1: INTRODUCTION

In this final chapter, the researcher provides a summary and conclusion of the study. The chapter begins with an argument for the importance of the unique contribution and findings emanating from the research, including their implications for EMS education and practice in South Africa. Also dealt with in this chapter are selected recommendations to stakeholders, including regulatory bodies, policymakers, educational institutions, and industry relating to critical care retrieval (CCR) education.

The researcher also uses this chapter to argue again and reemphasise the importance of integrating a specialised adult CCR curriculum aligned with the NECET and HEQSF at NQF Level 8. The known limitations of the research are acknowledged with regard to the method and approaches adopted. The chapter concludes by reflecting on the broader significance of the research in addressing gaps in EMS education and promoting professional specialisation to enhance patient outcomes and strengthen the South African EMS system, together with some suggestions for future research.

9.2 SUMMARY

This study employed a multi-phase approach, integrating retrospective case reviews, qualitative insights from key stakeholders, and a Delphi consensus process to develop a CCR curriculum applicable and relevant to the SA context. The core findings from the study revealed that:

- CCR is a significant burden on EMS, given the nature of the SA healthcare system and the significant resource constraints. It requires focused attention to ensure that high-acuity patients get the care they deserve.
- The patient population requiring CCR services is diverse, necessitating specialised training for the healthcare providers transferring them.

- In developed healthcare systems, CCRs are conducted by highly skilled specialised teams.
- In the SA context, CCR retrieval remains poorly defined and poorly understood by EMS management. Consequently, there is a lack of standardisation in practices and approaches to CCR retrieval and inter-facility transfers.
- Existing EMC undergraduate programmes focus more on primary response and associated acute care interventions and do not sufficiently prepare graduates for the complexities of high acuity transfers and critical care retrieval.
- A structured, competency-based adult CCR curriculum aligned with local needs and international best practices is necessary to enhance patient safety in CCR.
- Stakeholders, including EMS educators and practitioners, emphasise the importance of experiential learning, crew resource management, and ongoing professional development in adult CCR training.

9.3 AN ARGUMENT FOR VALUE AND UNIQUE CONTRIBUTION

This study delivers new and valuable understandings of CCR in the SA context. It also provides an empirical basis for arguments relating to the need to recognise CCR as a specialised practice area requiring specialised education and training. In his study, the researcher makes a unique contribution by employing Kern's six-step curriculum development model to integrate input from local role players with international best practices to design and validate a CCR curriculum for South African contexts. The core areas where contributions have been made are summarised below:

Bridging the EMS Education Gap - The study highlights a potential shortfall and mismatch between existing EMS education programmes and the real-world demands of critical care retrieval. It is argued that the adult CCR curriculum developed in this study could bridge this gap by ensuring that future emergency care practitioners are better equipped to manage critically ill patients during transport.

Strengthening South Africa's Healthcare System - By proposing a standardised curriuclum for adult CCR training, this research contributes to broader healthcare policy goals, including improved patient safety, reduced adverse events, and enhanced EMS operational efficiency**.**

Advancing Professionalisation of EMS - The study identifies the need to recognise CCR as a specialised area of practice that would require clear pathways for professional growth, creating opportunities for healthcare providers to develop into highly skilled specialists. Capable of transforming patient outcomes. This initiative also addresses systemic inequities in healthcare delivery by ensuring consistent expertise across varied settings, from urban centres to rural and underserved areas.

9.4 LIMITATIONS

As with all studies, there will be limitations linked to the methodology and approaches selected. The known limitations in relation to this study are acknowledged in the following narrative.

9.4.1 Scope and Generalisability

The adult CCR curriculum was developed with a focus on South Africa's EMS landscape at the time of the study. While informed by international practices, its applicability to other low-to-middle-income countries (LMICs) may require further adaptation. Furthermore, it is recognised that good educational practice is to revise curricula from time to time, and adjustments and changes are made that are responsive to and informed by changes in technologies and workplace contexts.

9.4.2 Data Limitations

The retrospective patient care report analysis was limited to Western Cape EMS data, which may not fully represent the national adult CCR patient profile. Expanding the dataset to include other provinces could yield either similar or divergent insights into retrieval trends and system dynamics. Additionally, while the qualitative phases provided rich insights into training needs and systemic gaps, they are subject to inherent limitations associated with self-reported data.

Participants may have unintentionally overemphasised or underreported certain experiences due to recall bias or social desirability. The retrospective data source also carried limitations, such as incomplete or inconsistent documentation. To mitigate these risks, the study employed triangulation across data sources, a structured interview guide, and member checking to improve credibility and analytical rigour. Future research may benefit from incorporating direct observation, cross-provincial data collection, and multi-stakeholder validation strategies to enhance objectivity, contextual transferability, and generalisability of findings.

9.4.3 Implementation Challenges

The study develops a curriculum for adult CCR education but does not evaluate its real-world implementation. Future research should pilot the adult CCR curriculum in different higher education settings to assess feasibility and impact.

9.4.4 Differences in Curricula

Generalised comments are made relating to gaps in the undergraduate curriculum of SA EMC programmes focusing on CCR. It is an acknowledged fact that each of the local universities offering this training has different and diverse approaches to delivering their curricula. The absence of standardised adult CCR education has led to inconsistencies in training across EMS providers. This means that implementing this curriculum would need to consider institutional autonomy and require careful coordination with national regulators to ensure uniform adoption and quality assurance.

9.4.4 The Nature of Focus Groups

As a qualitative research method, focus groups rely on participants' subjective experiences and perceptions rather than objective measures. The data collected is influenced by group dynamics, participant interaction, and moderator influence, which may lead to dominant voices overshadowing less vocal participants. Additionally, convenience sampling in focus group recruitment may not fully represent the broader EMS workforce, leading to potential biases.

While efforts were made to include diverse perspectives, the findings may not be entirely generalisable to all EMS providers or institutions.

9.4.5 Sampled Population Focus on Adults

This study focuses specifically on adult critical care retrieval, and as a result, it does not address the unique challenges associated with the retrieval of neonatal and pediatric patients. While some principles of CCR may overlap across age groups, neonatal and pediatric retrievals require specialised training, protocols, and equipment that were not within the scope of this study. Future research could explore the development of a parallel curriculum tailored to neonatal and pediatric CCR to ensure comprehensive prehospital critical care education across all patient demographics.

9.5 RECOMMENDATIONS

To ensure the effective adoption of the proposed adult CCR curriculum and further improve critical care retrieval training in South Africa, the following recommendations are made:

9.5.1 Recommendations for Policymakers and Regulators

- The HPCSA and the Professional Board for Emergency Care (PBEC) should define the minimum competencies and practice standards required for adult Critical Care Retrieval (CCR) within existing EMS education policies, ensuring alignment with professional registration requirements.
- The HPCSA and PBEC should establish a pathway for speciality registration in Critical Care Retrieval, recognising it as a distinct area of expertise within emergency care.
- The National Emergency Care Education and Training (NECET) policy should allow and make provision for specialisation in clinical areas such as adult Critical Care Retrieval, ensuring structured career pathways for EMS professionals.

9.5.2 Recommendations for Educational Institutions

- Universities offering EMC education and training should consider adding PG offerings to their programme qualification mixes to deliver the adult CCR curriculum and integrate

simulation-based learning, high-fidelity scenarios, and mentorship programmes to reinforce clinical competencies.

- Collaboration between educational institutions and the EMS sector should facilitate ongoing curriculum updates and professional development.

9.5.3 Recommendations for the Industry and Employer

- EMS must invest in specialised ambulances, ICU equipment, and telemedicine capabilities to manage critically ill patients during transport.
- Policies should promote career pathways for adult CCR-trained EMS providers, ensuring recognition and career progression within the EMS profession.
- Workforce planning should be developed in collaboration with the National Department of Health Human Resource Development division to project employment needs for CCR-trained EMS providers. To ensure sustainability, this should include structured costing models, resource allocation strategies, and funding mechanisms. Investment in CCR services should be guided by data-driven regional needs assessments, ensuring equitable access to critical care transport across urban and rural areas.

9.5.4 Future Research and Development

- A longitudinal study will be helpful to assess the impact of adult CCR-specialised training on patient outcomes and EMS performance metrics.
- Further research is required to develop frameworks and models to formalise CCR as a recognised subspecialty for SA emergency care practitioners.
- A pilot programme should be conducted to evaluate the practical implementation of the adult CCR curriculum in EMS across multiple provinces.
- Given that this study focuses solely on adult CCR, additional research is needed to develop a complementary pediatric CCR curriculum framework. This should explore pediatric-specific competencies, equipment needs, and transport considerations to ensure comprehensive critical care retrieval services across all age groups.

9.6: CONCLUSION

This doctoral study made a unique and valuable contribution to the Emergency Care Profession in the specialised area of adult CCR. The study highlighted the pressing need for specialised CCR services to professionally manage the high acuity and complexity of critical care patients moving between healthcare facilities. If implemented, the curriculum developed as an outcome of this study has the potential to address current gaps in EMC education.

Ultimately, it is acknowledged that simply developing a contextually relevant curriculum will not lead to improved patient outcomes. For this to happen, Universities and other higher education institutions need to play their role by establishing PG programmes that can deliver the curriculum and achieve the associated learning outcomes. The profession needs to play its role by agreeing on a universal definition for what a CCR is and what it is not. In doing this, they should also set minimum practice standards and expectations for persons conducting CCR. Regulators and health care funders also need to provide professional recognition and protection for the specialised nature and scope of practice that goes along with CCR in SA contexts.

END

Louis Chris van Rensburg 06 June 2025

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CHAPTER 10 – APPENDICES

APPENDIX 1: ETHICAL APPROVALS

UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Human Research Ethics Committee

Room 45 E-52-E-Floor- Old Main Building
Groote Schuur Hospital
Observatory 7925
Telephone [021] 406 6492
Email: hrec-submissions@uct.ac.za
Website: www.health.uct.ac.za/fhs/research/humanethics/forms

12 July 2022

HREC REF: 407/2022

Dr W Stassen
Division of Emergency Medicine
F-51 OMB
Email: Willem.stassen@uct.ac.za
Student: Vrnlou001@myuct.ac.za

Dear Dr Stassen

PROJECT TITLE: STUDY 1: DESCRIBING THE ADULT PATIENT POPULATION THAT IS CURRENTLY BEING TRANSFERRED IN SOUTH AFRICA- (DOCTORATE CANDIDATE-MR LOUIS VAN RENSBURG)

Thank you for submitting your study to the Faculty of Health Sciences Human Research Ethics Committee (HREC) for review.

