South African Emergency medical service personnel perceptions of research and evidence-based practice

by

Zamasiba Cynthia Dlamini

Division of Emergency Medicine,

University of Cape Town

DLMZAM017

This dissertation is submitted in partial fulfilment of the requirements for the degree Master of Philosophy: Clinical Emergency Care in the Faculty of Health Sciences at the University of Cape Town

Supervisor: A/Prof Colleen Saunders

Co-supervisor: Elzarie Theron

Division of Emergency Medicine, University of Cape Town

February 2025

Declaration

I, Zamasiba Cynthia Dlamini, hereby declare that the work on which this thesis is based is my original work (except where acknowledgements indicate otherwise) and that neither the whole work nor any part of it has been, is being, or is to be submitted for another degree in this or any other university. I authorise the University to reproduce for the purpose of research either the whole or any portion of the contents in any manner whatsoever. I further declare the following:

1. I know that plagiarism is a serious form of academic dishonesty.
2. I have read the document about avoiding plagiarism, am familiar with its contents and have avoided all forms of plagiarism mentioned there.
3. Where I have used the words of others, I have indicated this by the use of quotation marks.
4. I have referenced all quotations and properly acknowledged other ideas borrowed from others.
5. I have not and shall not allow others to plagiarise my work.
6. I declare that this is my own work.
7. I am attaching the summary of the Turnitin match overview.

Signature: Signed by candidate **Date: 16 February 2025……**

1. ABSTRACT

Background: Evidence based practice (EBP) is the deliberate application of up to date, best available evidence to make decisions about health care. The implementation of EBP includes five steps: asking the right question, accessing relevant evidence, appraising evidence for reliability and validity, applying evidence to patient care, and lastly assessing clinical practice. The aim of this study was to assess strength of beliefs about EBP, and the frequency of implementation of EBP in South African emergency medical service (EMS) personnel.

Methods: In this cross-sectional study we deployed an online survey of South African EMS personnel using two validated scales for measuring individual beliefs about EBP, their ability to implement it, and the extent of actual EBP implementation.

Results: There were 67 respondents who were predominantly male (77,6%, n=52), had a mean age of 41,1 (± 9,8) years, and represented a wide range of operational, management and education experience. Measured by the EBP beliefs scale, respondents had a favourable attitude towards EBP (Median score: 60, IQR:51-69). There was no significant difference between the median beliefs score between qualification categories (p=0,578). Responses to the EBP implementation scale items indicate that respondents were not routinely implementing EBP. The median score was 21 (IQR: 8-37). The three EBP activities that were implemented most frequently were informally discussing evidence from a research study with a colleague (n=25), accessing the clinical practice guidelines (n=25), and promoting the use of EBP to colleagues (n=25). Availability of, and access to, appropriate evidence, and a perceived lack of critical appraisal skills, were identified barriers to EBP. In addition, the nature of the patient-provider relationship and the lack of feedback loops limits the application of EBP in EMS.

Conclusion: The findings from this study indicate that respondents held favourable beliefs in EBP but identified several barriers to implementation of EBP. Supportive environments and training can facilitate the implementation of EBP principles in prehospital emergency medical care.

2. TABLE OF CONTENTS

3. ACKNOWLEDGEMENTS

I would like to express my deepest gratitude to the following individuals (superheroes) and institution for their invaluable support, dedication and guidance throughout my thesis journey.

To my Supervisor Associate Professor Colleen Saunders and my Co-supervisor Ms Elzarie Theron, I am immensely and forever grateful for your unwavering support, encouragement, guidance and constructive feedback. The journey hasn't been easy however, your dedication to this research has been a pillar of strength.

I would also like to extend my sincere gratitude towards my family especially my children for the love they've shown me and not forgetting Ms Abigail Seconds (MPhil administrative Officer) for the support, and my friend Mrs Hlengiwe Nzuza for the emotional support and checking up on me consistently.

Lastly, I thank the Heavenly Father for His mercies, love and grace.

4. LIST OF ABBREVIATIONS

AEA	Ambulance Emergency Assistant
BAA	Basic Life Support
CCA	Critical Care Assistant
EBM	Evidence based medicine
EBP	Evidence based practice
ECP	Emergency Care Practitioner
EIP	Evidence informed practice
EMS	Emergency Medical Services
HPCSA	Health Professions Council of South Africa
ILS	Intermediate Life Support
NQF	National Qualifications Framework
SA	South Africa

5. LIST OF TABLES

6. LIST OF FIGURES

7. PART A: LITERATURE REVIEW

Literature review objectives and search strategy

This narrative literature review sought to identify, review and summarise the available literature relating to evidence-based medicine (EBM) and evidence-based practice (EBP) in relation to prehospital paramedicine in South Africa. The objectives of the literature review were:

- To briefly describe the evolution of prehospital emergency medical care education in South Africa
- To briefly describe the concepts of EBM and EBP
- To summarise the existing literature on the perceptions, barriers, and facilitators to the implementation of EBP in paramedicine.

The University of Cape Town's library portal was used to access and conduct searches within the PubMed, EbscoHost, Google Scholar, and Elsevier-Scopus databases in order to identify relevant articles, non-systematic but targeted searches were conducted for each of the stated objectives using appropriate keywords, and further literature was identified from the reference lists of articles reviewed.

The evolution of prehospital emergency medical care education in South Africa

Historically, emergency care personnel in South Africa received training through non-credit-bearing short courses (one-week Basic Ambulance and Rescue Medic course) hence ambulances were driven by untrained personnel in the 1970's. In the early 1980's, the Pre-Hospital Care Committee, a division of the College of Medicine of South Africa, initiated other non-credit-bearing short courses such as the Emergency Medical Assistant I, followed by the Ambulance Medical Assistant II, and the Critical Care Assistant (CCA) course (1). Graduates of these programs registered with the South African Medical and Dental Council (now well-known as the Health Professions Council of South Africa (HPCSA)) but worked under the supervision of registered medical doctors and often lacked essential skills. The one-month Basic Ambulance Assistant (BAA) and three-month Intermediate Life Support Ambulance Emergency Assistant (AEA) courses were introduced in 1985. Furthermore, a four-month Advanced Life Support/CCA course was also developed, and later revised, to a five-month program with an experiential learning component added. Over time, training has become more structured and recognised with the introduction of formalised training programmes and the professionalization of emergency medical care services (1,2).

Emergency Medical Services (EMS) in South Africa is a vital public and private system that provides pre-hospital emergency care and transportation of patients to enhance healthcare outcomes and support universal health coverage. It operates as a hybrid model, consisting of government-funded provincial ambulance systems and private companies. The primary scope of EMS includes addressing medical and trauma emergencies, as well as accidents, with medical treatment ranging from basic to advanced life support. Professionalization of EMS training took place in 1987, when the three-year National Diploma in Ambulance and Emergency Technology was established and was later revised to a National Diploma in Emergency Medical Care which was presented by several Technikons and Ambulance Training Colleges (3). This progression continued with the introduction of a Bachelor of Technology (National Qualifications Framework (NQF) Level 7) and Bachelor of Health Sciences Degree in Emergency Medical Care (NQF Level 8), alongside the development of Master's and Doctoral programs. The offering of non-NQF aligned courses and the diploma programmes was stopped in 2019, and these programmes did not have research components incorporated into the curriculum. However, the NQF 7, and above programmes are the only pre-hospital qualifications that include basic research methodology training which includes exposure to the concepts of evidence-based medicine (EBM) (1,3,4). The overall practice of prehospital care is ensured through high-quality, patient-centered approaches and standardized procedures. This shift moves away from opinion-based practices towards care that is supported by scientific evidence through Evidence-Based Medicine.

Research highlights the inadequate organizational support for paramedics in engaging with research, noting a lack of time, training, and compensation that limits their participation. It emphasizes the importance of integrating research activities into the paramedic role to enhance their involvement. Benefits of EBP in the prehospital setting includes improved patient outcomes, better clinical decision-making, and increased consistency in care. EBP adherence is linked to enhanced patient survival and neurological outcomes, as well as standardized care that minimizes errors and optimizes resource use. However, the prehospital research also points out that the effective implementation of EBP is often hindered by various challenges faced by EMS personnel, which can restrict the positive impact of EBP in their practice.

Evidence based medicine

Evidence-Based Medicine (EBM) is the concept that clinical practice should integrate a clinician’s knowledge and expertise, the patient’s preferences and values, and the best available scientific evidence (5,6) into clinical care. This concept involves utilizing research-informed techniques or evidence to influence decision-making and guide patient care.

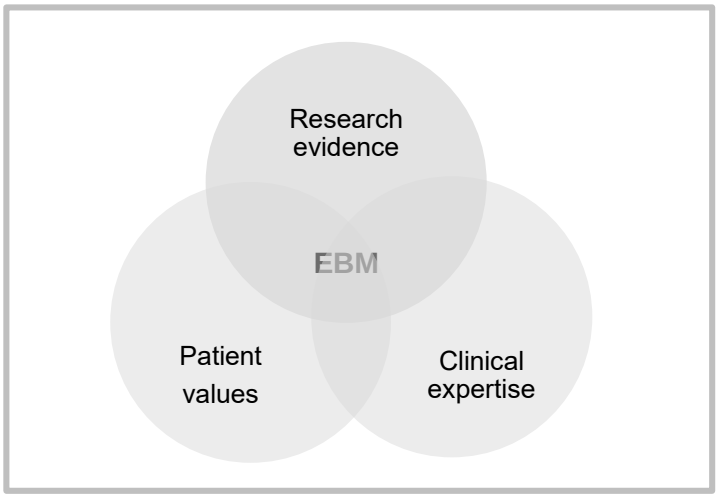


Figure 1: The three elements of Evidence-Based Medicine (EBM)

EBM is regarded as the intentional application of the most current and best available evidence to make informed decisions about necessary healthcare, ultimately improving patient outcomes and reducing healthcare costs (5). Despite its benefits, EBM faces challenges in application. Clinicians are overwhelmed with an ever-increasing volume of research findings, guidelines, and recommendations, which complicates their ability to identify what is relevant and applicable to practice (6). Greenhalgh et al (2015) suggested that "*those who produce and summarise research evidence must attend more closely to the needs of those who might use it*" (6). The current state of EBM emphasises the value of critical appraisal and expert opinion, however it has neglected other forms of evidence and has failed to centre qualitative research by facilitating communication among healthcare professionals, policymakers and patients in decision making (6).

Evidence-Based Practice

Evidence-based practice (EBP) is an evolving approach that inspires healthcare professionals to continually update their knowledge and skills (7). By integrating the best available evidence with clinical expertise and patient preferences, EBP aims to enhance patient outcomes and maintain high-quality care across various healthcare settings.

Despite the widespread adoption of EBP, challenges such as varied definitions and implementation barriers persist, highlighting the need for ongoing education and consensus-building among practitioners (8). The old definition of EBP was based on the practical application of the current best evidence to inform decision-making for individual patient care (8). This definition failed to identify the value of other factors involved in clinical decision-making. Jordan et al (2019) defined EBP in the Joanna Briggs Institute model as clinical decision-making that considers the best available evidence,

the context in which the care is delivered, patient values and preference, and the clinical judgment of the health professional (5). The current definition of EBP is therefore a problem-solving approach that uses the best available evidence, clinical expertise, and patient values and preferences to guide clinical decisions. The original use of EBP was for critical evaluation of the literature however, it has now been viewed as the gold standard for measuring high quality of care (9).

The implementation of EBP includes five steps which are: (i) asking the right question, (ii) accessing or searching for relevant evidence, (iii) appraising evidence for reliability and validity, (iv) applying evidence to patient care, and (v) assessing clinical practice regularly (Figure 2). Successfully implementing EBP necessitates a thorough understanding of the challenges associated with its adoption and sustainability in practice (7,10,11).

Figure 2: Five steps of Evidence Based Practice (EBP)

The application of best available scientific evidence highlights using high-quality research findings like systematic reviews and randomized controlled trials to inform clinical decisions. It integrates practitioners' clinical expertise with the best available evidence, considering each patient's individual values and preferences to provide patient-centred care. EBP recognizes the importance of considering patients as experts in their own lives, ensuring interventions are relevant and tailored to their specific needs and cultural contexts (9,11,12).