It is a pleasure to inform you that the HREC has **formally approved** the above-mentioned study.

This approval is subject to strict adherence to the HREC recommendations regarding research involving human participants during COVID -19. Please refer to guidance letter dated 02 February 2022 on our website:
http://www.health.uct.ac.za/fhs/research/humanethics/forms

Approval is granted for one year until the 30 July 2023.

Please submit a progress form, using the standardised Annual Report Form (FHS016) if the study continues beyond the approval period. Please submit a Standard Closure form if the study is completed within the approval period.
(Forms can be found on our website: www.health.uct.ac.za/fhs/research/humanethics/forms)

The HREC acknowledge that the student: Mr Louis van Rensburg will also be involved in this study.

Please quote the HREC REF 407/2022 in all your correspondence.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Please note that for all studies approved by the HREC, the principal investigator **must** obtain appropriate institutional approval, where necessary, before the research may occur.

HREC/ref 407.2022

Yours sincerely

PROFESSOR M BLOCKMAN
CHAIRPERSON, FACULTY OF HEALTH SCIENCES HUMAN RESEARCH ETHICS COMMITTEE
Federal Wide Assurance Number: FWA00001637. Institutional Review Board (IRB) number: IRB00001938 NHREC-registration number: REC-210208-007
This serves to confirm that the University of Cape Town Human Research Ethics Committee complies to the Ethics Standards for Clinical Research with a new drug in patients, based on the Medical Research Council (MRC-SA), Food and Drug Administration (FDA-USA), International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use: Good Clinical Practice (ICH GCP), South African Good Clinical Practice Guidelines (DoH 2020), based on the Association of the British Pharmaceutical Industry Guidelines (ABPI), and Declaration of Helsinki (2013) guidelines. The Human Research Ethics Committee granting this approval is in compliance with the ICH Harmonised Tripartite Guidelines E6: Note for Guidance on Good Clinical Practice (CPMP/ICH/135/95) and FDA Code Federal Regulation Part 50, 56 and 312.

HREC/ref 407.2022

UNIVERSITY OF CAPE TOWN
IYUNIVESITHI YASEKAPA • UNIVERSITEIT VAN KAAPSTAD

FACULTY OF HEALTH SCIENCES
Human Research Ethics Committee

FHS017: Annual Progress Report / Renewal

Record Reviews/Audits/Collection of Biological Specimens/Repositories/Databases/Registries

HREC office use only (FWA00001637; IRB00001938)			
This serves as notification of annual approval, including any documentation described below.			
☑ Approved	Annual progress report	Approved until/next renewal date	30.7.2024
☐ Not approved	See attached comments		
Signature Chairperson of the HREC/ Designee		Date Signed	2/7/2023

Note: Please note that incomplete submissions will not be reviewed.
Please email this form and supporting documents (if applicable) in a combined pdf-file to hrec-enquiries@uct.ac.za.

Please clarify your plan for research-related activities during COVID-19 lockdown

HUMAN RESEARCH ETHICS COMMITTEE
30 JUN 2023
HEALTH SCIENCES FACULTY
UNIVERSITY OF CAPE TOWN

Principal Investigator to complete the following:

1. Protocol information

Date (when submitting this form)	29 June 2023		
HREC REF Number	407/2022	Current Ethics Approval was granted until	30 July 2023
Protocol title	Describing the adult patient population that is currently being transferred in South Africa.		
Principal Investigator	W Stassen		
Department / Office Internal Mail Address	F51, OMB		
1.1 Does this protocol receive US Federal funding?		☐ Yes	X No

2. Protocol status (tick ✓)

✓	Research-related activities are ongoing
✓	Data collection is complete, data analysis only
Please indicate (in the block below) the titles and HREC reference numbers of any projects currently making use of the Database/registry/repository.	

3. Protocol summary

Total number of records or specimens collected, reviewed or stored since the original approval		26144
Total number of records or specimens collected, reviewed or stored since last progress report		26144
Have any research-related outputs (e.g. publications, abstracts, conference presentations) resulted from this research? If yes, please list and attach with this report.	☐ Yes	X No

4. Signature

Signature of PI		Date	29/06/2023

UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Human Research Ethics Committee

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Observatory 7925
Telephone [021] 406 6492
Email: hrec-enquiries@uct.ac.za
Website: www.health.uct.ac.za/fhs/research/humanethics/forms

12 July 2022

HREC/REF 408/2022

Dr W Stassen
Division of Emergency Medicine
F-51 OMB
Email: willem.stassen@uct.ac.za

Dear Dr Stassen

PROJECT TITLE: INITIATING THE DEVELOPMENT OF A CURRICULUM FOR SOUTH AFRICAN ADULT CRITICAL CARE RETRIEVAL-SCOPING REVIEW

Thank you for submitting your request to the Faculty of Health Sciences Human Research Ethics Committee.

The HREC note that the proposed study is a scoping review.

As the scoping review involves published literature available through publicly accessible electronic databases, research ethics review and approval is not required.

This is in accordance with Section 1.1.8 of the Department of Health's Ethics in Health Research: Principles, Processes and Structures (South African Department of Health, 2015), which states: "*Research that relies exclusively on publicly available information or accessible through legislation or regulation usually need not undergo formal ethics review. This does not mean that ethical considerations are irrelevant to the research.*"

The HREC acknowledges that DOCTORAL' candidate- Mr Louis van Rensburg, is also involved in this project.

Yours sincerely

PROFESSOR MARC BLOCKMAN
CHAIRPERSON, FACULTY OF HEALTH SCIENCES HUMAN RESEARCH ETHICS COMMITTEE

HREC.REF 408.2022

UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Human Research Ethics Committee

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Website: www.health.uct.ac.za/home/human-research-ethics

08 May 2024

HREC REF: 311/2024

A/Prof W Stassen
Division of Emergency Medicine
F-51 OMB
Email: willem.stassen@uct.ac.za
Student: Vrnlou001@myuct.ac.za

Dear A/Prof Stassen

PROJECT TITLE: STUDY 3: ASSESSING THE NEEDS OF AND UNDERSTANDING THE CURRENT GAPS OF EDUCATION AS IT RELATES TO TRAINING IN ADULT CRITICAL CARE RETRIEVAL WITHIN EMERGENCY MEDICAL SERVICES IN SOUTH AFRICA-
(DOCTOR OF PHILOSOPHY IN EMERGENCY MEDICINE-MR LOUIS VAN RENSBURG)

Thank you for submitting your study to the Faculty of Health Sciences Human Research Ethics Committee (HREC) for review.

It is a pleasure to inform you that the HREC has **formally approved** the above-mentioned study, subject to adding the HREC contact details to the informed consent document and why they may contact us.

Approval is granted for one year until the 30 May 2025.

Please submit a progress form, using the standardised Annual Report Form (FHS016) or FHS017 if the study continues beyond the approval period. Please submit a Standard Closure form if the study is completed within the approval period.
(Forms can be found on our website: www.health.uct.ac.za/fhs/research/humanethics/forms)

The HREC acknowledge that the student: Mr. Louis van Rensburg will also be involved in this study.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Please note that for all studies approved by the HREC, the principal investigator **must** obtain appropriate institutional approval, where necessary, before the research may occur.

Please quote HREC REF 311/2024 in all your correspondence.

Yours sincerely

PROFESSOR M BLOCKMAN
CHAIRPERSON, FACULTY OF HEALTH SCIENCES HUMAN RESEARCH ETHICS COMMITTEE

HREC/ref 311.2024

Federal Wide Assurance Number: FWA00001637. Institutional Review Board (IRB) number: IRB00001938 NHREC-registration number: REC-210208-007

This serves to confirm that the University of Cape Town Human Research Ethics Committee complies to the Ethics Standards for Clinical Research with a new drug in patients, based on the Medical Research Council (MRC-SA), Food and Drug Administration (FDA-USA), International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use: Good Clinical Practice (ICH GCP), South African Good Clinical Practice Guidelines (DoH 2020), based on the Association of the British Pharmaceutical Industry Guidelines (ABPI), and Declaration of Helsinki (2013) guidelines. The Human Research Ethics Committee granting this approval is in compliance with the ICH Harmonised Tripartite Guidelines E6: Note for Guidance on Good Clinical Practice (CPMP/ICH/135/95) and FDA Code Federal Regulation Part 50, 56 and 312.

HREC/ref 311.2024

UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Human Research Ethics Committee

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Website: www.health.uct.ac.za/home/human-research-ethics

08 May 2024

HREC REF: 313/2024

A/Prof W Stassen
Division of Emergency Medicine
F-51 OMB
Email: willem.stassen@uct.ac.za
Student: Vrnlou001@myuct.ac.za

Dear A/Prof Stassen

PROJECT TITLE: STUDY 4: DERIVATION OF THE GOALS AND OBJECTIVES OF A CURRICULUM IN PRE-HOSPITAL PROVIDER TRAINING IN CRITICAL CARE TRANSFER OF THE CRITICALLY ILL OR INJURED ADULT-
(Doctor of Philosophy in Emergency Medicine-Mr. Louis van Rensburg)

Thank you for submitting your study to the Faculty of Health Sciences Human Research Ethics Committee (HREC) for review.

It is a pleasure to inform you that the HREC has **formally approved** the above-mentioned study, subject to adding the HREC contact details to the informed consent document and why they may contact us.

Approval is granted for one year until the 30 May 2025.