Critical assessment of Evidence-Based Practice

While EBP is often regarded as the gold standard in various disciplines particularly in healthcare, social sciences, and education, it is imperative to clarify what this means and consider the implications of its application as the gap between evidence and healthcare practice is well acknowledged (7,9,12). Melnyk and Fineout-Overholt (2014) in a two-round Delphi survey emphasize that the core of EBP involves systematically reviewing and applying research findings, combined with clinical judgment and patient preferences, to make informed healthcare decisions. The authors further advocates for organizational support, continuous education, and a culture that values evidence-based decision-making to fully realize these benefits. However, there has been controversy in the literature about whether evidence-informed practice (EIP) should be used instead of EBP (7,11).

While evidence plays a major role in practice, advocates of the change from EBP to EIP agree that if most interventions are to be successful, evidence should not outweigh the clinician's judgment and the patient's values and preferences (13). According to Nevo and Slonim-Nevo (2011), evidence should inform practice rather than be the basis for it. Furthermore, the authors suggested that a variety of information sources, clinical experiences, practical results, and case studies, should be used in a constructive manner throughout the process of intervening with patients, refuting the need for the steps of EBP or any other set process (13). Thus, patient's preferences and values, the clinician's experience, and evidence are all crucial components of the EBP decision-making process (7). Melnyk et al (2014) therefore proposed that the knowledge and abilities required for the efficient and reliable implementation of evidence in practice must be taught to graduates of healthcare training programs (7,13,14).

The key skills required for EBP comprise of critical appraisal abilities, knowledge of research methodologies, and the ability to apply research findings to clinical practice. Research conducted in a private intensive care unit found that barriers to implementing evidence-based practice include lack of knowledge about EBP, an inability to synthesize existing literature, individual beliefs guiding clinical judgment, and lack of information and reliable sources for evidence (5). Likewise, Mohamed et al (2024) suggested that investing in ongoing education and addressing barriers are essential to empower nurses to utilize EBP effectively, improve quality of care and improve patient outcomes (15). Literature further advocates for the use of EBP by health care practitioners and over the years health care professionals have been encouraged to adopt EBP as a gold standard (16,17). Studies suggest that the effectiveness of EBP educational programs and continuous professional development significantly influences prehospital emergency care personnel's ability to critically appraise literature

and make evidence-informed decisions. The barriers and facilitators to the implementation of EBP in the prehospital setting are not without challenges (18,19).

Perceptions towards evidence-based practice

Perceptions towards the implementation of EBP refer to the attitudes, beliefs, opinions, and experiences of healthcare professionals regarding interventions or practices that are based on the best available evidence (20,21). These perceptions can significantly influence how EBP is adopted and integrated into professional practice as they contribute to the challenges in implementing evidence-based practice. While many hold the belief that high-quality, peer-reviewed research is essential for making informed decisions, research suggests that attitudes have a significant impact on the retrieval of information and the modification of beliefs (20-22).

Attitudes toward EBP are beliefs of professionals regarding the use of research evidence in decision-making. These attitudes play a crucial role in determining the extent to which EBP is integrated into professional practice. Enhancing positive attitudes through educational initiatives, while simultaneously addressing existing barriers, can lead to improved outcomes (23). Additionally, Lanssens (2022) in their cross-sectional survey design of n=251, identified that, despite the acknowledged significance of EBP, practitioners face challenges in its implementation in routine practice. The author further suggests that lack of time (35.9%), insufficient access to resources (19,5%) and dearth of support within work environment (17.9%) simple acknowledging EBP's is inadequate (23,24).

Several studies have explored the perceptions, beliefs, barriers, knowledge, and facilitators of EBP within the nursing community (14,23,24). These studies have shown that nurses believe EBP enhances clinical care and improves patient outcomes (14,25,26). Similarly, Stokke et al (2014), in a study involving 185 nurses, observed that 86% expressed a strong belief that EBP guidelines can enhance practice and lead to optimal healthcare for patients (26). In contrast, Leonard and colleagues (2012) suggested that factors impeding engagement in research include low confidence levels, unclear study goals, concerns about liability and litigation, a lack of perceived research benefits, negative perceptions among allied health providers, and a general lack of professional development (27). Furthermore, Leonard et al (2012) highlighted that lack of communication and organisational support within EMS and prehospital researchers negatively impacts research efforts (27). According to Nesrin (2021), implementation of EBP is very low despite the positive beliefs (28). However, uncertainty about the relevance of research to clinical practice often deterred implementation. The findings indicated that positive beliefs about the benefits of EBP such as improved patient outcomes, were significant contributors to the adoption of evidence-based practices (26,28,29).

According to Hadgu (2013), 78% of nurses expressed a positive attitude toward EBP, however only 47% of nurses in their study expressed positive perceptions regarding the integration of EBP into clinical practice (30). Additionally, these results are consistent with the conclusions drawn by Sherriff et al (2007) which indicated that an EBP educational program led to a significant improvement in nurses' perceptions of organizational support and their confidence in finding and assessing research (31). Similarly, Hargreaves et al (2014) examined paramedics' attitudes and barriers regarding prehospital clinical trials (32). In this cross-sectional study, the results indicated that while there was clear interest and understanding of the research, there was also limited use of evidence, perceptions of inadequate knowledge regarding research methods, time constraints and lack of support for trial participation. These findings are consistent with that of the previous researchers (32).

Barriers to the implementation of evidence-based practice

To enhance research participation, it is essential to eliminate identified barriers, provide adequate training, and fostered a research-valuing environment. Barriers to the implementation of EBP refers to the challenges faced by researchers, organizations, and healthcare professionals when attempting to incorporate the best available evidence into practice. These barriers make it more difficult for research findings to be applied in clinical settings, which may have an effect on patient treatment and outcomes. Addressing these barriers is vital for successfully integrating EBP into clinical practice, ultimately improving the quality of care provided to patients. Time delays and lack of computer access were identified as key barriers affecting perceptions of EBP in pre-hospital care (27,28,30). The prehospital environment is diverse and unpredictable, which makes it difficult to control variables and ensure consistency. Researchers often face challenges in accessing patients, maintaining patient confidentiality, obtaining informed consent, and collecting data in high-stress, time-sensitive situations. Furthermore, pre-hospital care involves a diverse patient population, various conditions, and different treatment protocols, making it challenging to standardize care and compare outcomes (33). In a study conducted by Woods et al (2013) which focused on implementing evidence into practice, it was established that by educating health professionals and providing EBP mentors, professionals were able to successfully integrate the three elements of EBM in their clinical decision making (34).

Duncombe (2018) in a descriptive study of n = 100 nurses, 72.1% suggested that they had never attempted to use EBP before and the barriers indicated were insufficient resources for implementing research findings (85.2%) and (83.6%) had inadequate training in research methods (35). Likewise, Nakaye et al (2019) concluded in their systemic review examining barriers to EBP among nurses in

low-and middle-income countries (36). The review analysed 16 studies with n=8409 participants, identifying three main themes, (i) interdisciplinary barrier, institutional-related barriers and nurses related barriers. Lack of communication between academics, clinical practice settings and organisational factors, a discrepancy between nursing education and practice, a lack of teamwork, and a negative public perception of the nursing profession are suggested as the interdisciplinary barriers to EBP (33,36,37).

Organizational factors that impede research participation includes inadequate training, limited understanding of prehospital settings, excessive bureaucracy, time constraints, conflicts with existing standards, resistance to change, and incompatible structures. Concerns about patient safety also serve as a barrier to EBP implementation (38). Moreover, a lack of prioritization of EBP in organizational culture further contributes to barriers and limits access to research (38).

Another barrier to EBP is the belief that there is not enough power to modify patient care procedures, as research studies have frequently shown. To uncover the reasons for the inability to use research findings in clinical practice, Umarani (2011) observed that 72% of participants believed that a significant barrier to the adoption of EBP was a lack of authority to change patient care procedures and to compel administration and other staff members to cooperate in implementing the research findings (39). These results were consistent with those of other studies which found that the perception of inadequate authority was a significant deterrent to the adoption of EBP (38,40).

Facilitators of the implementation of evidence-based practice

Facilitators to the implementation of EBP refer to a number of factors, resources, or strategies that support and enhance the adoption and integration of research findings and evidence into clinical practice or decision-making processes. EBP emphasizes the use of the best available evidence, clinical expertise, and patient values to make informed decisions about healthcare. the key facilitators for enhancing EBP implementation comprise of strong leadership support, collaboration, provision of continuous education and training, easy access to resources, mentorship, and feedback mechanisms to measure benefits in practice (14). Similarly, McArthur and Bai (2021) in their qualitative study claimed that leadership support, adequate resources, and strategic opportunities are key to significantly facilitate the implementation (41). The essential elements that are recommended to promote EBP include collaborative decision-making, clearly defined roles, support from leadership, cooperation among practitioners, and effective communication (25,39,41,42).

Similarly, Chang (2014) highlighted in a cross-sectional study (n=386) the importance of mentoring and support from clinical facilitators in modifying nursing practice (43). Melnyk et al (2014) emphasized in a Delphi survey (n=80) the crucial role of EBP mentors in ensuring consistent implementation in healthcare settings (7,31). Accordingly, studies stress the significance of incorporating EBP into healthcare education for various professions to foster a culture of EBP among healthcare professionals. Moreover, addressing challenges such as lack of funding and resistance to change can enhance the integration of EBP and ultimately improve patient care. Li et al (2019) further highlights the importance of continuing education and training in equipping healthcare professionals with the necessary skills and knowledge to promote evidence-based interventions and enhance patient care (44).

Conclusion

The findings of this review demonstrate that implementing EBP, specifically interventions based on evidence synthesis, led to significant improvements in patient outcomes. The main barriers to the implementation of EBP include a lack of time, insufficient access to resources, and inadequate training. Addressing these barriers through education and organizational support is crucial for fostering a culture of EBP.

The studies above highlight the significant impact of organizational culture and support on the adoption of EBP in healthcare. Key facilitators include strong leadership, positive culture, and mentorship. Hence, having a dedicated EBP advocate within the healthcare team also aids in disseminating evidence-based information. Addressing barriers and adopting strategies such as training programs, creating a supportive environment, and improving access to research materials are crucial for effective EBP implementation. Patient involvement and empowerment are also key factors for better outcomes.

References

1. Sobuwa S, Christopher LD. Emergency care education in south africa: Past, present and future. Vol. 16, Australasian Journal of Paramedicine. Australasian College of Paramedicine; 2019.

2. Department of Health of South Africa. National Emergency Care Education and Training Policy. 2017;1–16. Available from: http://www.health.gov.za/index.php/2014-08-15-12-53-24/category/327-2017po?download=2126:national-emergency-care-education-and-training-policy

3. Kotze JM. The role of the ambulance service as part of the health profession A look at the past. Vol. 78, Atr Med J. 1990.

4. MacFarlane C, Van Loggerenberg C, Kloeck W. International EMS systems in South Africa - Past, present, and future. Resuscitation. 2005;64(2):145–8.

5. Jordan Z, Lockwood C, Munn Z, Aromataris E. The updated Joanna Briggs Institute Model of Evidence-Based Healthcare. Int J Evid Based Healthc. 2019 Mar 1;17(1):58–71.

6. Kelly MP, Heath I, Howick J, Greenhalgh T. The importance of values in evidence-based medicine. Vol. 16, BMC Medical Ethics. BioMed Central Ltd.; 2015.

7. Melnyk BM, Gallagher-Ford L, Long LE, Fineout-Overholt E. The establishment of evidence-based practice competencies for practicing registered nurses and advanced practice nurses in real-world clinical settings: Proficiencies to improve healthcare quality, reliability, patient outcomes, and costs. Worldviews Evidence-Based Nurs. 2014 Feb;11(1):5–15.

8. Sackett DL. Evidence-Based Medicine. Vol. 21, Seminars in Perinatology. 1997.

9. Fineout-Overholt E, Melnyk BM, Schultz A. Transforming health care from the inside out: Advancing evidence-based practice in the 21st century. J Prof Nurs. 2005 Nov;21(6):335–44.

10. Grant C, Osanloo A. Understanding, Selecting, and Integrating a Theoretical Framework in Dissertation Research: Creating the Blueprint for Your "House." Adm Issues J Educ Pract Res [Internet]. 2014;4(2). Available from: https://aij.scholasticahq.com/article/7-understanding-selecting-and-integrating-a-theoretical-framework-in-dissertation-research-creating-the-blueprint-for-your-house

11. Bernadette Mazurek MelnykFineout-overholt E, Stillwell SB, Kathleen M. The Seven Steps of Evidence-Based Practice. 2010;110(1):51–3.

12. Alblooshi SM, Razzak HA, Hijji FHR, Wishah MAM, Alkarbi M, Harbi AZ. Knowledge, Attitude and Implementation of Evidence-Based Practice among Nurses; A National Survey [Internet]. 2022. Available from: https://www.researchsquare.com/article/rs-2113129/v1

13. Nevo I, Slonim-Nevo V. The Myth of Evidence-Based Practice: Towards Evidence-Informed Practice. Br J Soc Work [Internet]. 2011 Sep 1;41(6):1176–97.

14. Tiwari R, Naidoo R, English R, Chikte U, Bernadette Mazurek Melnyk EF-O, Melnyk BM, et al. Evidence-Based Practice in Nursing & Healthcare: A Guide to Best Practice. Injury [Internet]. fourth edi. 2018 Dec 1;7(1):430–41. Available from: http://dx.doi.org/10.1016/j.injury.2015.07.004

15. Mohamed RA, Alhujaily M, Ahmed FA, Nouh WG, Almowafy AA. Nurses ' experiences and perspectives regarding evidence- - based practice implementation in healthcare context : A qualitative study. 2024;(December 2023):1–12.

16. Bergström A, Ehrenberg A, Eldh AC, Graham ID, Gustafsson K, Harvey G, et al. The use of the PARIHS framework in implementation research and practice - A citation analysis of the literature. Vol. 15, Implementation Science. BioMed Central Ltd; 2020.

17. Haycox A, Martin Antony. What is health economics? What is...? series. What is.? Ser [Internet]. 2009;(April):1–8. Available from: www.whatisseries.co.uk

18. Newton J, Smith ADAC. Ambulance clinicians implementing evidence-based practice: mind the gap! Attitudes, perceptions and experiences of student paramedics. Br Paramed J. 2023;8(3):11–9.

19. Cimino J, Braun C. Clinical Research in Prehospital Care: Current and Future Challenges. Vol. 13, Clinics and Practice. Multidisciplinary Digital Publishing Institute (MDPI); 2023. p. 1266–85.

20. Karki S, Acharya R, Budhwani H, Shrestha P, Chalise P, Shrestha U, et al. Perceptions and attitudes towards evidence based practice among nurses and nursing students in Nepal. Kathmandu Univ Med J [Internet]. 2016;13(52):308–15. Available from: https://pubmed.ncbi.nlm.nih.gov/27423280

21. Conner M, Armitage CJ. Extending the Theory of Planned Behavior: A Review and Avenues for Further Research. J Appl Soc Psychol [Internet]. 1998 Aug 31 [cited 2025 Feb 15];28(15):1429–64. Available from: https://onlinelibrary.wiley.com/doi/10.1111/j.1559-1816.1998.tb01685.x

22. Reid N, Amanat Ali A. Beliefs and Attitudes: Why do attitudes matter? In: Making sense of learning [Internet]. Switzerland: Springer Nature; 2020. p. 253–79. Available from: https://link.springer.com/10.1007/978-3-030-53677-0_11

23. Ghojazadeh M, Azami-aghdash S, Azar FP, Fardid M, Mohseni M. A systematic review on barriers , facilities , knowledge and attitude toward evidence-based medicine in Iran A systematic review on barriers , facilities , knowledge and attitude toward evidence-based medicine in Iran. 2015;(March).

24. Lanssens D, Goemaes R, Vrielinck C, Tency I. Knowledge, attitudes and use of evidence-based practice among midwives in Belgium: A cross-sectional survey. Eur J Midwifery [Internet]. 2022 Jun 10;6(June):1–9.

25. Melnyk BM, Fineout-Overholt E, Mays MZ. The evidence-based practice beliefs and implementation scales: Psychometric properties of two new instruments. Worldviews Evidence-Based Nurs. 2008;5(4):208–16.

26. Stokke K, Olsen NR, Espehaug B, Nortvedt MW. Evidence based practice beliefs and implementation among nurses: A cross-sectional study. BMC Nurs. 2014 Mar 25;13(1).

27. Leonard JC, Scharff DP, Koors V, Brooke Lerner E, Adelgais KM, Anders J, et al. A qualitative assessment of factors that influence emergency medical services partnerships in prehospital research. Acad Emerg Med. 2012;19(2):161–73.

28. Abu-baker NN, Abualrub S, Obeidat RF, Assmairan K. Evidence-based practice beliefs and implementations : a cross-sectional study among undergraduate nursing students. 2021;4–11.

29. Li S, Cao M, Zhu X, Ford C. Evidence-based practice: Knowledge, attitudes, implementation, facilitators, and barriers among community nurses-systematic review. Vol. 98, Medicine (United States). Lippincott Williams and Wilkins; 2019.

30. Hadgu G. Assessment of Nurses' Perceptions and Barriers on Evidence Based Practice in Tikur Anbessa Specialized Hospital Addis Ababa Ethiopia. Am J Nurs Sci. 2015;4(3):73.

31. Sherriff KL, Wallis M, Chaboyer W. Nurses' attitudes to and perceptions of knowledge and skills regarding evidence-based practice. Int J Nurs Pract. 2007;13(6):363–9.

32. Hargreaves K, Goodacre S, Mortimer P. Paramedic perceptions of the feasibility and practicalities of prehospital clinical trials : a questionnaire survey. 2014;499–504.

33. Maurin Söderholm H, Andersson H, Andersson Hagiwara M, Backlund P, Bergman J, Lundberg L, et al. Research challenges in prehospital care: the need for a simulation-based prehospital research laboratory. Vol. 4, Advances in Simulation. Advances in Simulation; 2019. p. 1–6.

34. Woods AD. Implementing evidence into practice. Lippincott's 2013 Nurs Career Educ Dir 5 [Internet]. 2013;43(2 SUPPL.1):4–6. Available from: http://www.nursingcenter.com

35. Duncombe DC. A multi-institutional study of the perceived barriers and facilitators to implementing evidence-based practice. J Clin Nurs. 2018 Mar 1;27(5–6):1216–26.

36. Shayan SJ, Kiwanuka F, Nakaye Z. Barriers Associated With Evidence-Based Practice Among Nurses in Low- and Middle-Income Countries: A Systematic Review. Vol. 16, Worldviews on Evidence-Based Nursing. Blackwell Publishing Ltd; 2019. p. 12–20.

37. Hargreaves K, Goodacre S, Mortimer P. Paramedic perceptions of the feasibility and practicalities of prehospital clinical trials: A questionnaire survey. Emerg Med J. 2014;31(6):499–504.

38. Damschroder LJ, Reardon CM, Widerquist MAO, Lowery J. Conceptualizing outcomes for use with the Consolidated Framework for Implementation Research (CFIR): the CFIR Outcomes Addendum. Implement Sci [Internet]. 2022;5:1–10. Available from: https://doi.org/10.1186/s13012-021-01181-5

39. J U. A study to assess the Perceived barriers to Evidence Based Practice among Registered Nurses. Asian J Biomed Pharm Sci [Internet]. 2014 Jun 15;4(32):15–9. Available from: http://www.jbiopharm.com/index.php/ajbps/article/view/485/442

40. Shayan SJ, Kiwanuka F, Nakaye Z. Barriers Associated With Evidence-Based Practice Among Nurses in Low- and Middle-Income Countries: A Systematic Review. Vol. 16, Worldviews on Evidence-Based Nursing. Blackwell Publishing Ltd; 2019. p. 12–20.

41. Mcarthur C, Bai Y, Hewston P, Giangregorio L, Straus S, Papaioannou A. Barriers and facilitators to implementing evidence-based guidelines in long-term care : a qualitative evidence synthesis. 2021;

42. Alatawi M, Aljuhani E, Alsufiany F, Aleid K, Rawah R, Aljanabi S, et al. Barriers of Implementing Evidence-Based Practice in Nursing Profession: A Literature Review. Am J Nurs Sci. 2020;9(1):35.

43. Chang CS. Moderating Effects of Nurses' Organizational Justice Between Organizational Support and Organizational Citizenship Behaviors for Evidence-Based Practice. Worldviews Evidence-Based Nurs. 2014;11(5):332–40.

44. Li S, Cao M, Zhu X. Evidence-based practice. Medicine (Baltimore) [Internet]. 2019 Sep 1;98(39):e17209. Available from: https://journals.lww.com/10.1097/MD.0000000000017209

8. PART B: MANUSCRIPT IN ARTICLE FORMAT

This article has been formatted in accordance with the African Journal of Emergency Medicine guidelines for authorship of original articles available here:

https://www.sciencedirect.com/journal/african-journal-of-emergency-medicine/publish/guide-for-authors

South African Emergency medical service personnel perceptions of research and evidence-based practice

Zamasiba Dlamini, Elzarie Theron, Colleen Saunders

Division of Emergency Medicine, Department of Family, Community and Emergency Care, University of Cape Town

Corresponding author:

A/Prof Colleen Saunders

Division of Emergency Medicine, Department of Family, Community and Emergency Care, University of Cape Town

Colleen.saunders@uct.ac.za

Word count: 2823

Figure count: 4

Table count: 3

Abstract

Background: Evidence based practice (EBP) is the deliberate application of up to date, best available evidence to make decisions about health care. The implementation of EBP includes five steps: asking the right question, accessing relevant evidence, appraising evidence for reliability and validity, applying evidence to patient care, and lastly assessing clinical practice. The aim of this study was to assess strength of beliefs about EBP, and the frequency of implementation of EBP in South African emergency medical service (EMS) personnel.

Methods: In this cross-sectional study we deployed an online survey of South African EMS personnel using two validated scales for measuring individual beliefs about EBP, their ability to implement it, and the extent of actual EBP implementation.

Results: There were 67 respondents who were predominantly male (77,6%, n=52), had a mean age of 41,1 (± 9,8) years, and represented a wide range of operational, management and education experience. Measured by the EBP beliefs scale, respondents had a favourable attitude towards EBP (Median score: 60, IQR:51-69). There was no significant difference between the median beliefs score between qualification categories (p=0,578). Responses to the EBP implementation scale items indicate that respondents were not routinely implementing EBP. The median score was 21 (IQR: 8-37). The three EBP activities that were implemented most frequently were informally discussing evidence from a research study with a colleague (n=25), accessing the clinical practice guidelines (n=25), and promoting the use of EBP to colleagues (n=25). Availability of, and access to, appropriate evidence, and a perceived lack of critical appraisal skills, were identified barriers to EBP. In addition, the nature of the patient-provider relationship and the lack of feedback loops limits the application of EBP in EMS.

Conclusion: The findings from this study indicate that respondents held favourable beliefs in EBP but identified several barriers to implementation of EBP. Supportive environments and training can facilitate the implementation of EBP principles in prehospital emergency medical care.

Deidentified data is available upon request to the corresponding author for use in accordance with the participant consent obtained and pending appropriate ethical approvals

Background

Evidence-Based Practice (EBP) is the deliberate application of the most up to date, best available evidence to make decisions about the required health care, improving patient outcome and reducing healthcare costs. Melnyk et al (2010) suggested that the 5-steps of EBP should include: asking the right question, searching for the best evidence, critically appraising the evidence, integrating evidence with expert opinion and patient preferences, and evaluating the outcomes of implementation (1). However, healthcare professionals often fail to adopt evidence-based methods and procedures that have been validated through scientific research, nor do they discontinue outdated practices that have been demonstrated to be ineffective (2). This gap between evidence and practice frequently stems from challenges in integrating best practices into actual patient care that has been highlighted mostly in nursing research. Nursing research plays a critical role in patient care as they constitute the largest segment of healthcare providers.