Please submit a progress form, using the standardised Annual Report Form (FHS016) or FHS017 if the study continues beyond the approval period. Please submit a Standard Closure form if the study is completed within the approval period.
(Forms can be found on our website: www.health.uct.ac.za/fhs/research/humanethics/forms)

The HREC acknowledge that the student: Mr. Louis van Rensburg will also be involved in this study.

Please quote HREC REF 313/2024 in all your correspondence.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Please note that for all studies approved by the HREC, the principal investigator **must** obtain appropriate institutional approval, where necessary, before the research may occur.

Yours sincerely

PROFESSOR M BLOCKMAN
CHAIRPERSON, FACULTY OF HEALTH SCIENCES HUMAN RESEARCH ETHICS COMMITTEE

HREC/ref 313.2024

Federal Wide Assurance Number: FWA00001637. Institutional Review Board (IRB) number: IRB00001938 NHREC-registration number: REC-210208-007

This serves to confirm that the University of Cape Town Human Research Ethics Committee complies to the Ethics Standards for Clinical Research with a new drug in patients, based on the Medical Research Council (MRC-SA), Food and Drug Administration (FDA-USA), International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use: Good Clinical Practice (ICH GCP), South African Good Clinical Practice Guidelines (DoH 2020), based on the Association of the British Pharmaceutical Industry Guidelines (ABPI), and Declaration of Helsinki (2013) guidelines. The Human Research Ethics Committee granting this approval is in compliance with the ICH Harmonised Tripartite Guidelines E6: Note for Guidance on Good Clinical Practice (CPMP/ICH/135/95) and FDA Code Federal Regulation Part 50, 56 and 312.

HREC/ref 313.2024

APPENDIX 2: WESTERN CAPE DEPARTMENT OF HEALTH & WELLNESS INSTITUTIONAL APPROVAL

STRATEGY & HEALTH SUPPORT
Health.Research@westerncape.gov.za
tel: +27 21 483 0866: fax: +27 21 483 6058
5th Floor, Norton Rose House,, 8 Riebeek Street, Cape Town, 8001
www.capegateway.gov.za)

REFERENCE: WC_202207_014
ENQUIRIES: Dr Sabela Petros

University of Cape Town
Anzio Road
Observatory
Cape Town
7925

For attention: Mr Louis van Rensburg, Dr Willem Stassen, Prof Craig Vincent-Lambert

Re: Initiating the development of a curriculum for South African Adult Critical Care Retrieval

Thank you for submitting your proposal to undertake the above-mentioned study. We are pleased to inform you that the department has granted you approval for your research.
Please contact the following people to assist you with any further enquiries in accessing the following sites:

Emergency Medical Services	**Craig Wylie**	**021 508 4519**

Kindly ensure that the following are adhered to:

1. Arrangements can be made with managers, providing that normal activities at requested facilities are not interrupted and the constraints caused by the Covid-19 epidemic above are respected and adhered to.
2. Researchers, in accessing provincial health facilities, are expressing consent to provide the department with an electronic copy of the final feedback (**Annexure 9**) within six months of completion of research. This can be submitted to the provincial Research Co-ordinator (Health.Research@westerncape.gov.za).
3. In the event where the research project goes beyond the *estimated completion* date which was submitted, researchers are expected to complete and submit a progress report (**Annexure 8**) and an updated ethics clearance letter to the provincial Research Co-ordinator (Health.Research@westerncape.gov.za).
4. The reference number above should be quoted in all future correspondence.

Yours sincerely

PROF. V ZWEIGENTHAL
DIRECTORATE: HEALTH INTELLIGENCE
DATE: 14 October 2022
CC

APPENDIX 3: SEARCH STRATEGY

Database: PUBMED:

Search date: 30/09/2022

Number of results: 713 (REPEATED 13/08/2024)

((((((((((Critical Care Retrieval) OR (Critical Care Transport)) OR (Critical Care Transfer)) AND (y_10[Filter])) AND ((((Curriculum)) OR (Syllabus)) OR (Educational Framework) AND (y_10[Filter]))) AND (((Training) OR (Education)) OR (Learning) AND (y_10[Filter]))) AND (((Standards) OR (Criteria)) OR (Requirements) AND (y_10[Filter])),,in the last 10 years,"((((""critical care""[MeSH Terms] OR (""critical""[All Fields] AND ""care""[All Fields]) OR ""critical care""[All Fields]) AND (""retrievability""[All Fields] OR ""retrievable""[All Fields] OR ""retrieval""[All Fields] OR ""retrievals""[All Fields] OR ""retrieve""[All Fields] OR ""retrieved""[All Fields] OR ""retrieves""[All Fields] OR ""retrieving""[All Fields])) OR ((""critical care""[MeSH Terms] OR (""critical""[All Fields] AND ""care""[All Fields]) OR ""critical care""[All Fields]) AND (""biological transport""[MeSH Terms] OR (""biological""[All Fields] AND ""transport""[All Fields]) OR ""biological transport""[All Fields] OR ""transport""[All Fields] OR ""membrane transport proteins""[MeSH Terms] OR (""membrane""[All Fields] AND ""transport""[All Fields] AND ""proteins""[All Fields]) OR ""membrane transport proteins""[All Fields] OR ""transporter""[All Fields] OR ""transporters""[All Fields] OR ""transportable""[All Fields] OR ""transportation""[MeSH Terms] OR ""transportation""[All Fields] OR ""transportations""[All Fields] OR ""transported""[All Fields] OR ""transporter s""[All Fields] OR ""transporting""[All Fields] OR ""transports""[All Fields])) OR ((""critical care""[MeSH Terms] OR (""critical""[All Fields] AND ""care""[All Fields]) OR ""critical care""[All Fields]) AND (""transfer""[All Fields] OR ""transferability""[All Fields] OR ""transferable""[All Fields] OR ""transfered""[All Fields] OR ""transfering""[All Fields] OR ""transferred""[All Fields] OR ""transferring""[All Fields] OR ""transfers""[All Fields]))) AND ""2012/09/01 00:00"":""3000/01/01 05:00""[Date - Publication] AND ((""curriculum""[MeSH Terms] OR

""curriculum""[All Fields] OR ""curricula""[All Fields] OR ""curriculums""[All Fields] OR ""curriculum s""[All Fields] OR ""education""[MeSH Subheading] OR ""education""[All Fields] OR ""Syllabus""[All Fields] OR (((""educability""[All Fields] OR ""educable""[All Fields] OR ""educates""[All Fields] OR ""education""[MeSH Subheading] OR ""education""[All Fields] OR ""educational status""[MeSH Terms] OR (""educational""[All Fields] AND ""status""[All Fields]) OR ""educational status""[All Fields] OR ""education""[MeSH Terms] OR ""education s""[All Fields] OR ""educational""[All Fields] OR ""educative""[All Fields] OR ""educator""[All Fields] OR ""educator s""[All Fields] OR ""educators""[All Fields] OR ""teaching""[MeSH Terms] OR ""teaching""[All Fields] OR ""educate""[All Fields] OR ""educated""[All Fields] OR ""educating""[All Fields] OR ""educations""[All Fields]) AND (""framework""[All Fields] OR ""framework s""[All Fields] OR ""frameworks""[All Fields]))) AND ""2012/09/01 00:00"":""3000/01/01 05:00""[Date - Publication]) AND ((""education""[MeSH Subheading] OR ""education""[All Fields] OR ""training""[All Fields] OR ""education""[MeSH Terms] OR ""train""[All Fields] OR ""train s""[All Fields] OR ""trained""[All Fields] OR ""training s""[All Fields] OR ""trainings""[All Fields] OR ""trains""[All Fields] OR (""educability""[All Fields] OR ""educable""[All Fields] OR ""educates""[All Fields] OR ""education""[MeSH Subheading] OR ""education""[All Fields] OR ""educational status""[MeSH Terms] OR (""educational""[All Fields] AND ""status""[All Fields]) OR ""educational status""[All Fields] OR ""education""[MeSH Terms] OR ""education s""[All Fields] OR ""educational""[All Fields] OR ""educative""[All Fields] OR ""educator""[All Fields] OR ""educator s""[All Fields] OR ""educators""[All Fields] OR ""teaching""[MeSH Terms] OR ""teaching""[All Fields] OR ""educate""[All Fields] OR ""educated""[All Fields] OR ""educating""[All Fields] OR ""educations""[All Fields]) OR (""learning""[MeSH Terms] OR ""learning""[All Fields] OR ""learn""[All Fields] OR ""learned""[All Fields] OR ""learning s""[All Fields] OR ""learnings""[All Fields] OR ""learns""[All Fields])) AND ""2012/09/01 00:00"":""3000/01/01 05:00""[Date - Publication]) AND ((""reference standards""[MeSH Terms] OR (""reference""[All Fields] AND ""standards""[All Fields]) OR ""reference standards""[All Fields] OR ""standardization""[All Fields] OR ""standard""[All Fields] OR ""standard s""[All Fields] OR ""standardisation""[All Fields] OR ""standardisations""[All Fields] OR ""standardise""[All Fields] OR ""standardised""[All Fields] OR ""standardises""[All Fields] OR

""standardising""[All Fields] OR ""standardization s""[All Fields] OR ""standardizations""[All Fields] OR ""standardize""[All Fields] OR ""standardized""[All Fields] OR ""standardizes""[All Fields] OR ""standardizing""[All Fields] OR ""standards""[MeSH Subheading] OR ""standards""[All Fields] OR (""criteria s""[All Fields] OR ""criterias""[All Fields] OR ""standards""[MeSH Subheading] OR ""standards""[All Fields] OR ""criteria""[All Fields]) OR (""require""[All Fields] OR ""required""[All Fields] OR ""requirement""[All Fields] OR ""requirements""[All Fields] OR ""requires""[All Fields] OR ""requiring""[All Fields])) AND ""2012/09/01 00:00"":""3000/01/01 05:00""[Date - Publication])) AND (y_10[Filter])",713,07:46:46