The implementation of EBP should be evaluated to ensure that healthcare delivery is based on the best available evidence, and improved quality of care, which ultimately contributes to better patient outcomes. Melnyk et al (2008) previously developed two EBP scales to measure nurses attitudes, knowledge and implementation of EBP (3). The scales were completed voluntarily by 394 nurses participating in continuing education sessions. The first scale consists of 16 items measuring an individuals' beliefs about EBP and their ability to implement it, while the second scale, consisting of 18 items measured the extent of actual EBP implementation. The validity and reliability of both instruments were assessed through psychometric properties. The scales demonstrated good internal consistency (3-5). By using these two validated scales researchers and healthcare organizations can assess strength of beliefs about EBP and implementation to enhance clinical practice.

There is a significant lack of research in the field of emergency care, particularly concerning low and middle-income countries (LMIC) (6). The relative scarcity of research in emergency care may be attributed to the perceived barriers identified in by van Hoving and Brysiewicz (2017), which indicated that lack of training, research funding, and time, among other factors, hinders increased research involvement in African emergency care (7). Tiwari et al (2018) further indicate in their study that one of the primary obstacles to the knowledge and development of emergency care structures is the limited number of researchers who are adequately skilled and funded to conduct research (5). This suggests that integrating EBP into training curricula and ongoing staff development by providing students with opportunities to engage in information-seeking and critical appraisal can enhance attitudes toward research (8). Similarly, Majid et al (2011) found that heavy workloads and the challenge of keeping up with new evidence can be significant obstacles; however, incorporating EBP into training could prove beneficial (8). Perhaps, early introduction to the fundamentals of EBP during

undergraduate studies, may contribute to the concept of “best practice” and confident application of EBP as suggested by McInerney (9). Therefore, the aim of this study was to assess South African emergency medical service personnel strength of beliefs about EBP, and the frequency of implementation of EBP using a validated, cross-sectional survey.

Methodology

Design, population and sampling

A quantitative research approach was adopted in this observational, cross-sectional study using a self-administered survey to collect data. The study took place in South Africa amongst public and private sector EMS. The research employed convenience and snowball sampling methods, with the sampling frame consisting of all emergency medical services (EMS) personnel registered with the Health Professions Council of South Africa (HPCSA) Professional Board for Emergency Care.

Recruitment and data collection

Ethical approval was obtained from University of Cape Town Human Ethics and Research Committee (HREC Ref 236/2024). The distribution was carried out using work-based email databases and public social media platforms, with prior permission obtained from the respective administrators of these accounts. Participants were encouraged to share the study invitation with their colleagues. The self-administered survey was distributed electronically using email and social media platforms and data was captured using a mobile-friendly Google form. Data was collected anonymously over a six week period in November and December 2024 and survey settings only allowed one response per internet protocol address. The survey consisted of five sections, including study information and consent, the previously published Melnyk (2008) Evidence-Based Practice Beliefs Scale, the Evidence-Based Practice Implementation Scale, participant demographics and identifying barriers and facilitators of EBP.

Participants were categorised based on their pre-hospital emergency medical care qualifications into those who had not been exposed to research methodology training in their undergraduate curriculum (non-NQF aligned short courses and NQF 5 and 6 qualifications), those who had been exposed to research methodology training in their undergraduate curriculum only (Bachelor’s degrees, NQF 7 and 8), and those who had completed postgraduate qualifications (Masters and doctoral studies).

Data analysis

Response data was analysed using IBM® SPSS® software version 30.0.0 (IBM Corp., Armonk, New York, USA) was used for analysis. Descriptive statistics were performed for all response variables. A Kruskal-Wallis test was used to test for differences in median scale scores between groups.

Results

The majority of study participants fell within the 30 - 59 age ranges however, the high proportion of participants (34.3%) aged 30 to 39 and (31.3%) aged 40 - 49 was observed and considered beneficial for the study, as this demographic is generally assumed to be more mature and objective. The age distribution is presented in Figure 3.

Demographic Variables	Category	Frequency	Percent
A1. Age	< 29 years	7	10.4%
	30 - 39 years	23	34.3%
	40 - 49 years	21	31.3%
	50 – 59 years	15	22.4%
	60 and above	1	1.5%
A2. Gender	Male	52	78%
	Female	15	22%

Figure 3: Demographic representation of the total population

Gender

There were significantly fewer females (22%) than males (78%) and this is suggests that male emergency care personnel in the South African provinces are predominant in all categories and sectors of EMS.

There were 67 respondents to the survey. Respondents were predominantly male (77,6%, n=52) and had a mean age (± standard deviation) of 41,1 (± 9,8) years. The majority of participants had completed undergraduate or non-NQF aligned short courses that did not include research methodology training (43,3%, n=29), while just under a third held undergraduate Bachelor's degrees that included research methodology training (29,9%, n=20). The remaining respondents had completed postgraduate studies in addition to their undergraduate training (26,9%, n=18), with four (6,0%) holding doctoral degrees. As depicted in Figure 3, respondents represented a wide range of operational, management and education experience.

Participants predominantly worked in the public sector (62,7%, n=42), and the majority were working in an urban area (74,6%, n=50). A third of participants were working in KwaZulu-Natal (35,8%, n=24), followed by Gauteng (26,9%, n=18), and the Western Cape (13,4%, n=9) and seven of the 11 South African Provinces were represented in the sample.

The respondents held a favourable attitude towards EBP however their confidence in the application of EBP was less favourable (Table 1). The median score from this instrument was 60 (Interquartile range (IQR): 51-69) out of a possible score between 16 and 80. There was no significant difference between the median beliefs score between qualification categories (p=0,578). The analysis of endorsement of each EBP belief scale item indicated that participants largely hold a strong belief regarding the value of EBP. However, statements indicating their belief in their ability to implement and overcome barriers to EBP received reduced endorsement.

Table 1: Percentage endorsement (strongly agree or agree) of items on the EBP beliefs scale (N=67).

Evidence-based practice (EBP) beliefs scale item	**Strongly agree or agree** n (%)
I believe that EBP results in the best clinical care for patients.	55 (82,1%)
I am clear about the steps of EBP.	45 (67.2%)
I am sure that I can implement EBP.	45 (67.2%)
I believe that critically appraising evidence is an important step in the EBP process.	52 (77.6%)
I am sure that evidence-based guidelines can improve clinical care.	53 (79.1%)
I believe that I can search for the best evidence to answer clinical questions in a time efficient way.	38 (56.7%)
I believe that I can overcome barriers in implementing EBP.	31 (46.2%)
I am sure that I can implement EBP in a time efficient way.	34 (50.7%)
I am sure that implementing EBP will improve the care that I deliver to my patients.	53 (79.1%)
I am sure about how to measure the outcomes of clinical care.	35 (52.2%)
I believe that EBP takes too much time. (*reverse scored*)	11 (16.4%)
I am sure that I can access the best resources in order to implement EBP.	37 (55.2%)
I believe EBP is difficult. (*reverse scored*)	15 (22.4%)
I know how to implement EBP sufficiently enough to make practice changes.	30 (44,8%)
I am confident about my ability to implement EBP where I work.	36 (53,7%)
I believe the care that I deliver is evidence-based.	46 (68,7%)

Responses to the EBP implementation scale items indicate that respondents were not routinely implementing EBP (Table 2).

Table 2: Percentage endorsement (strongly agree or agree) of items on the EBP implementation scale (N=67).

Evidence-based practice (EBP) implementation scale item	**5 or more times in last 8 weeks** n (%)
Used evidence to change my clinical practice.	15 (22.4%)
Critically appraised evidence from a research study.	21 (31.3%)
Generated a research question (PICO) about my clinical practice	8 (11.9%)
Informally discussed evidence from a research study with a colleague	25 (37.3%)
Collected data on a patient problem	14 (20.9%)
Shared evidence from a study/ies in the form of a report/presentation to >2 colleagues	13 (19.4%)
Evaluated the outcomes of a practice change	8 (11.9%)
Shared an EBP guideline	21 (31.3%)
Shared evidence from a research study with a patient/family member	17 (25.3%)
Shared evidence from a research study with a multidisciplinary team member	14 (20.9%)
Read and critically appraised a clinical research study	20 (29.9%)
Accessed the Cochrane database of systematic reviews	11 (16.4%)
Accessed the Clinical Practice Guidelines	25 (37.3%)
Used an EBP guideline or systematic review to change clinical practice where I work	18 (26.9%)
Evaluated a care initiative by collecting patient outcome data	9 (13.4%)
Shared the outcome data with collected with colleagues	9 (13.4%)
Changed practice based on patient outcome data	14 (20.9%)
Promoted the use of EBP to my colleagues	25 (37.3%)

The median score from this instrument was 21 (IQR: 8-37) out of a maximum score of 72. The three EBP activities that were implemented most frequently were informally discussing evidence from a research study with a colleague (n=25), accessing the clinical practice guidelines (n=25), and promoting the use of EBP to colleagues (n=25). Scale items related to generating and answering a research question, and evaluating outcomes, were performed infrequently. There was no significant difference between the distribution of implementation scores between qualification categories (p=0,062). However, it is possible that the study was underpowered to detect this effect as the

pairwise comparison between those participants who were exposed to research methodology training in their undergraduate studies and those who had undertaken further postgraduate training was statistically significant (p=0,018; Figure 4).

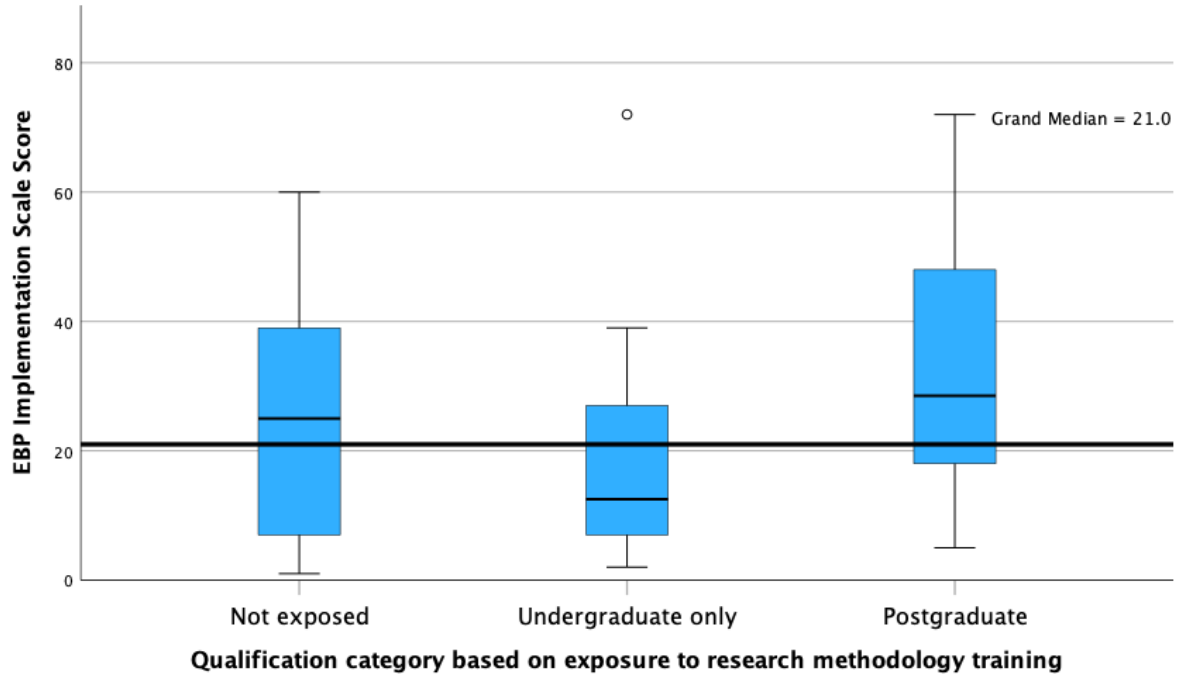


Figure 4: Comparison of EBP Implementation scale scores between qualification categories

The barriers to implementing each of the five steps of EBP identified by participants are provided in Table 3.

Table 3: Barriers to implementing the five steps of EBP as identified by study participants.

EBP Implementation step	Barrier
Ask a clinical research question	Time constraints due to workload.
	Lack of confidence in formulating a research question.
	Inability to identify a research gap from the literature.
	Lack of supportive environment and research culture.
	Lack of appropriate training during undergraduate studies.
	Lack of interest.
Acquire the best evidence	Access to appropriate evidence is blocked by paywalls.
	Time constraints due to workload.
	Available evidence is not contextually relevant.
	Access to internet and computers.
	Knowing where to look for evidence.
Appraise the evidence	Lack of training in critical appraisal.
	Limited opportunities to practice critical appraisal.
	Time constraints due to workload.
Apply the evidence	Prehospital care is scope and guideline driven.
	Timescale of each patient-provider interaction.
	Generalist nature of EMS.
	Current clinical governance processes.
	Uncertainty on how to integrate evidence into care.
	Resistance to change from medical insurance providers.

	Lack of training in evaluation and analytical approaches.
Evaluate the outcome	Access to outcome data.
	Short patient contact times.

One particular response captures a fundamental challenge to EBP in EMS - "*You also do not develop a long term patient-clinician relation(ship) where you can leave that space, do the relevant research, and then come back at a later date to discuss the outcomes of the systematic review"* suggesting that the nature of the patient-provider relationship and the lack of feedback loops which assist the provider to evaluate practice based on clinical outcome limits the application of EBP in EMS.

Discussion

The most important finding in this study was that respondents held a strong belief in the value of EBP, but lacked the confidence to implement aspects of EBP. Melnyk et al (2010) concluded in their study that nurses' believed that EBP improves the clinical care and outcomes of patients (1). Similarly, Stokke et al (2014) suggested that n=185 (86%) nurses demonstrated a strong belief that EBP guidelines can improve practice and results in the best health care for patients (10). These results are consistent with Sherriff et al (2007) findings that the EBP educational program led to a significant improvement in nurses' perceptions of organizational support and confidence in their ability to find and assess research (11). Likewise, Lanssens (2022) found that midwives believed in the importance of EBP but also felt that it was challenging to apply in their everyday work (12).

This study also identified several factors that are barriers to EBP in the context of prehospital emergency care. Firstly, participant's infrequently generated research questions related to their practice and identified barriers included time constraints due to work load, lack of supportive environment and research culture, insufficient training during undergraduate studies, and a lack of interest. Secondly, the study identified that the rapid transition of patients from EMS to an emergency care facility hindered the establishment of a feedback loop and the evaluation of practices based on the patients' clinical outcomes. Additionally, participants highlighted their inability to apply evidence, identify research gaps in the literature and their lack of confidence in formulating research questions. According to Lanssens et al (2022), the barriers to EBP was time constraints, the use of evidence-based clinical guidelines, access and organisational support (12). Chang et al (2010) further emphasizes the importance of mentoring and support from clinical facilitators in modifying nursing practice (13). Similarly, Melnyk et al (2014) stresses the crucial role of EBP mentors in ensuring consistent implementation in healthcare settings (14). Mohamed et al (2024) recommended that investing in

ongoing education especially improving the skills required in formulating research question, and to effectively retrieve and apply EBP into clinical practice improving quality of care and improve patient outcomes (15).

One of the primary barriers to acquiring the best available evidence was the inability to access publications behind pay walls other than through academic institutions libraries. This is concerning and makes a strong case for why clinical evidence must be published under open access. Bruijns et al (2019) highlighted challenges in accessing published articles without a subscription. In their study of 500 articles, they found that n=167 (33%) were easily accessible, while n=111 (22%) required subscription access, thereby limiting access for researchers without institutional support. The other 204 (61%) articles were only accessible through alternative access (5). Other factors that limit the ability to acquire the appropriate evidence include limitations in the availability of contextually relevant evidence, as much of the emerging evidence base in prehospital care emanates from high-income settings and is not generalisable to the South African public health and private sector. Furthermore, paramedicine research is still in its early stages, and the quality of the evidence that is currently available may still be lacking (15). Simpson et al (2012) suggested that paramedics that had tertiary education were more supportive of EBP than those with vocational studies (16). Furthermore, 98% of respondents demonstrated willingness to adjust their clinical practices, 32% indicated that they were 'extremely likely' to implement changes, while 44% claimed to be 'very likely' to do so (16).

Studies indicate that evidence-based nursing encounters challenges such as lack of education and training, time constraints, and insufficient knowledge regarding EBP (17,18). This study also revealed that n=13 participants identified a lack of knowledge and training as significant barriers to the implementation of EBP, while n=20 participants highlighted the importance of knowledge and training in supporting EBP. Moreover, the study conducted by Alblooshi (2022) found that nurses' implementation and knowledge of EBP were relatively moderate, while their attitudes toward EBP appeared to be positive (19).

The unpredictable nature of prehospital environment makes it difficult to maintain consistency and control variables. Moreover, factors such as time-consuming trial protocols and limited access to computer resources are the key barriers in the adoption and effective implementation of evidence-based practices in prehospital care settings (20-23). The barriers and facilitators identified in this study were largely consistent with those reported in the majority of existing literature (24). Traditionally, paramedicine education has predominantly focused on practical training (skills based) in the field, with comparatively less emphasis on research and skills assessment (15). However, there has been a substantial increase in research knowledge within the field of paramedicine, and many jurisdictions globally are transitioning towards higher education standards (25). Hoving et al. (2017) found that

most participants (134 of 168) viewed research as a valuable teaching tool, with n=137 emphasizing its role in critical thinking (5). Similarly, Duncombe (2018) further suggested that the primary facilitators recognized were: "Research methods training" 54 (88.5%) and "Evidence-based organizational policies and protocols" n=53 (86.9%) (26). Additionally, it is acknowledged that practitioners should stay updated on clinical research (7). Likewise in this study, several participant identified gaps in knowledge and skills, and inadequate resources as barriers and facilitator to EBP (5,7). Albarqouni et al. (2018) emphasized the importance of developing structured educational programs to support EBP for healthcare professionals (27). Also highlighted is the need for enhanced methods to evaluate the impact of these programs on clinical practice and patient care (25,28).

Manal Elmagd (2024), concluded that nursing students believe that the application of EBP would enhance their critical thinking abilities, increase their confidence in clinical decision-making, and improve patient care (29). The importance of utilizing evidence-based resources, such as clinical practice guidelines, to inform the practice should be acknowledged. However, access to technological resources and the capability to collect, organize, and analyse data, the skills required to gather higher-level evidence is often encountered. The literature review highlights solutions such as health technologies (easily accessible applications without mandated subscriptions), collaboration between EMS and hospitals, and standardized protocols and guidelines (9,30,31).

In this study, as well as in several others, the lack of adequate facilities was identified as a significant barrier preventing emergency medical care personnel from effectively applying research findings (32). Additionally, the study revealed that higher levels of education correlated with an improved knowledge and understanding of EBP. The barriers to the implementation of EBP in emergency medical care settings identified in the study were; lack of knowledge and skills, inadequate time allocation, access to outcome data and short patient contact times. According to Daphne Duncombe (2018), n=52 (85.2%) nurses surveyed indicated that a lack of necessary resources, despite their desire to apply EBP, deliver high-quality care and improve patient outcomes, is a significant barrier to the implementation of EBP (26). Likewise, Jacob Joy Nkeiruka et al. suggested that n=105 (82%) nurses surveyed had a good understanding of EBP, while 53% exhibited a negative attitude, and 70% demonstrated poor evidence-based nursing practices (31). Training, workshops, and resources that support EBP can improve efficiency and reduce uncertainty in healthcare. The study highlighted that well-organized systems are crucial for helping healthcare workers use research in their practice.

This study has some limitations. Although the sample was encouragingly diverse, the study was likely underpowered to detect differences in EBP perceptions and implementation between qualification categories, and the limited sample size may restrict generalisability.

Conclusion

The several barriers to the implementation of EBP in the South African prehospital environment, includes issues related to access to appropriate evidence, resources, time, lack of training in research methodology and critical appraisal and the nature of the patient-provider relationship in a generalist discipline. Despite a generally positive attitude towards EBP among emergency care personnel, significant challenges remain in integrating evidence into clinical practice, necessitating future initiatives to address historical barriers and improve EBP consistency.

Recommendations

To overcome these barriers, the authors recommend focusing on improving access to high-quality evidence, offering continuous education and training in research and critical appraisal skills, and addressing logistical and relational barriers to promote the consistent integration of evidence-based practices within the South African prehospital environment.

Acknowledgement

I would like to express my deepest gratitude to the following individuals (superheroes) and institution for their invaluable support, dedication and guidance throughout my thesis journey.

To my Supervisor Associate Professor Colleen Saunders and my Co-supervisor Ms Elzarie Theron, I am immensely and forever grateful for your unwavering support, encouragement, guidance and constructive feedback. The journey hasn't been easy however, your dedication to this research has been a pillar of strength.

I would also like to extend my sincere gratitude towards my family especially my children for the love they've shown me and not forgetting Ms Abigail Seconds (MPhil administrative Officer) for the support, and my friend Mrs Hlengiwe Nzuza for the emotional support and checking up on me consistently.

Lastly, I thank the Heavenly Father for His mercies, love and grace.

Author contribution

Associate Professor Colleen Saunders: Supervisor.: **Ms Elzarie Theron**: Co-supervisor.: **Zamasiba Dlamini:** Writing and reviewing

Declaration

The authors declare that they have no known competing financial interest or personal relationships that could have appeared to influence the work reported in this article. This includes, but not limited

to, employment, paid expert testimony, honoraria, grants or patents received or pending and any other potential source of bias.

References

1. Bernadette Mazurek MelnykFineout-overholt E, Stillwell SB, Kathleen M. The Seven Steps of Evidence-Based Practice. 2010;110(1):51–3.

2. Rengerink KO, Zwolsman SE, Ubbink DT, Mol BWJ, Van Dijk N, Vermeulen H. Tools to assess Evidence-Based Practice behaviour among healthcare professionals. Vol. 18, Evidence-Based Medicine. 2013. p. 129–38.

3. Melnyk BM, Fineout-Overholt E, Mays MZ. The evidence-based practice beliefs and implementation scales: Psychometric properties of two new instruments. Worldviews Evidence-Based Nurs. 2008;5(4):208–16.

4. Fineout-Overholt E, Melnyk BM, Schultz A. Transforming health care from the inside out: Advancing evidence-based practice in the 21st century. J Prof Nurs. 2005 Nov;21(6):335–44.

5. Tiwari R, Naidoo R, English R, Chikte U, Bernadette Mazurek Melnyk EF-O, Melnyk BM, et al. Evidence-Based Practice in Nursing & Healthcare: A Guide to Best Practice. Injury [Internet]. fourth edi. 2018 Dec 1;7(1):430–41. Available from: http://dx.doi.org/10.1016/j.injury.2015.07.004

6. Holliman R, Wallis L, Saunders C. Determining the research priorities for emergency care within the Western Cape province of South Africa: A consensus study. African J Emerg Med [Internet]. 2024;14(1):1–6. Available from: https://doi.org/10.1016/j.afjem.2023.11.007

7. Van Hoving DJ, Brysiewicz P. Les attitudes et pratiques des fournisseurs de soins d'urgence en Afrique en matière de recherche. African J Emerg Med. 2017;7(1):9–14.

8. Majid S, Foo S, Luyt B, Zhang X, Theng Y, Chang Y, et al. Adopting evidence-based practice in clinical decision making: nurses' perceptions, knowledge, and barriers. J Med Libr Assoc [Internet]. 2011;99(3):229–36.

9. McInerney P, Suleman F. Exploring Knowledge, Attitudes, and Barriers Toward the Use of Evidence-Based Practice Amongst Academic Health Care Practitioners in Their Teaching in a South African University: A Pilot Study. Worldviews Evidence-Based Nurs [Internet]. 2010;(April 2018).

10. Stokke K, Olsen NR, Espehaug B, Nortvedt MW. Evidence based practice beliefs and implementation among nurses: A cross-sectional study. BMC Nurs. 2014 Mar 25;13(1).