((Standards) OR (Criteria)) OR (Requirements),,in the last 10 years,"(""reference standards""[MeSH Terms] OR (""reference""[All Fields] AND ""standards""[All Fields]) OR ""reference standards""[All Fields] OR ""standardization""[All Fields] OR ""standard""[All Fields] OR ""standard s""[All Fields] OR ""standardisation""[All Fields] OR ""standardisations""[All Fields] OR ""standardise""[All Fields] OR ""standardised""[All Fields] OR ""standardises""[All Fields] OR ""standardising""[All Fields] OR ""standardization s""[All Fields] OR ""standardizations""[All Fields] OR ""standardize""[All Fields] OR ""standardized""[All Fields] OR ""standardizes""[All Fields] OR ""standardizing""[All Fields] OR ""standards""[MeSH Subheading] OR ""standards""[All Fields] OR (""criteria s""[All Fields] OR ""criterias""[All Fields] OR ""standards""[MeSH Subheading] OR ""standards""[All Fields] OR ""criteria""[All Fields]) OR (""require""[All Fields] OR ""required""[All Fields] OR ""requirement""[All Fields] OR ""requirements""[All Fields] OR ""requires""[All Fields] OR ""requiring""[All Fields])) AND (y_10[Filter])","2,231,595",07:44:37

((Training) OR (Education)) OR (Learning),,in the last 10 years,"(""education""[MeSH Subheading] OR ""education""[All Fields] OR ""training""[All Fields] OR ""education""[MeSH Terms] OR ""train""[All Fields] OR ""train s""[All Fields] OR ""trained""[All Fields] OR ""training s""[All Fields] OR ""trainings""[All Fields] OR ""trains""[All Fields] OR (""educability""[All Fields] OR

""educable""[All Fields] OR ""educates""[All Fields] OR ""education""[MeSH Subheading] OR ""education""[All Fields] OR ""educational status""[MeSH Terms] OR (""educational""[All Fields] AND ""status""[All Fields]) OR ""educational status""[All Fields] OR ""education""[MeSH Terms] OR ""education s""[All Fields] OR ""educational""[All Fields] OR ""educative""[All Fields] OR ""educator""[All Fields] OR ""educator s""[All Fields] OR ""educators""[All Fields] OR ""teaching""[MeSH Terms] OR ""teaching""[All Fields] OR ""educate""[All Fields] OR ""educated""[All Fields] OR ""educating""[All Fields] OR ""educations""[All Fields]) OR (""learning""[MeSH Terms] OR ""learning""[All Fields] OR ""learn""[All Fields] OR ""learned""[All Fields] OR ""learning s""[All Fields] OR ""learnings""[All Fields] OR ""learns""[All Fields])) AND (y_10[Filter])","1,729,804",07:42:20

(((Curriculum)) OR (Syllabus)) OR (Educational Framework),,in the last 10 years,"(""curriculum""[MeSH Terms] OR ""curriculum""[All Fields] OR ""curricula""[All Fields] OR ""curriculums""[All Fields] OR ""curriculum s""[All Fields] OR ""education""[MeSH Subheading] OR ""education""[All Fields] OR ""Syllabus""[All Fields] OR (""educability""[All Fields] OR ""educable""[All Fields] OR ""educates""[All Fields] OR ""education""[MeSH Subheading] OR ""education""[All Fields] OR ""educational status""[MeSH Terms] OR (""educational""[All Fields] AND ""status""[All Fields]) OR ""educational status""[All Fields] OR ""education""[MeSH Terms] OR ""education s""[All Fields] OR ""educational""[All Fields] OR ""educative""[All Fields] OR ""educator""[All Fields] OR ""educator s""[All Fields] OR ""educators""[All Fields] OR ""teaching""[MeSH Terms] OR ""teaching""[All Fields] OR ""educate""[All Fields] OR ""educated""[All Fields] OR ""educating""[All Fields] OR ""educations""[All Fields]) AND (""framework""[All Fields] OR ""framework s""[All Fields] OR ""frameworks""[All Fields]))) AND (y_10[Filter])","893,695",07:40:54

(((((((Critical Care Retrieval) OR (Critical Care Transport)) OR (Critical Care Transfer)),,in the last 10 years,"((((""critical care""[MeSH Terms] OR (""critical""[All Fields] AND ""care""[All Fields]) OR ""critical care""[All Fields]) AND (""retrievability""[All Fields] OR ""retrievable""[All Fields] OR

""retrieval""[All Fields] OR ""retrievals""[All Fields] OR ""retrieve""[All Fields] OR ""retrieved""[All Fields] OR ""retrieves""[All Fields] OR ""retrieving""[All Fields])) OR (""critical care""[MeSH Terms] OR (""critical""[All Fields] AND ""care""[All Fields]) OR ""critical care""[All Fields]) AND (""biological transport""[MeSH Terms] OR (""biological""[All Fields] AND ""transport""[All Fields]) OR ""biological transport""[All Fields] OR ""transport""[All Fields] OR ""membrane transport proteins""[MeSH Terms] OR (""membrane""[All Fields] AND ""transport""[All Fields] AND ""proteins""[All Fields]) OR ""membrane transport proteins""[All Fields] OR ""transporter""[All Fields] OR ""transporters""[All Fields] OR ""transportable""[All Fields] OR ""transportation""[MeSH Terms] OR ""transportation""[All Fields] OR ""transportations""[All Fields] OR ""transported""[All Fields] OR ""transporter s""[All Fields] OR ""transporting""[All Fields] OR ""transports""[All Fields])) OR (""critical care""[MeSH Terms] OR (""critical""[All Fields] AND ""care""[All Fields]) OR ""critical care""[All Fields]) AND (""transfer""[All Fields] OR ""transferability""[All Fields] OR ""transferable""[All Fields] OR ""transfered""[All Fields] OR ""transfering""[All Fields] OR ""transferred""[All Fields] OR ""transferring""[All Fields] OR ""transfers""[All Fields])))) AND (y_10[Filter])","13,927",07:36:07

Database: Scopus:
Search date: 30/09/2022
Number of results: 157 (REPEATED 13/08/2024)

Critical Care Retrieval OR Critical Care Transport OR Critical Care Transfer AND Curriculum OR Syllabus OR Educational Framework AND Training OR Education OR Learning AND standards OR criteria OR requirements AND (LIMIT-TO (SUBJAREA,"MEDI") OR LIMIT-TO (SUBJAREA,"NURS") OR LIMIT-TO (SUBJAREA,"HEAL") OR LIMIT-TO (SUBJAREA,"PHAR") OR LIMIT-TO (SUBJAREA,"MULT")) AND (LIMIT-TO (PUBYEAR,2023) OR LIMIT-TO (PUBYEAR,2022) OR LIMIT-TO (PUBYEAR,2021) OR LIMIT-TO (PUBYEAR,2020) OR LIMIT-TO (PUBYEAR,2019) OR LIMIT-TO (PUBYEAR,2018) OR LIMIT-TO (PUBYEAR,2017) OR LIMIT-TO (PUBYEAR,2016) OR LIMIT-TO (PUBYEAR,2015) OR LIMIT-TO (PUBYEAR,2014) OR LIMIT-TO (PUBYEAR,2013) OR LIMIT-TO (PUBYEAR,2012))