11. Sherriff KL, Wallis M, Chaboyer W. Nurses' attitudes to and perceptions of knowledge and skills regarding evidence-based practice. Int J Nurs Pract. 2007;13(6):363–9.

12. Lanssens D, Goemaes R, Vrielinck C, Tency I. Knowledge, attitudes and use of evidence-based practice among midwives in Belgium: A cross-sectional survey. Eur J Midwifery [Internet]. 2022 Jun 10;6(June):1–9.

13. Chang CS. Moderating Effects of Nurses' Organizational Justice Between Organizational Support and Organizational Citizenship Behaviors for Evidence-Based Practice. Worldviews Evidence-Based Nurs. 2014;11(5):332–40.

14. Melnyk BM, Gallagher-Ford L, Long LE, Fineout-Overholt E. The establishment of evidence-based practice competencies for practicing registered nurses and advanced practice nurses in real-world clinical settings: Proficiencies to improve healthcare quality, reliability, patient outcomes, and costs. Worldviews Evidence-Based Nurs. 2014 Feb;11(1):5–15.

15. Bowles KA, Batt AM, O'Toole M, Knox S, Hemingway L, Williams J, et al. Identifying the essential

elements to inform the development of a research agenda for Paramedicine in Ireland: a Delphi Study. Heal Res Policy Syst. 2024 Dec 1;22(1).

16. Simpson P, Bendall JC. Beliefs and expectations of paramedics towards evidence-based practice and research. 2012;(September).

17. Alatawi M, Aljuhani E, Alsufiany F, Aleid K, Rawah R, Aljanabi S, et al. Barriers of Implementing Evidence-Based Practice in Nursing Profession: A Literature Review. Am J Nurs Sci. 2020;9(1):35.

18. McArthur C, Bai Y, Hewston P, Giangregorio L, Straus S, Papaioannou A. Barriers and facilitators to implementing evidence-based guidelines in long-term care: a qualitative evidence synthesis. Implement Sci [Internet]. 2021 Dec 9;16(1):70.

19. Alblooshi SM, Razzak HA, Hijji FHR, Wishah MAM, Alkarbi M, Harbi AZ. Knowledge, Attitude and Implementation of Evidence-Based Practice among Nurses; A National Survey [Internet]. 2022.

20. Abu-baker NN, Abualrub S, Obeidat RF, Assmairan K. Evidence-based practice beliefs and implementations : a cross-sectional study among undergraduate nursing students. 2021;4–11.

21. Hadgu G. Assessment of Nurses' Perceptions and Barriers on Evidence Based Practice in Tikur Anbessa Specialized Hospital Addis Ababa Ethiopia. Am J Nurs Sci. 2015;4(3):73.

22. Leonard JC, Scharff DP, Koors V, Brooke Lerner E, Adelgais KM, Anders J, et al. A qualitative assessment of factors that influence emergency medical services partnerships in prehospital research. Acad Emerg Med. 2012 Feb;19(2):161–73.

23. Hargreaves K, Goodacre S, Mortimer P. Paramedic perceptions of the feasibility and practicalities of prehospital clinical trials: A questionnaire survey. Emerg Med J. 2014;31(6):499–504.

24. Maurin Söderholm H, Andersson H, Andersson Hagiwara M, Backlund P, Bergman J, Lundberg L, et al. Research challenges in prehospital care: the need for a simulation-based prehospital research laboratory. Vol. 4, Advances in Simulation. Advances in Simulation; 2019. p. 1–6.

25. Newton J, Smith ADAC. Ambulance clinicians implementing evidence-based practice: mind the gap! Attitudes, perceptions and experiences of student paramedics. Br Paramed J. 2023;8(3):11–9.

26. Duncombe DC. A multi-institutional study of the perceived barriers and facilitators to implementing evidence-based practice. J Clin Nurs. 2018 Mar 1;27(5–6):1216–26.

27. Albarqouni L, Hoffmann T, Straus S, Olsen NR, Young T, Ilic D, et al. Core Competencies in Evidence-Based Practice for Health Professionals: Consensus Statement Based on a Systematic Review and Delphi Survey. JAMA Netw open. 2018;1(2):e180281.

28. Hargreaves K, Goodacre S, Mortimer P. Paramedic perceptions of the feasibility and practicalities of prehospital clinical trials : a questionnaire survey. 2014;499–504.

29. Abo Elmagd MH, Alharbi M. Nursing Students' Beliefs and Willingness to Implement Evidence-Based Nursing Practice at Umm Al-Qura University: A Descriptive Cross-Sectional Study. Cureus. 2024 Apr 18;

30. Li S, Cao M, Zhu X. Evidence-based practice.

31. Nkeiruka, Agbapuonwu, Yarhere. Knowledge, Attitude and Practice of Evidence-Based Nursing among Nurses in Children's Ward at Tertiary Health Institutions in Anambra State, Nigeria. African J Heal Nurs Midwifery [Internet]. 2024 Jun 13;7(2):115–40.

9. PART C: APPROVED RESEARCH PROPOSAL

Emergency medical service personnel perceptions of research and evidence-based practice

by

Zamasiba Cynthia Dlamini

Division of Emergency Medicine,

University of Cape Town

DLMZAM017

This proposal is submitted in partial fulfilment of the requirements for the degree Master of Philosophy: Clinical Emergency Care in the Faculty of Health Sciences at the University of Cape Town

Supervisor: Dr Colleen Saunders

Co-supervisor: Elzarie Theron

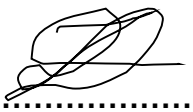
Division of Emergency Medicine, University of Cape Town

August 2023

Declaration

I, Zamasiba Cynthia Dlamini, hereby declare that the work on which this thesis is based is my original work (except where acknowledgements indicate otherwise) and that neither the whole work nor any part of it has been, is being, or is to be submitted for another degree in this or any other university. I authorise the University to reproduce for the purpose of research either the whole or any portion of the contents in any manner whatsoever. I further declare the following:

8. I know that plagiarism is a serious form of academic dishonesty.
9. I have read the document about avoiding plagiarism, am familiar with its contents and have avoided all forms of plagiarism mentioned there.
10. Where I have used the words of others, I have indicated this by the use of quotation marks.
11. I have referenced all quotations and properly acknowledged other ideas borrowed from others.
12. I have not and shall not allow others to plagiarise my work.
13. I declare that this is my own work.
14. I am attaching the summary of the Turnitin match overview.



Signature: …… Date: 13 June 2023……

Background

Evidence-Based Practice (EBP) is the idea that clinical practice should be based on the integration of the clinician's knowledge and expertise, the patient's preferences and values, and the best available scientific evidence (1). EBP is the use of research-informed techniques or evidence to impact decision-making and planned patient care. It is viewed as the deliberate application of the most up-to-date, best available evidence to make decisions about the required health care, improving patient outcome and reducing health costs (2-4). However, health care professionals often fail to implement revised methods and procedures that have undergone scientific research validation, or to disregard old practices that have been determined ineffective (2). This evidence-practice gap often occurs as a result of the inability to integrate best practice with actual care (34).

To overcome this challenge, it is necessary to implement the five steps of the EBP model which includes asking the right question, accessing or searching for relevant evidence, appraising evidence for reliability and validity, applying evidence to patient care, and lastly assessing clinical practice regularly (2). In a study conducted by Woods et al (35) which focused on implementing evidence into practice, it was established that by educating health professionals and providing EBP mentors, professionals were able to successfully integrate the three aspects of EBP in their clinical decision making (2)(35).

The United Kingdom's Universal Health Coverage (UHC) further advocates that research has an impact on the quality of patient treatment in all areas of health care (36). Moreover, facility-based research continues to underpin the development and implementation of evidence-based medical therapies and management procedures (37), and only recently has prehospital emergency care practice moved towards research based care (8,9).

In well-resourced countries, research has transformed the way traditional emergency medical services (EMS) have practiced, with a shift towards evidence-based practice (10-12). Further, the Institute of Medicine in the United States of America compiled a report regarding standards of operation within EMS which concluded that the service lacked evidence based practice when correcting issues concerning clinical interventions, system design and resource organization (13-16).

A study conducted by Nkemtendong et al evaluated common challenges faced by EMS in resource limited settings (43). This study identified that in underdeveloped EMS systems, there is often limited research that is specific to emergency care, specifically that describes the prehospital burden of disease (43). Perhaps, early introduction to the fundamentals of EBP during undergraduate studies, may contribute to the concept of "best practice" and confident application of EBP (44).

The relative paucity in emergency care research may be due to the perceived barriers noted in van Hoving and Brysiewicz's findings, which indicated that lack of training, research funding and time, among others, are barriers to increased research involvement in African emergency care (7). Hsia et al further indicates in their study that one of the primary barriers that impedes the knowledge and development of emergency structures is that there are few researchers who are appropriately skilled and or funded to do research (45). This can consequently imply that integration of EBP in training curricula and continuous staff development by exposing students to learning opportunities that include searching for information and critical appraisal improves and yields positivity towards research (46). Likewise, Majid et al, also found that heavy workload and keeping up with new evidence can be challenging, nevertheless, incorporating EBP in training could be beneficial (46). Wong also agreed with Karki's' study when he suggested that EBP training improved students' knowledge, skills and confidence (47)(21,22).

A study by Koehn and Lehman, evaluated barriers that prevents sustainability of EBP (50). Cited in the argument is that resistance to new practice, education levels, time and knowledge affect attitudes towards EBP (50). Prehospital research offers opportunities to improve patient care whilst influencing the development of the practitioner's scope of practice. By assessing the perceptions of South African paramedics' towards EBP we could suggest strategies to improve prehospital understanding and application of EBP and encourage prehospital healthcare providers to become more involved in context-specific research (51).

A number of studies have examined the use of EBP, including critical appraisal and utilising scientific literature in clinical practice. Melnyk et al (52) developed and tested the validity and reliability of two scales for EBP. The scales were filled out voluntarily by nurses (n=394) taking part in continuing education sessions. The first scale consists of 16-items measuring individuals belief about EBP and the ability to implement it, and the second scale consisting of 18-items measures the extent of actual EBP implementation. The validity and reliability of both instruments were assessed through psychometric properties. The reliability of the tool was examined through internal consistency (Cronbach's alpha and Spearman). Coefficient values from 0.7 to 0.9 indicate good reliability and are excellent if above 0.9. The Cronbach's Alpha and Spearman-Brown coefficients to test content validity and reliability exceeded 0.85 for both scales which demonstrated good internal consistency. The results of the study are consistent with the author's previous research work (24,25,26).

Study aim

The aim of this study is to assess South African emergency medical service personnel strength of beliefs about evidence-based practice, and the frequency of implementation of evidence-based practice.

In order to achieve this aim, the objectives of this study are to:

1. Assess and describe South African emergency medical care personnel's strength of beliefs about the value of EBP
2. Assess and describe South African emergency medical care personnel's ability to implement EBP
3. Assess and describe the frequency of EBP implementation in South African Emergency medical service personnel
4. Identify barriers and facilitators to using research in practice

Methodology

Study design

This is an observational, cross-sectional study using a self-administered survey to collect data.

Study setting and population

The study will take place in South Africa amongst public and private sector EMS personnel. There are several categories of emergency care personnel within the EMS. This study will focus on different categories of prehospital emergency medical care qualifications that are NQF and non-NQF aligned. There are four non-NQF aligned short courses that has limited to non-exposure on research. These are a three-week Basic Ambulance Assistant (BAA) course, a 12-week Ambulance Emergency Assistant (AEA) and six-month Critical Care Assistant (CCA) or nine-month Advanced Life Support (ALS) course and a two-year Emergency Care Technician (ECT) course.

The NQF aligned courses are the one-year NQF 5 Higher Certificate in EMC (Emergency Care Assistant which is an ECA), a three-year NQF 6 National Diploma in EMC (NDip)both of which has no research related training, an NQF 7 Bachelor of Technology (BTech) degree, a four-year NQF 8 Bachelor of Health Sciences (BHSc) degree in EMC both has basic research methodology training. And these two degrees are categorised as Emergency Care Practitioner (ECP). Furthermore, the post graduate degrees which are Masters degree that is NQF 9 and NQF 10 Doctor of Philosophy (PhD) which has an intense exposure to research. The bachelor's degree and post graduate degrees are the only emergency medical care qualifications that include basic research to advanced research methodology training.

Inclusion criteria: Health Professions Council of South Africa (HPCSA) registered BAA, AEA, ECT, ANT (CCA and NDip) and ECPs working in either the public or private prehospital sector in South Africa in any operational, administrative or managerial capacity;

Exclusion criteria: No exclusion criteria, all emergency medical care cadres will be included in this study.

The sample will be drawn using convenience and snowball sampling.

Recruitment and data collection:

Following administrator approval, the survey information sheet and invite (Appendix 1) will be distributed to all potential participants via provincial EMS Colleges work-based databases and on established social media platforms. EMS social media accounts are managed by the Department of Health. Permission to use these social media accounts for distribution will be sourced from the National EMS Director through application to the National Health Research Database, although the participants will participate in their private capacity.

Following administrator approval, list administrators will be asked to share the study invitations and consenting participants will be asked to further share the invitation to participate with their colleagues. A summary will be supplied with the invitation to inform participants about the study's purpose and method. The email and social media invite will contain a brief description of the research and a link that will direct participants to the survey. The survey will be administered electronically using Google forms.

A previously published two scale survey by Melnyk et al. will be used as the data collection tool in this study context (52). The survey tool used in this study has been previously published by a credible international author and the results of that study had both internal and external validity. (52)

The survey will be divided into several sections (Appendix 2), and will collect baseline demographic information about the participants, such as age, gender, job title and experience, their clinical experience and education level. A two-part questionnaire will solicit responses related to participant's perceptions of research and EBP consisting of 16-items that measures the individual's belief about the value of EBP and the ability to implement it, and the second scale consisting of 18-items will measure the frequency of actual EBP implementation. Data collection will be open for six weeks only. Survey settings will only allow one response per participant (identified only through internet protocol addresses).

Data analysis

Likert scales (5=Strongly Agree to 1=Strongly Disagree) will be used to assess the participant's perceptions of research and EBP. The higher scores (reflect higher levels of agreement) will reflect positive attitudes and the lower scores (reflecting higher levels of disagreement to the statements) will reflect negative attitudes. Data will be analysed using descriptive data analysis.

Barriers and facilitators to implementing EBP will be collected using short, open-ended questions. Responses will be analysed using quantitative content analysis by quantifying meaning units.

Data management

Collected data will be exported from Google Forms into an Excel spreadsheet. Since this approach allows for the export of responses into a compatible database, transcription errors can be avoided, and survey modifications can be avoided. Data received will be stored for five years in a server/data storage controlled by the PI (Dr Saunders) on a UCT password protected laptop. The student and supervisors will have access to the data, but information received will be kept safe and will not be shared with anyone except at the institutions request.

Ethical considerations

The researcher will apply for ethical approval from the UCT Human Research Ethics Committee, thereafter permission to undertake the study will be requested from the National Director of EMS through the National Health Research Database. Once approval and clearance have been obtained, data collection will commence.

Description of risks and benefits

This is a minimal risk study however, there is potential risk for loss of privacy and confidentiality of participant information. This risk will be mitigated by using an anonymous survey. The demographic information collected is non-identifying thus the survey will be anonymous. Participation in this study will strictly be voluntary. The researcher will not have access to email addresses or contact details and thus there's no risk compromising participants contact details in accordance with the Protection of Personal Information Act.

There are no direct benefits to this study, however the results of the study can be generalised throughout the EMS community as it will include all government and private sector practitioners nationally and the risk will be minimized.

Informed consent process

Invitations to participate in the study will be sent via social media accounts (Appendix 1). The invitation will contain an information sheet, invite to participate and link to the survey. The first page of the survey (Appendix 2) will also contain information on the study and request the participant to consent to voluntary participation in the survey or choose not to participate, without prejudice. Once the survey has been completed, participants will be unable to withdraw from the study as their responses are collected anonymously.

Participants will be offered the opportunity to print the text content for their record. Should they wish to continue with the survey and agree to have their data used since they will be aware of the content and an "I Agree" or "Do Not Agree" buttons will be used to submit the survey.

Privacy and confidentiality

Participation in this study will strictly be voluntary and anonymity will be ensured by using the anonymity feature within the google form configurations before the data is exported to a secured electronic spreadsheet using Microsoft excel.

The researcher will not have access to email addresses nor contact details and thus there's no risk compromising participants contact details in accordance with the POPI Act. The demographic information collected is non-identifying thus the survey is anonymous.

Reimbursement for participation

No reimbursement for participating will be provided in the study

Strengths and limitations

A limitation to this study is that the survey will be distributed electronically with which non – computer literate personnel might have challenge completing the survey. However, this will only affect a minority of the targeted population as the instrument will only be accessed through the computerised electronic platform only, thus the limitation will automatically be eliminated. The 2021/2022 HPCSA Annual report suggested a decline number of registered EMS cadres. Another limitation is the usage of emailed based survey distribution with which recipients might receive it as spam, wherein accessing the survey can be difficult.

A strength of this study is the use of validated and reliable survey instruments, which have been successfully used in other health care worker populations.

Dissemination of findings

On completion of the study, the results of this study will be written up as a University Cape Town MPhil dissertation and the research findings will be submitted for publication in peer reviewed Department of Higher Education and Training and Department of Health accredited journals.

Timeline

2023	June 2023	July 2023	Aug 2023	Sept 2023	Oct 2023	Nov 2023	Dec 2023	Jan 2024	Feb 2024
DRC	X	x	x						
Ethics			x	x					
Approval				x					
Data collection					x	x			
Analysis						X			
Write-up						X	X	x	
Submission									x

Budget

Item	Cost
Traveling	R3000.00
Printing/ photocopying	R2000.00
Internet/ data	R3000.00
Total	R8000.00
The funding source- Department of Health Human Resource Development (HRD)	

References

1. Bernadette Mazurek MelnykFineout-overholt E, Stillwell SB, Kathleen M. The Seven Steps of Evidence-Based Practice. 2010;110(1):51–3.

2. Rengerink KO, Zwolsman SE, Ubbink DT, Mol BWJ, Van Dijk N, Vermeulen H. Tools to assess Evidence-Based Practice behaviour among healthcare professionals. Vol. 18, Evidence-Based Medicine. 2013. p. 129–38.

3. Melnyk BM, Fineout-Overholt E, Mays MZ. The evidence-based practice beliefs and implementation scales: Psychometric properties of two new instruments. Worldviews Evidence-Based Nurs. 2008;5(4):208–16.

4. Fineout-Overholt E, Melnyk BM, Schultz A. Transforming health care from the inside out: Advancing evidence-based practice in the 21st century. J Prof Nurs. 2005 Nov;21(6):335–44.

5. Tiwari R, Naidoo R, English R, Chikte U, Bernadette Mazurek Melnyk EF-O, Melnyk BM, et al. Evidence-Based Practice in Nursing & Healthcare: A Guide to Best Practice. Injury [Internet]. fourth edi. 2018 Dec 1;7(1):430–41. Available from: http://dx.doi.org/10.1016/j.injury.2015.07.004

6. Holliman R, Wallis L, Saunders C. Determining the research priorities for emergency care within the Western Cape province of South Africa: A consensus study. African J Emerg Med [Internet]. 2024;14(1):1–6. Available from: https://doi.org/10.1016/j.afjem.2023.11.007

7. Van Hoving DJ, Brysiewicz P. Les attitudes et pratiques des fournisseurs de soins d'urgence en Afrique en matière de recherche. African J Emerg Med. 2017;7(1):9–14.

8. Majid S, Foo S, Luyt B, Zhang X, Theng Y, Chang Y, et al. Adopting evidence-based practice in clinical decision making: nurses' perceptions, knowledge, and barriers. J Med Libr Assoc [Internet]. 2011;99(3):229–36. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3133901/

9. McInerney P, Suleman F. Exploring Knowledge, Attitudes, and Barriers Toward the Use of Evidence-Based Practice Amongst Academic Health Care Practitioners in Their Teaching in a South African University: A Pilot Study. Worldviews Evidence-Based Nurs [Internet]. 2010;(April 2018). Available from: https://onlinelibrary.wiley.com/doi/10.1111/j.1741-6787.2009.00180.x

10. Stokke K, Olsen NR, Espehaug B, Nortvedt MW. Evidence based practice beliefs and implementation among nurses: A cross-sectional study. BMC Nurs. 2014 Mar 25;13(1).

11. Sherriff KL, Wallis M, Chaboyer W. Nurses' attitudes to and perceptions of knowledge and skills

regarding evidence-based practice. Int J Nurs Pract. 2007;13(6):363–9.

12. Lanssens D, Goemaes R, Vrielinck C, Tency I. Knowledge, attitudes and use of evidence-based practice among midwives in Belgium: A cross-sectional survey. Eur J Midwifery [Internet]. 2022 Jun 10;6(June):1–9. Available from: http://www.europeanjournalofmidwifery.eu/Knowledge-attitudes-and-use-of-evidence-based-practice-among-midwives-in-Belgium,147478,0,2.html

13. Chang CS. Moderating Effects of Nurses' Organizational Justice Between Organizational Support and Organizational Citizenship Behaviors for Evidence-Based Practice. Worldviews Evidence-Based Nurs. 2014;11(5):332–40.

14. Melnyk BM, Gallagher-Ford L, Long LE, Fineout-Overholt E. The establishment of evidence-based practice competencies for practicing registered nurses and advanced practice nurses in real-world clinical settings: Proficiencies to improve healthcare quality, reliability, patient outcomes, and costs. Worldviews Evidence-Based Nurs. 2014 Feb;11(1):5–15.

15. Bowles KA, Batt AM, O'Toole M, Knox S, Hemingway L, Williams J, et al. Identifying the essential elements to inform the development of a research agenda for Paramedicine in Ireland: a Delphi Study. Heal Res Policy Syst. 2024 Dec 1;22(1).

16. Simpson P, Bendall JC. Beliefs and expectations of paramedics towards evidence-based practice and research. 2012;(September).

17. Alatawi M, Aljuhani E, Alsufiany F, Aleid K, Rawah R, Aljanabi S, et al. Barriers of Implementing Evidence-Based Practice in Nursing Profession: A Literature Review. Am J Nurs Sci. 2020;9(1):35.

18. McArthur C, Bai Y, Hewston P, Giangregorio L, Straus S, Papaioannou A. Barriers and facilitators to implementing evidence-based guidelines in long-term care: a qualitative evidence synthesis. Implement Sci [Internet]. 2021 Dec 9;16(1):70. Available from: https://implementationscience.biomedcentral.com/articles/10.1186/s13012-021-01140-0

19. Alblooshi SM, Razzak HA, Hijji FHR, Wishah MAM, Alkarbi M, Harbi AZ. Knowledge, Attitude and Implementation of Evidence-Based Practice among Nurses; A National Survey [Internet]. 2022. Available from: https://www.researchsquare.com/article/rs-2113129/v1

20. Abu-baker NN, Abualrub S, Obeidat RF, Assmairan K. Evidence-based practice beliefs and implementations : a cross-sectional study among undergraduate nursing students. 2021;4–11.

21. Hadgu G. Assessment of Nurses' Perceptions and Barriers on Evidence Based Practice in Tikur Anbessa Specialized Hospital Addis Ababa Ethiopia. Am J Nurs Sci. 2015;4(3):73.

22. Leonard JC, Scharff DP, Koors V, Brooke Lerner E, Adelgais KM, Anders J, et al. A qualitative assessment of factors that influence emergency medical services partnerships in prehospital research. Acad Emerg Med. 2012 Feb;19(2):161–73.

23. Hargreaves K, Goodacre S, Mortimer P. Paramedic perceptions of the feasibility and practicalities of prehospital clinical trials: A questionnaire survey. Emerg Med J. 2014;31(6):499–504.

24. Maurin Söderholm H, Andersson H, Andersson Hagiwara M, Backlund P, Bergman J, Lundberg L, et al. Research challenges in prehospital care: the need for a simulation-based prehospital research laboratory. Vol. 4, Advances in Simulation. Advances in Simulation; 2019. p. 1–6.