APPENDIX 4: EXTRACTION MATRIX

1	Article Title	Authors	Yea	Origin of d	Aims/Purpose
2	A 12-month retrospective descriptive analysis of a single helicopter emergency medical service operator in four South African provinces		2023	South Africa	
3	A BRILL idea? The benefits, risks, insights, learning and limitations of an emergency airway registry in pre-hospital and retrieval medicine	John GLASHEEN, Brigid WALL and Sean KEOGH	2019	AUS	This paper discusses the benefits, risks, insights, learning and limitations of the use of an airway registry in pre-hospital and retrieval medicine, for both rese
4	A Clinical Teaching Blended Learning Program to Enhance Registered Nurse Preceptors' Teaching Competencies: Pretest and Posttest Study	Zhao, Shengdong ; Sehgal, Vibhor ; Ang, Neo Kim Emily	2020	Singapore	CTBL program on nurse preceptors' clinical teaching competencies, self-efficacies, attitudes toward web-based learning, and blended learning outcomes.
5	A comparison of the content taught in critical care transportation modules across South African bachelor's degrees in emergency medical care	Conradie NJ, Vincent-Lambert C, Stassen W.	2022	South Africa	The aim of this study was to evaluate and compare the intensive and critical care transport modules offered at SA universities in their BEMC programmes.
6	A Continuous Quality Improvement Airway Program Results in Sustained Increases in Intubation Success	Olvera DJ, Stuhlmiller DFE, Wolfe A, Swearingen CF, Pennington T, Davis DP.;	2018	USA	The aim of this research was to describe the experience witha novel, integrated advanced airway management programacross a large air medical company an
7	A national retrospective descriptive analysisof critical care transfers in the privatesector in South Africa		2023	South Africa	
8	A Statewide Collaboration to Deliver and Evaluate a Pediatric Critical Care Simulation Curriculum for Emergency Medical Services	Farrell, C., Dorney, K., Mathews, B., Boyle, T., Kitchen, A., Doyle, J., Monuteaux, M.C., Li, J., Walsh, B., Nagler, J., Chung, S.	2022	USA	participants'knowledge and confidence.
9	A Survey Assessing Pediatric Transport Team Composition and Training	Patel MM, Hebbar KB, Dugan MC, Petrillo T.	2020	USA	The aim of this study was to assess national pediatric/neonatalspecialty transport teams' composition and training requirements to determine if any current
10	A two phase study to revise the Australian Practice Standards for Specialist Critical Care Nurses	Gill FJ, Kendrick T, Davies H, Greenwood M	2016	AUS	TheaimoftheresearchwastorevisetheCompe-tencyStandardsforSpecialistCriticalCareNurses12toensuretheycontinuetomeettheneedsofcriticalcarenursesandr
11	Ability of Critical Care Medics to Confirm Endotracheal Tube Placement by Ultrasound	Joyce, M., Tozer, J., Vitto, M., Evans, D.	2020	USA	feasible, and these results show that the skill itself is easily trainable to those with very little ultrasound experience.
12	Airway Management: A Structured Curriculum for Critical Care Transport Providers	Kuszajewski, M.L., O'Donnell, J.M., Phrampus, P.E., Robey, W.C., Tuite, P.K.	2016	USA	structured curriculum to show skill competence. Optimal methods in thedevelopment of airway management competence and the frequency of training neede
13	An Assessment of Nursing Skills Required for Sustaining a Casualty during Prolonged Casualty Care: Implications for Training and Preparing for the Next Major War	Wilson KE, Vasek M, VanFosson CA, Flarity K, Mann-Salinas E, Gillespie K, Keenan S, Fisher AD, April MD, Schauer SG	2022	USA	Sought to determine the frequency of deployed nursing skills required for sustaining a casualty for the first 72 hours after injury in accordance with relevant
14	An Evaluation of Navy En Route Care Training Using a High-Fidelity Medical Simulation Scenario of Interfacility Patient Transport	DeForest CA, Blackman V, Alex JE, Reeves L, Mora A, Perez C, Maddry J, Selby D, Walrath B.;	2018	USA	to iden-tify practice differences between provider types to poten-tially improve the USN ERC training system.
15	Benefit of Critical Care Flight Paramedic-Trained Search and Rescue Corpsmen in Treatment of Severely Injured Aviators	Snow RW, Papalski W, Siedler J, Drew B, Walrath B	2018	USA	
16	Beyond crisis resource management: new frontiers in human factors training for acute care medicine	Petrosoniak A, Hicks CM.;	2013	Canada	This review will address key considerations in CRM training and outline recommendations for the future of human factors education in healthcare.
17	Cardiopulmonary Resuscitation During Simulated Pediatric Interhospital Transport: Lessons Learned From Implementation of an Institutional Curriculum	Noje C, Duval-Arnould J, Costabile PM, Henderson E, Perretta J, Sorcher JL, Shilkofski N, Hunt EA.	2022	USA	Little is known about cardiopulmonary resuscitation (CPR) quality during pediatric interhospital transport; hence, our aim was to investigate its feasibility
18	Clinical course teaching in transport of critically ill patients: Small group methods	Beigmohammadi MT, Rahimi M, Nabavian O, Davarani SH, Karvandian K, Kamalitabar F.;	2016	Iran	physicians' abilities in the transport of critically ill patients. In an interventional study, 320 interns, male and female, were taught about patient transfer in two
19	Continuing Medical Education for Air Medical Providers: The Successes and Challenges	Miller JO, Thammasitboon S, Hsu DC, Shah MI, Minard CG, Graf JM.;	2016	USA	service providers, thus we aimed to develop a model curriculum to increase their knowledge regarding pediatric respiratory distressand failure.
20	Core Components of a Pediatric Critical Care Transport Communication Curriculum: A Modified Delphi Approach	Silberman AP, Rozenfeld RA, Kessler DO.	2022	USA	critical care medicine (PCCM) fellows have differing experiences in their fellowships, and there is no standardized way of training medical command for the
21	Critical Care Network in the State of Qatar	Hijjeh M, Al Shaikh L, Alinier G, Selwood D, Malmstrom F, Hassan IF.;	2019	Qatar	
22	Critical care paramedics in England: A national survey of ambulance services	Von Vopelius-Feldt, J., Benger, J.	2014	UK	We conducted an online survey of NHS ambulance services to provide an overview of the current utilization and role of CCPs in England.
23	Critical care transportation by paramedics: a cross-sectional survey	Raynovich W, Hums J, Stuhlmiller DF, Bramble JD, Kasha T, Galt K.;	2013	USA	The purpose of this study was to gather data fromparamedics practicing in the critical care transport setting toguide development of the education, training
24	Critical events during intra-hospital transport of critically ill patients to and from intensive care unit	Parveez MQ, Yaddanapudi LN, Saini V, Kajal K, Sharma A.	2020	Turkey	events occurring during the transport of critically ill patients in a tertiary care hospital
25	Descriptive record of the activity of military critical care transfer teams deployed to London in 20 April to undertake transfer of patients with COVID-19	James, R.H., Doyle, C.P., Cooper, D.J	2020	UK	and activity of these military teams, records the lessons identified (LI) and reviews the complications encountered'. The teams each had two members. A con
26	Difficult airway response team: a novel quality improvement program for managing hospital-wide airway emergencies	Mark LJ, Herzer KR, Cover R, Pandian V, Bhatti NI, Berkow LC	2015	USA	Difficult airway cases can quickly become emergencies, increasing the risk of life-threatening compl cations or death. Emergency airway management outside
27	Diploma in Retrieval and Transfer Medicine	McKinlay JA		USA	
28	Emergency Patient Handoffs: Identifying Essential Elements and Developing an Evidence-Based Training Tool	Reimer AP, Alfes CM, Rowe AS, Rodriquez-Fox BM.;	2017	USA	guiding education and training.
29	En Route Critical Care Transfer From a Role 2 to a Role 3 Medical Treatment Facility in Afghanistan	Staudt AM, Savell SC, Biever KA, Trevino JD, Valdez-Delgado KK, Suresh M	2018	USA	To describe patients transferred from a role 2 to a role 3 US military treatment facility in Afghanistan.
30	Epidemiology and location of primary retrieval missions in a Scottish aeromedical service	Neagle, G., Curatolo, L., Ferris, J., Donald, M., Hearns, S., Corfield, A.R.;	2019	Scotland	The aim of this study was to describe the geographic distribution and appropriateness of the current tasking system.
31	Evaluating the fundamental critical care support course in critical care education in Japan: a survey of Japanese fundamental critical care support course experience	Ataqi K, Nishi S, Fujitani S, Kodama T, Ishikawa J, Shimaoka H.;	2013	Japan	The purpose of this study is to evaluate whether Japanese FCCS course is useful and has a possib lity to deserve a basis of critical care management in Jap
32	Experience of physician and nurse specialists in Sweden undertaking long distance aeromedical transportation of critically ill patients: A qualitative study	Frost E, Kihlgren A, Jaensson M.	2018	Sweden	The aim of this study was to explore the experiences of nurse and physician specialists in Sweden un-dertakinglongdistanceaeromedicaltransportofcritically
33	Experiences of emergency care providers conducting critical care transfers in Gauteng Province, South Africa	Senekal, A.C.G., Vincent-Lambert, C.;	2021	South Africa	To investigate and describe the experiences of a sample of Gauteng Province-based emergency care (EC) providers conducting CCTs
34	Feasibility of Paramedic Performed Prehospital Lung Ultrasound in Medical Patients with Respiratory Distress	Becker, T.K., Martin-Gill, C., Callaway, C.W., Guyette, F.X., Schott, C	2018	USA	We assessed the feasibility of paramedic performed prehospital lung ultrasound in medical patients with respiratory distress
35	Focused Training for the Handover of Critical Patient Information During Simulated Pediatric Emergencies	Lautz AJ, Martin KC, Nishisaki A, Bonafide CP,	2018	USA	multidisciplinary simulations of critically ill children.
36	Framework for Critical Care in Obstetrics	Baird SM, Martin S	2018	USA	withteam composition, scope of service, maternal transportconsiderations, and training recommendations
37	Handover and transport of critically ill children: An integrative review	Foronda C, VanGraafeiland B, Quon R, Davidson P.;	2016	USA	To synthesize published data on pediatric handover and transport and identify gaps to provide direction for future investigation
38	Health professionals' experience of teamwork education in acute hospital settings: a systematic review of qualitative literature	Kylie Eddy, Zoe Jordan, Matthew Stephenson	2016	AUS	The objective of this systematic review was to search for the best available evidence on the experiences of health professionals who participate in teamwork
39	Human patient simulation education in the nursing management of patients requiring mechanical ventilation: a randomized, controlled trial	Jansson MM, Ala-Kokko TI, Ohtonen PP, Meriläinen MH, Syrjälä HP, Kyngäs HA	2014	Finland	The aim of our study was to evaluate the effectiveness of human patient simulation (HPS) education in the nursing management of patients requiring mechani
40	Identifying the educational needs of Emergency nurses in rural and Critical access hospitals	Identifying the educational needs of Emergency nurses in rural and Critical access hospitals		USA	Identifying the educational needs of Emergency nurses in rural and Critical access hospitals
41	Impact of Critical Care Air Transport Team (CCATT) ventilator management on combat mortality	Maddry JK, Mora AG, Savell SC, Perez CA, Mason PE, Aden JK, Bebarta VS	2017	USA	The purpose of this study was to evaluate the impact of ARDSNet protocol compliance during aeromedical evacuation of ventilated combat injured patients
42	In situ simulation training for a better interprofessional team performance in transferring critically ill patients with COVID-19: a prospective randomised control trial	Mangqala SK, Tantri AR, Sugiarto A, Sianipar IR, Prasetyono TOH.	2022	Indonesia	COVID-19
43	Initiation of Invasive Arterial Pressure Monitoring by Critical Care Transport Crews	Standifird, C., Wassermann, M., Lauria, M.J.	2022	USA	this article aimed to demonstrate that arterial lines can be placed safely and effectively in the prehospital setting
44	Interfacility Transport of the Pregnant Patient: A 5-year Retrospective Review of a Single Critical Care Transport Program	Nawrocki PS, Levy M, Tang N, Trautman S, Margolis A.	2018	USA	care.
45	Interhospital transfers: Decision-making in critical care areas	Lee, A., Lum, M.E., Beehan, S.J., Hillman, K.M.;	1996	AUS	o evaluate the training of clinical staff in the use of interhospital transfer guidelines and to examine the underlying decision-making behavior in organizing pat
46	Interhospital transport of critically ill patients: experiences and challenges, a qualitative study	Eiding H, Kongsgaard UE, Braarud AC.	2019	Norway	The aim of this study was to examine how these transports are executed and to discover challenges during transports and potentials of improvement
47	Interprofessional learning and rural paramedic care	Mulholland, P., Barnett, T., Spencer, J.;	2014	AUS	This article presents a critical review of the literature in this area and identifies gaps in which further research is required to further interprofessional learning
48	Lung ultrasound for critical care physiotherapists: a narrative review	Leech M, Bissett B, Kot M, Ntoumenopoulos G	2015	AUS	physiotherapists and the implementation of LUS are also explored.
49	Mapping the use of simulation in prehospital care - a literature review	Abelsson, A., Rystedt, I., Suserud, B.-O., Lindwall, L.	2014	Sweded	The aim of this study wasto provide an overview of the development and foci of research on simultion in prehospital care practice
50	Measuring Intangibles: Defining Predictors of Non-Technical Skills in Critical Care Air Transport Team Trainees	Jernigan PL, Wallace MC, Novak CS, Gerlach TW, Hanseman DJ, Pritts TA, Davis BR.	2016	USA	This study was conducted to evaluate predictors of performance in non-technical skills.
51	MEDEVAC: survival and physiological parameters improved with higher level of flight medic training	Holland SR, Apodaca A, Mabry RL.	2013	USA	Determine if a higher level of Army flight medic (AFM) training was associated withimproved physiological state on arrival to a combat support hospital (C
52	Medication Administration in Critical Care Transport of Adult Patients with Hypoxemic Respiratory Failure	Wilcox SR, Saia MS, Waden H, McGahn SJ, Frakes M, Wedel SK, Richards JB.	2015	USA	As there are few data describing the patterns of medication administration, this study quantifies medication administrations and patterns in a series of adult
53	Medication-related interventions to improve medication safety and patient outcomes on transition from adult intensive care settings: a systematic review and meta-analysis	Bourne RS, Jennings JK, Panagioti M, Hodkinson A, Sutton A, Ashcroft DM	2021	UK	The aims were to examine the impact of medication-related interventions on medication and patient outcomes on transition from adult ICU settings and ident
54	Non-technical skills evaluation in the critical care air ambulance environment: introduction of an adapted rating instrument--an observational study	Myers JA, Powell DM, Psirides A, Hathaway K, Aldington S, Haney MF.	2016	NZ	The objective of this study was to adapt and evaluate a non-technical skills rating framework for the air ambulance clinical environment.
55	Paramedic specialization: a strategy for better out-of-hospital care	Caffrey SM, Clark JR, Bourn S, Cole J, Cole JS, Mandt M, Murray J, Sibold H, Stuhlmiller D, Swanson ER	2014	USA	
56	Patient discharge from intensive care: an updated scoping review to identify tools and practices to inform high-quality care	HT, Fiest KM.;	2021	Canada	The aim of this study was to answer the question: what elements facilitate a successful, high-quality discharge from the ICU?
57	Patient safety in ambulance services: a scoping review	Fisher JD, Freeman K, Clarke A, Spurgeon P, Smyth M, Perkins GD, Sujan MA, Cooke MW.	2015	UK	To identify and map available evidence relating to patient safety when using ambulance services.
58	Point-of-Care Ultrasound Curriculum for Endotracheal Tube Confirmation for Pediatric Critical Care Transport Team Through Remote Learning and Teleguidance	Leviter J, Auerbach M, Amick M, O'Marr J, Battipaglia T, Amendola C, Riera A.	2021	USA	This study aimed to teach pediatric critical care team members to use POCUS for endotracheal tube (ETT) placement confirmation. A secondary aim was to
59	Pre-hospital advanced airway management in children: A challenge that training can handle	Watterson, J.B., Reid, C., Burns, B.J., Regan, L.;	2017	AUS	
60	Prehospital emergency nurses' experiences of care in critical incidents	Sjölin H, Lindström V, Vicente V, Hult H, Ringsted C, Kurland L	2020	Sweden	the aim of the study was to explore PENs' experiences of care in CIs.
61	Quality improvement education incorporated as an integral part of critical care fellows training	Kashani KB, Ramar K, Farmer JC, Lim KG, Moreno-Franco P, Morgenthaler TI, Dankbar GC, Hale CW.	2014	USA	conducted a pilot QI education program to incorporate QI training as a required curriculum for the 2010–2011 academic year.
62	Quantitative Analysis of the Content of EMS Handoff of Critically Ill and Injured Patients to the Emergency Department	Goldberg, S.A., Porat, A., Strother, C.G., Lim, N.Q., Wijeratne, H.R.S., Sanchez, G., Munjal, K.G.;	2016	USA	However, evaluation of handoff from field providers to ED personnel is limited. We here present a quantitative analysis of the information transferred from E
63	Reflective and collaborative skills enhances Ambulance nurses' competence - A study based on qualitative analysis of professional experiences	Wihlborg J, Edgren G, Johansson A, Sivberg B	2017	Sweden	The aim of this study was to elucidate ambulance nurses' professional experiences and to describe aspects affecting their competence.
64	Resuscitative endovascular balloon occlusion of the aorta (REBOA) in non-traumatic out-of-hospital cardiac arrest: Evaluation of an educational programme	Brede, J.R., Lafrenz, T., Krüger, A.J., Søvik, E., Steffensen, T., Kriesi, C., Steinert, M., Klepstad, P.;	2019	Norway	This study describes a training programme to implement the REBOA procedure to a prehospital working team, in preparation to a planned clinical study.
65	Setting the Benchmark for the Ground and Air Medical Quality in Transport International Quality Improvement Collaborative	Aspiotes CR, Gothard MQ, Gothard MD, Parrish R, Schwartz HP, Bigham MT.	2018	USA	collaborative database which tracks consensus quality metrics. The Institute of Medicine recommends benchmarking of comparative data to accelerate impro
66	Shaping the Flight Paramedic Program	Davids NB	2016	USA	
67	Simulation-based training and assessment of non-technical skills in the Norwegian Helicopter Emergency Medical Services: a cross-sectional survey	Abrahamsen HB, Sollid SJ, Öhlund LS, Røislien J, Bondevik GT	2014	Norway	simulation-based training in, and assessment of, NTSs. We also hypothesised that the extent of simulation-based training and assessment of these skills diff
68	Staffing and training issues in critical care hyperbaric medicine	Staffing and training issues in critical care hyperbaric medicine		Poland	Staffing and training issues in critical care hyperbaric medicine
69	Taking upstairs care outside	Howard I	2019	Qatar	
70	The capabilities and scope-of-practice requirements of advanced life support practitioners undertaking critical care transfers: A Delphi study	Venter, M., Stassen, W.	2016	South Africa	the SA setting.
71	The delivery of the new prehospital emergency medicine curriculum: reflections on a pilot programme in the UK	McQueen C, Wyse M	2014	UK	
72	The effectiveness of team-based learning in nursing education: A systematic review	Alberti S, Motta P, Ferri P, Bonetti L.;		Italy	
73	The Imperial Paediatric Emergency Training Toolkit (IPETT) for use in paediatric emergency training: development and evaluation of feasibility and validity			UK	
74	The introduction of new critical care equipment into the aeromedical evacuation service of the Royal Air Force	Lamb, D.	2003	UK	
75	The need for purposeful teaching, learning and assessment of crisis resource management principles and practices in the undergraduate pre-hospital emergency care curriculum: A narrative literature review	Rowland, M., Adefuye, A.O., Vincent-Lambert, C	2021	South Africa	hospital emergency care students on the principles and practices of CRM
76	The obstetric caseload of a physician-based helicopter emergency medical service: case review and recommendations for retrieval physician training	Kaye R, Shewry E, Reid C, Burns B.	2014	AUS	We aimed to quantify and describe the obstetric caseload of our retrieval service with respect to primary diagnosis and required interventions for providing
77	The PrOSTE: identifying key components of effective procedural teaching	McSparron JI, Ricotta DN, Moskowitz A, Volpicelli FM, Roberts DH, Schwartzstein RM, Huang GC	2015	USA	novices. Some of theresults have been previously reported in theform of an abstract
78	The role of the certified flight paramedic (CFP) as a critical care provider and the required education	Gryniuk, J	2001	USA	
79	The role of the paramedic practitioner in the UK	Woollard, M.	2006	UK	
80	Transfer of critically ill adults-assessing the need for training	O'Leary RA, Marsh B, O'Connor P	2018	UK	articulated by these practitioners
81	Transferring patients with refractory hypoxemia to a regional extracorporeal membrane oxygenation center: key considerations for clinicians	Schulman CS, Bibro C, Downey DB, Lasich C	2014	USA	
82	Transport of Critically Ill Cardiovascular Patients	Ignatyeva Y, Nguyen AP, Schmidt U, Barak R, Agarwal R, Davidson JE.	2018	USA	
83	Ventilator Boot Camp Improves the Knowledge and Skills Associated With Mechanical Ventilator Use During Interfacility Transport of Intubated Pediatric Patients	Walton JL, Dunn DK, Haines NY, Heisler I, Bigham MT, Volsko TA	2018	USA	We sought toidentify knowledge gaps and evaluate the effectiveness of a transport ventilator competency bootcamp.
84	What nurses involved in a Medical Emergency Teams consider the most vital areas of knowledge and skill when delivering care to the deteriorating ward patient. A nurse-oriented curriculum development project	Judy Currey, Debbie Massey, Josh Allen, Daryl Jones	2018	AUS & NZ	We aimed to identify and describe what nurses involved in a MET consider the most vital areas of knowledge and skill when delivering care to the deteriorati
85	Who does what in prehospital critical care? An analysis of competencies of paramedics, critical care paramedics and prehospital physicians	Von Vopelius-Feldt, J., Benger, J	2014	UK	We describe the clinical competencies of three groups of prehospital providers in the UK with the aim of informing future planning of the delivery of PHCC.

APPENDIX 5: SEMI-STRUCTURED INTERVIEW & FOCUS GROUP DISCUSSION SCHEDULE

Discussion schedule for:

INITIATING THE DEVELOPMENT OF A CURRICULUM FOR SOUTH AFRICAN ADULT CRITICAL CARE RETRIEVAL

FACILITATION

Before the interview/discussion, please refer back to these notes to ensure familiarity with the content. All interviews/discussions should be run by a facilitator. The facilitator is to lead the discussion while taking notes. Each discussion should lead to ensure some conclusions.

PREPARATION

Test the recording equipment and its sensitivity. The participant consent forms should also be available and ready. Make sure that participants are comfortable before the start of the discussion. Ensure that the participants have signed the consent form and that she/he consents to being audio recorded.

Statement on confidentiality:

There are no right or wrong opinions to any of the topics of discussion. I am here to establish your individual views. Any opinions expressed will be treated in confidence.

Introduction to the session"

Start by introducing yourself. You may start the session by:

I would firstly like to thank you for sparing the time to come and talk about initiating the development of a South African curriculum for education in adult critical care transfers. Loosely, the transfer of adults in South Africa is performed by advanced life support (ALS) providers. This high-risk service is reserved for specialist teams internationally. Adverse events during these transfers have been associated with the providers' level of knowledge. There is

currently no specific course in adult critical care transfers offered in South Africa. The practitioners that fall under ALS providers have variable education backgrounds. The purpose of these interviews and focus group discussions are to establish your opinion on education in adult critical care transfers in South Africa. There are no right or wrong opinions, I would like you to feel comfortable saying what you really think and how you really feel.

ONE ON ONE INTERVIEWS WITH EXPERT/INDUSTRY GROUP:

Please could you start by introducing yourself and giving a bit of career background.

PROBES AND PROMPTS
Demographic data: Age, Gender, Qualification, Location, Position
Private versus provincial Adult care and/or critical care transfer experience

Understanding the current limitations to training in adult critical care transfers within academic and health institutions in South Africa?

PROBES AND PROMPTS
• Did the training you received at university or college prepare you for the adult critical care transfers that you are currently performing? • What gaps, if any, did you see in the programme's structure or outcomes?

• How did you close the gap in education of adult critical care transfers if any? • What changes would you recommend in the curriculum that are currently being presented by Universities and colleges?

To derive the goals of a curriculum in prehospital practitioner training in critical care transfers of adults?

PROBES AND PROMPTS
• Do you think additional training in adult critical care transfers are needed for pre-hospital providers? • How long should such training be? • What method of training would you advise? • What core competencies i.e.: knowledge, skills, and attitudes should a adult critical transfer practitioner graduate with?

What would you say are the specific needs to teaching, learning and assessment (TLA) as an expert in adult critical care transfer education?

PROBES AND PROMPTS
• What knowledge, skills both clinical and non-clinical necessary for TLA of these patient categories? • Any broad categories you would include in addition to these findings? • The literature review yielded the following core modules that should be included in the curriculum. Do you agree? • In your opinion, what are the best strategies for assessment in achieving the competencies you outlined above?

Final Reflection

What is the most important thing you would like to tell the curriculum committee as they work towards developing a curriculum in adult critical care transfers?

FOCUS GROUP DISCUSSION WITH STUDENTS "Learners":

Please could you start by introducing yourselves and giving a bit of career background.

PROBES AND PROMPTS
Demographic data: Age, Gender, Qualification, Location, Position
Private versus provincial Adult transfer experience

Understanding the current limitations to training in adult critical care transfers within academic and health institutions in South Africa?

PROBES AND PROMPTS
• How much time was spent on the topic of adult transfers during your training at university or college? • Did this training prepare you for the adult transfers that you are currently performing? • How did you close the gap in education of adult transfers if any? • What changes would you recommend in the curriculum that are currently being presented by Universities and colleges in adult transfers?

What would you say your specific needs are in learning and assessment (TLA) as a student in adult critical care transfer education?

PROBES AND PROMPTS
• Do you need additional training in adult critical care transfers? • If so, which specific areas of knowledge, clinical and non-clinical skills would you like further training on? • How much time could you spare for such training? • Do you have financial support to pay for additional training? • What method of training do you prefer? • Would you be able to travel to another city for such training? • Do you have access to a computer and an internet connection? • Do you have specific needs as it pertains to language, religion or culture that will have to be considered during training?

To derive the goals of a curriculum in prehospital practitioner training in critical care transfers of adults?

PROBES AND PROMPTS

- Experts in the field of adult care and critical care transfers have suggested the following core topics to be included in a new adult critical care course.
- Experts have suggested the following methods and duration of education and assessment for this course:
- Do you agree with the suggested methods and duration of education and examination for such a course?
- What would be a reasonable cost of such training?
- Would you travel for such training?

Final Reflection

- What is the most important thing you would like to tell the curriculum committee as they work towards developing a curriculum in adult critical care transfers?

APPENDIX 6: CONSENT FORM

INITIATING THE DEVELOPMENT OF A CURRICULUM FOR SOUTH AFRICAN ADULT CRITICAL CARE RETRIEVAL

This informed consent form is for English-speaking experts in adult critical care retrieval who are participating in a one-on-one interview. The same form will be used for a focus group discussion with students in adult critical care transfers. The experts and students will be discussing and describing their perceptions regarding education in Adult critical care transfers in South Africa.

Name of Primary Researcher: Louis Chris van Rensburg

Name of Affiliations: University of Cape Town

Name of Research Supervisor: Dr Willem Stassen

Name of Research Co-supervisors: Prof Craig Vincent - Lambert

This informed consent form has two parts:

• Information Sheet (to share information about the research study with you as the prospective participant)

• Certificate of Consent (to be signed if you agree to participate)

You will be provided with a full copy of the informed consent form.

PART 1: Information Sheet

Introduction

I, Louis Chris van Rensburg, the primary researcher, am currently doing my PhD in Emergency Medicine at the University of Cape Town.

I am conducting research with the aim of initiating the development of a curriculum for education in adult critical care transfers. I will be approaching experts in South Africa to participate in a one-on-one participant interview as well as a group of students to take part in a focus group discussion. This document will provide you with information about the study and it will invite you to be part of the research. If there is anything you do not understand or if you have any questions about the research, please feel free to ask. You may also call or email me and I will respond to any questions that you may have.

Voluntary Participation

Being part of this research is entirely your choice and voluntary. Whether you decide to participate in the research or not – there will be no consequences to you. You may also decide to change your mind and may withdraw from participating in the research, even if you agreed to it at an earlier stage.

Description of the Process

During the research the following will happen:

Experts:

- You will be interviewed in a one-on-one format with only the primary researcher present at a convenient and private location of your preference.
- A total of six to eight people will be interviewed.

Industry:

- You will be interviewed in a one-on-one format with only the primary researcher present at a convenient and private location of your preference.
- A total of six to eight people will be interviewed.

Learners:

- You will take part in a focus group discussion with four to six other advanced life support providers that are currently conducting Adult transfers in South Africa. The term student is based on your potential future participation in a course in Adult critical care transfers.

All participants:

- The interview/discussion should take approximately one hour.
- The interview/discussion will be audio-recorded so that it can be transcribed at a later stage.
- You will be contacted at a later stage of the research process to confirm the interpretation of your interview/discussion.

Risks or Benefits

There are no foreseen risks to your participation in this research project. You will not benefit from participation and will not be compensated for your participation in any way.

Confidentiality

The information that is gathered during the study will be kept confidential. As the participant, your identity will remain anonymous during the transcription, analysis and reporting of the data. The audio recordings and transcribed interviews will be kept on a password protected computer to which only the primary researcher has access. All of the audio recordings will be destroyed (deleted) after the transcription of the interviews. Auditors might require access to the anonymised transcribed for quality assurance purposes; however, at no stage will your identity, as the participant be revealed.

Right to Refuse or Withdraw

You are not obliged to participate in this research study if you do not want to do so. You may withdraw your participation during the research study at any stage before the audio recording transcription. The transcriptions will be completely anonymised and thus the researcher will have no way of identifying the participant after this. It is entirely your choice; no negative consequences will be incurred if you should choose not to participate or withdraw. In order to withdraw the participant can contact the primary researcher with the information provided below.

Ethics Clearance and Approval

This proposal has been reviewed and approved by the University of Cape Town's Human Research and Ethics Committee who's task it is to ensure that research participants are protected from any research-related harm. The research complies with the ethical codes of the Helsinki Declaration and the South African Good Clinical Practice Guidelines.

Who to Contact

If you have any question, you can ask them now or later. If you want to ask questions at a later stage, you may contact Louis van Rensburg on his mobile number: +27 83 320 6584 or email address louis.vanrensburg@uct.ac.za

Part 2: Consent

INITIATING THE DEVELOPMENT OF A CURRICULUM FOR SOUTH AFRICAN ADULT CRITICAL CARE RETRIEVAL

I have read the foregoing information, or it has been read to me. I have had the opportunity to ask questions about it and any questions that I have had has been answered to my satisfaction. I consent voluntarily to participate as a participant in this research study.
The purpose of the recording and the details of its storage and eventual destruction has been described to me. I have been offered to have any questions that I may have on the recording of the interview – answered and explained. I am giving consent voluntarily and I have been given a copy of this consent form.

Print Name of Participant: _____

Signature of Participant: _____

Date: _____

Statement by the researcher/person taking consent:

I have accurately read the information of the research to the potential participant. To the best of my ability, I have made sure that the participant understands that the following will be completed:

Experts:

• You will be interviewed in a one-on-one format with only the primary researcher present at a convenient and private location of your preference.

• A total of six to eight people will be interviewed.

Students:

• You will take part in a focus group discussion with four to six other advanced life support providers that are currently conducting Adult transfers in South Africa. The term student is based on your potential future participation in a course in Adult critical care transfers.

All participants:

• The interview/discussion should take approximately one hour.

• The interview/discussion will be audio-recorded so that it can be transcribed at a later stage.

• You will be contacted at a later stage of the research process to confirm the interpretation of your interview/discussion.

I confirm that the participant was given an opportunity to ask questions regarding the research study; all the questions asked have been answered correctly and to the best of my ability. I confirm that the research participant has not been coerced into giving consent for this research study and that consent has been given freely and voluntarily.

A copy of this informed consent form has been provided to the participant.

Print Name of Researcher: _____

Signature of Researcher: _____

APPENDIX 7: SUPPORTING DOCUMENTS FOR INTERVIEWS

INITIATING THE DEVELOPMENT OF A CURRICULUM FOR SOUTH AFRICAN ADULT CRITICAL CARE RETRIEVAL

Appendix

Results Overview/Summary:

Study 1

"A RETROSPECTIVE REVIEW OF ADVANCED LIFE SUPPORT INTERFACILITY TRANSFERS UNDERTAKEN IN THE PUBLIC HEALTH SECTOR EMERGENCY MEDICAL SERVICE IN THE WESTERN CAPE"

&

Study 2

"A SCOPING REVIEW OF INTERNATIONAL ADULT CRITICAL CARE TRAINING AND PROGRAM CURRICULA"

Study 1:

Objectives:

To broadly describe the context and population of adult patients undergoing CCTs facilitated by the public sector Emergency Medical Service (EMS) in the Western Cape Province of South Africa.

Methods:

A retrospective descriptive analysis was conducted focusing electronic patient care records (ePCRs) from January 2018 - December 2021 that were logged in the EMS's Computer-Aided Dispatch (CAD) database. Our focus being on those cases that required Advanced Life Support (ALS) care during the transfer.

Results:

Over the study period 25,635 records were found relating to CCTs performed by ALS providers. 12 892 (50.3%) of the patients were male and 12 718 (49.7%) were female with a median age of 40 years. The most prevalent diagnosis within the cohort was respiratory disease (n=4 606, 18%), followed by cardiovascular disease (n=3142, 12.27%) and central nervous system disorders (n=3 127, 12.21%).

Table 1:

Table 1: Pathologies of patients undergoing transfers (n = 25635)		
Pathologies	**n**	**%**
Respiratory Disease	4606	17,98%
Cardiovascular Disease	3142	12,27%
Central Nervous System Disorder	3127	12,21%
Obstetric Emergency	2729	10,66%
Head Injury	1649	6,44%
Soft Tissue Injury	1459	5,70%
Infection	1224	4,78%
Gunshot Injury	1106	4,32%
Endocrine Disorder	1043	4,07%
Overdose	869	3,39%
Gynaecological Emergency	496	1,94%
Other	475	1,85%
Conduction Disorder	446	1,74%
Polytrauma	417	1,63%
Burns	383	1,50%
Renal Failure	317	1,24%
Poisoning	236	0,92%
Gastrointestinal Bleed	226	0,88%
Mental & Behavioural Disorders	186	0,73%
Preterm Labour	184	0,72%
Post-Cardiac Arrest	183	0,71%
Acute Pain	180	0,70%
Spinal Injury	174	0,68%
Extremity Fracture	140	0,55%
Pulmonary Embolism	127	0,50%
Bowel Obstruction	122	0,48%
Central Nervous System Disease	119	0,46%
Diagnosis Unspecified	82	0,32%
Neoplasm	70	0,27%
Pelvic Fracture	62	0,24%
Post-Surgery	52	0,20%
Trunk Fracture	2	0,01%
Congenital Defect	1	0,00%
Submersion Injury	1	0,00%
Total	**25635**	**100,00%**

Table 2:

Table 2: Indwelling Devices & Attachments of patients undergoing transfers (n = 72061)		
Description	**n**	**%**
Patient Monitoring		
Non-Invasive Blood Pressure	25112	97,96%
SpO2 monitoring	24600	95,96%
Capnography	4236	16,52%
Electrocardiography	637	2,48%
ABG's	347	1,35%
Vascular Access		
Peripheral Intravenous Line	4434	17,30%
Central Venous Line	260	1,01%
Other, n<100	86	0,34%
IO	17	0,07%
Ventilation & Oxygenation		
Mechanical Ventilation (unspecified)	4693	18,31%
Passive oxygen devices	3365	13,13%
BVM Ventilation	247	0,96%
Indwelling attachments		
IC Drain	470	1,83%
Orogastric/Nasogastric Tube	210	0,82%
Urinary Catheter	203	0,79%
Medication Infusion Devices		
Infusion Device	1733	6,76%
Artificial Airways		
ET Tube	1597	6,23%
Oropharyngeal Airway	578	2,25%
Supraglottic Device	18	0,07%
Surgical Cric	14	0,05%
Circulation		
Transcutaneous Pacing	29	0,11%
Synchronised Cardioversion	5	0,02%
Total	**72061**	**100,00%**

Table 3:

Table 3: Medications administered during CCT (n=5564)		
Description	**n**	**%**
Analgesics		
Morphine Sulphate	1107	4,32%
Fentanyl	46	0,18%
Paracetamol	3	0,01%
CNS Depressants		
Midazolam	1651	6,44%
Ketamine	267	1,04%
Diazepam	111	0,43%
Propofol	89	0,35%
Lorazepam	34	0,13%
Etomidate	28	0,11%
Phenytoin	16	0,06%
Sodium Valproate	10	0,04%
Vasoactive/Inotropes		
Adrenaline	514	2,01%
Isordil	96	0,37%
Atropine	64	0,25%
Nitroglycerin IV	34	0,13%
Labetalol	33	0,13%
Phenylephedrine	2	0,01%
Anticoagulants or Thrombolytics		
Aspirin	25	0,10%
Clopidogrel	13	0,05%
Streptokinase	10	0,04%
Enoxaparin	1	0,00%
Electrolytes		
Magnesium Sulphate	187	0,73%
Sodium Bicarbonate	10	0,04%
Potassium Chloride	8	0,03%
Calcium Chloride	4	0,02%
Anti Emetics		
Metoclopramide	66	0,26%
Neuromuscular Blockers		
Rocuronium Bromide	391	1,53%
Suxamethonium	9	0,04%
Cisatracurium	6	0,02%
Antiarrythimitics		
Amiodarone	29	0,11%
Adenosine	3	0,01%
Bronchodilators		
Beta 2 Stimulants	135	2,42%
Ipratropium Bromide	55	0,99%
Aminophylline	1	0,02%

Steroids		
Corticosteroids	28	0,11%
Dexamethasone	2	0,01%
Betamethasone	1	0,00%
Furosemide	56	0,22%
Glucose	216	0,84%
Insulin	112	0,44%
TXA	11	0,04%
Antibiotics	12	0,05%
Other	68	0,27%
Total	**5564**	**100%**

Study 2:

Objectives:

This study examines local and international adult critical care retrieval training programs to inform the development of a contextually appropriate curriculum for South African Adult Critical Care Retrieval, aiming to address training gaps and improve patient outcomes in critical care transport.

Methods:

This scoping review aimed to explore critical care retrieval training programs and curricula internationally, with a specific focus on identifying literature relevant to South Africa. A comprehensive search strategy was developed, incorporating scientific databases and grey literature sources, guided by predefined eligibility criteria.

Results:

After screening and review, 47 sources were included: published articles and grey literature. The majority of the literature originated from high-income countries (HICs), with a smaller proportion from low- and middle-income countries (LMICs), including South Africa. Results revealed seven thematic categories aligning with existing frameworks for defining critical care retrieval services (CCRS). These categories encompassed additional skills and expanded scope, additional training, case selection and specific patient populations, dedicated crew, dedicated equipment, quality management, and continuing medical education.

Seven thematic categories derived from literature:

- Additional Skills/Expanded scope
- Additional Training
- Case selection/ Specific patient populations
- Dedicated Crew
- Dedicated Equipment
- Quality Management
- Continuing Medical Education

Topics included in Critical Care Paramedic Programmes:

Topics included in Critical Care Paramedic Programmes	
Clinical Teaching Additions	**Non-Clinical Skills**
Additional diagnostic training	Effective communication and decision-making skills
Advanced Airway Training	Ethical and professional behaviour
Advanced Ventilation techniques	Factors that influence safe care
Antibiotic Chemotherapy	Interprofessional teamwork
Flight Physiology	Safe, effective, person-centred care
Geriatric and Special	Patient Advocacy

needs patients	
ICU Medications and infusion	How to practice evidence-based medicine
Intra-Aortic Balloon Pump	
Special monitoring/assessment techniques (Ultrasonography, ABG Analysis, Invasive Haemodynamic monitoring)	
Transport and packaging considerations	
Transport Radiology	
	(35,51,75–82)

APPENDIX 8: LIST OF ABBREVIATIONS

ALS - Advanced Life Support

BEMC - Bachelor of Emergency Medical Care

CAD - Computer-Aided Dispatch

CCR - Critical Care Retrieval

CCRS - Critical Care Retrieval Service

CCFPs - Critical Care Flight Paramedics

CCP - Critical Care Paramedics

CCT - Critical Care Transfer

CME - Continuous Medical Education

CoP - Community of Practice

CPGs – Clinical Practice Guidelines

CQI – Continuous Quality Improvement

CRM – Crew Resource Management

CTBL – Clinical Teach Blending Learning

ECG - Electrocardiogram

ECP - Emergency Care Practitioner

ELO's – Exit Level Outcomes

EMS - Emergency Medical Services

ePCRS – Electronic Patient Care Report Forms

EtCO2 - End-Tidal Carbon Dioxide

HEMS – Helicopter Emergency Medical Services

HFS – High Fidelity Simulation

HICs – High-Income Countries

HPCSA - Health Professions Council of South Africa

ICU - Intensive Care Unit

IFTs – Inter-Facility Transfers

IQR – Interquartile ranges

LMICs - Low to Middle-Income Countries

MICU – Mobile Intensive Care Unit

MO - Medical Officers

NCDs – Non-Communicable Diseases

NDoH - National Department of Health

NECET - National Emergency Care Education and Training

NQF - National Qualifications Framework

PBEC – Professional Board for Emergency Care

PhD - Doctor of Philosophy

PISA – Post-Intubation Analgesia and Sedation

PRISMA-ScR – PRISMA Extension for Scoping Reviews

QI – Quality Improvement

REBOA – Resuscitative Endovascular Balloon Occlusion of the Aorta

RECORD - Reporting of studies Conducted using Observational Routinely collected health Data

RPL – Recognition of Prior Learning

SA - South Africa

SAQA - South African Qualifications Authority

ScR – Scoping Review

SO's – Specific Outcomes

STROBE - Strengthening the Reporting of Observational Studies in Epidemiology

TLA – Teach, Learning, and Assessment

UHC – Universal Healthcare

WC-EMS – Western Cape Emergency Medical Services