25. Newton J, Smith ADAC. Ambulance clinicians implementing evidence-based practice: mind the gap! Attitudes, perceptions and experiences of student paramedics. Br Paramed J. 2023;8(3):11–9.

26. Duncombe DC. A multi-institutional study of the perceived barriers and facilitators to implementing evidence-based practice. J Clin Nurs. 2018 Mar 1;27(5–6):1216–26.

27. Albarqouni L, Hoffmann T, Straus S, Olsen NR, Young T, Ilic D, et al. Core Competencies in Evidence-Based Practice for Health Professionals: Consensus Statement Based on a Systematic Review and Delphi Survey. JAMA Netw open. 2018;1(2):e180281.

28. Hargreaves K, Goodacre S, Mortimer P. Paramedic perceptions of the feasibility and practicalities of prehospital clinical trials : a questionnaire survey. 2014;499–504.

29. Abo Elmagd MH, Alharbi M. Nursing Students' Beliefs and Willingness to Implement Evidence-Based Nursing Practice at Umm Al-Qura University: A Descriptive Cross-Sectional Study. Cureus. 2024 Apr 18;

30. Li S, Cao M, Zhu X. Evidence-based practice.

31. Nkeiruka, Agbapuonwu, Yarhere. Knowledge, Attitude and Practice of Evidence-Based Nursing among Nurses in Children's Ward at Tertiary Health Institutions in Anambra State, Nigeria. African J Heal Nurs Midwifery [Internet]. 2024 Jun 13;7(2):115–40. Available from: https://abjournals.org/ajhnm/papers/volume-7/issue-2/knowledge-attitude-and-practice-of-evidence-based-nursing-among-nurses-in-childrens-ward-at-tertiary-health-institutions-in-anambra-state-nigeria/

32. Novrianda D, Hermalinda. Knowledge, Attitude and Practice of Evidence-Based Nursing Practice and Barriers. J Keperawatan Padjadjaran. 2019 Oct 1;7(3):238–47.

33. Hui DS, Chow BK, Ng SS, Chu LCY, Hall SD, Gin T, et al. Exhaled air dispersion distances during noninvasive ventilation via different respironics face masks. Chest [Internet]. 2009;136(4):998–1005. Available from: http://dx.doi.org/10.1378/chest.09-0434

34. Kristensen N, Nymann C, Konradsen H. Implementing research results in clinical practice- the experiences of healthcare professionals. BMC Health Serv Res. 2016 Feb 10;16(1).

35. Woods AD. Implementing evidence into practice. Nursing (Lond) [Internet]. 2013 Feb;43(2):4–6. Available from: https://journals.lww.com/00152193-201302001-00002

36. Kruk ME, Gage AD, Arsenault C, Jordan K, Leslie HH, Roder-DeWan S, et al. High-quality health systems in the Sustainable Development Goals era: time for a revolution. Vol. 6, The Lancet Global Health. 2018. p. e1196–252.

37. Burgess S, Smith E, Piper S, Archer F. The development of an updated prehospital search filter for the Cochrane Library: Prehospital Search Filter Version 2.0. Australas J Paramed [Internet]. 2010 Nov 1;8(4):5. Available from: https://ajp.paramedics.org/index.php/ajp/article/view/82

38. Tanigawa K, Tanaka K. Emergency medical service systems in Japan: Past, present, and future. Resuscitation [Internet]. 2006 Jun;69(3):365–70. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0300957206001511

39. Nir V LN. The Increase in the Number of Publications in the Field of Emergency Medicine: A 9-Year Analysis. Emerg Med Open Access [Internet]. 2015;05(02):10–3. Available from: https://www.omicsgroup.org/journals/the-increase-in-the-number-of-publications-in-the-field-of-emergency-medicine-2165-7548.1000232.php?aid=40909

40. Aluisio AR, Waheed S, Cameron P, Hess J, Jacob ST, Kissoon N, et al. Clinical emergency care research in low-income and middle-income countries: Opportunities and challenges. BMJ Glob Heal. 2019;4:1–8.

41. Mould-Millman N-K, Sasser SM, Wallis LA. Prehospital research in sub-saharan Africa: establishing research tenets. Cone DC, editor. Acad Emerg Med [Internet]. 2013 Dec;20(12):1304–9. Available from: http://www.ncbi.nlm.nih.gov/pubmed/24341586

42. Kobusingye OC, Hyder AA, Bishai D. Kobusingye OC, Hyder AA, Bishai D. Chapter 68 Emergency Medical Services. 1996. 2017;

43. Nkemtendong Tolefac P, Njamen Nana T, Mefire Chichom A, Nguefack Tchente C, Kouam Siegning L, Tembi Efie D, et al. Challenges in Emergency Medical Services in a ResourceLimited Setting in Sub-Sahara Africa; Perspectives from Cameroon: a Review Article. Int Ann Med.

2017;1(10).

44. McInerney P, Suleman F. Exploring Knowledge, Attitudes, and Barriers Toward the Use of Evidence-Based Practice Amongst Academic Health Care Practitioners in Their Teaching in a South African University: A Pilot Study. Worldviews Evidence-Based Nurs [Internet]. 2010 Jan;(April 2018). Available from: https://onlinelibrary.wiley.com/doi/10.1111/j.1741-6787.2009.00180.x

45. Hsia R, Junaid R, C. TA, Hirshon JM. Placing emergency care on the global agenda. Ann Emerg Med [Internet]. 2010;56(2):142–9. Available from: http://dx.doi.org/10.1016/j.annemergmed.2010.01.013

46. Majid S, Foo S, Luyt B, Zhang X, Theng Y, Chang Y, et al. Adopting evidence-based practice in clinical decision making: nurses' perceptions, knowledge, and barriers. J Med Libr Assoc [Internet]. 2011 Jul;99(3):229–36. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3133901/

47. Nir V LN. The Increase in the Number of Publications in the Field of Emergency Medicine: A 9-Year Analysis. Emerg Med Open Access [Internet]. 2015;05(02). Available from: https://www.omicsgroup.org/journals/the-increase-in-the-number-of-publications-in-the-field-of-emergency-medicine-2165-7548.1000232.php?aid=40909

48. Maguire BJ, O'Meara P, Newton A. Toward an International Paramedic Research Agenda. Irish J Paramed [Internet]. 2016 Nov 29;1(2):0–3. Available from: http://www.irishparamedicine.com/index.php/ijp/article/view/38

49. Wong SC, McEvoy MP, Wiles LK, Lewis LK. Magnitude of change in outcomes following entry-level evidence-based practice training: a systematic review. Int J Med Educ [Internet]. 2013 Jun 6;4:107–14. Available from: http://www.ijme.net/archive/4/entry-level-ebp-training-a-systematic-review/

50. Koehn ML, Lehman K. Nurses' perceptions of evidence-based nursing practice. J Adv Nurs. 2008 Apr;62(2):209–15.

51. Bulger JK, Brown A, Evans BA, Fegan G, Ford S, Guy K, et al. Rapid analgesia for prehospital hip disruption (RAPID): Protocol for feasibility study of randomised controlled trial. Pilot Feasibility Stud [Internet]. 2017;3(1):1–7. Available from: http://dx.doi.org/10.1186/s40814-016-0115-6

52. Melnyk BM, Fineout-Overholt E, Mays MZ. The evidence-based practice beliefs and implementation scales: Psychometric properties of two new instruments. Worldviews Evidence-Based Nurs. 2008 Dec;5(4):208–16.

53. Melnyk BM, Fineout-Overholt E, Fischbeck Feinstein N, Li H, Small L, Wilcox L, et al. Nurses' perceived knowledge, beliefs, skills, and needs regarding evidence-based practice: implications for accelerating the paradigm shift. Worldviews evidence-based Nurs [Internet]. 2004 Sep 19;1(3):185–93. Available from: https://onlinelibrary.wiley.com/doi/10.1111/j.1524-475X.2004.04024.x

54. Bernadette Mazurek Melnyk EF-O. Evidence-Based Practice in Nursing & Healthcare: A Guide to Best Practice [Internet]. 5TH ed. Hartman S editor: S, editor. Mexico: Lippincott Williams & Wilkins, 2022; 2018. 936 p. Available from: https://books.google.co.za/books?hl=en&lr=&id=EPaBEAAAQBAJ&oi=fnd&pg=PT26&ots=PG3gQcIpxG&sig=6QLhvsjBRtYDVuvfPeaRa6zHeCc&redir_esc=y#v=onepage&q&f=false

10. APPENDICES

Appendix 1: Email invite

Dear colleagues,

My name is Zamasiba Dlamini, and I am an ECP completing my MPhil in Emergency Medicine at the University of Cape Town. I am writing to invite you to participate in my research study.

The aim of this study is to assess South African emergency medical service personnel's beliefs about the value of evidence-based practice, their ability to implement evidence-based practice, as well as to assess the frequency to which evidence-based practice is implemented.

If you choose to participate in this study, you will be asked to complete a single, online questionnaire consisting of three parts. The survey should take between **15 to 20 minutes** to complete. There are no direct benefits to you for taking part in this study but doing so will help us to understand if improvements can be made to training and support for evidence-based practice in our field. This is a low-risk study and we have put measures in place to protect your confidentiality and privacy.

Participation in this study is entirely voluntary and you may freely choose not to participate. Once you have started the questionnaire, you may stop your participation at any point without negative consequences to you. As the questionnaire is anonymous, we will not be able to withdraw your responses once you have completed the questionnaire.

The study is supervised by Dr Colleen Saunders (Principal investigator) and Ms Elzarie Theron. If you have any queries about the study, you may contact either Ms Dlamini (zcdlamini3@gmail.com) or Dr Saunders (colleen.saunders@uct.ac.za). This study has been approved by the Human Research Ethics Committee of the University of Cape Town (HREC ref: 236/2024) and the National Health Research Committee. If you have any queries about your rights as a research participant, you may contact the UCT HREC at hrec-enquiries@uct.ac.za .

If you agree to participate in this study, please click through to the questionnaire using this link: (link).

Kind regards

Ms Zamasiba Dlamini

MPhil student,

University of Cape Town

Appendix 2: Survey

Emergency medical service personnel perceptions of research and evidence-based practice

SECTION A: Study information and consent to participate

Thank you for considering participating in our study. **The aim of this study is to assess South African emergency medical service personnel strength of beliefs about evidence-based practice, and the frequency of implementation of evidence-based practice.**

If you choose to participate in this study, you will be asked to complete a single, online questionnaire consisting of three parts. The survey should take between **15 to 20 minutes** to complete. There are no direct benefits to you for taking part in this study but doing so will help us to understand if improvements can be made to training and support for EBP in our field. This is a low-risk study and we have put measures in place to protect your confidentiality and privacy.

Participation in this study is entirely voluntary and you may freely choose not to participate. Once you have started the questionnaire, you may stop your participation at any point without negative consequences to you. As the questionnaire is anonymous, we will not be able to withdraw your responses once you have completed the questionnaire.

This study is being conducted by Ms Zamasiba Dlamini as part of her MPhil in Emergency Medicine at the University of Cape Town. The study is supervised by Dr Colleen Saunders (Principal investigator) and Ms Elzarie Theron. If you have any queries about the study, you may contact either Ms Dlamini (zcdlamini3@gmail.com) or Dr Saunders (colleen.saunders@uct.ac.za).

This study has been approved by the Human Research Ethics Committee of the University of Cape Town (HREC ref: xxx) and the National Health Research Committee. If you have any queries about your rights as a research participant, you may contact the UCT HREC at hrec-enquiries@uct.ac.za .

If you agree to participate in this study, you may click through to the questionnaire below. By doing so, you agree that:

- You have been provided clear information, including the risks and benefits, about the study.
- You have been provided the opportunity to ask questions about participating in this study, and had your questions answered.
- You have not been coerced, and voluntarily consent to taking part in the study.

Evidence-Based Practice (EBP) is the idea that clinical practice should be based on the integration of the clinician's knowledge and expertise, the patient's preferences and values, and the best available scientific evidence. The **implementation of EBP includes 5 steps**: asking the right question, accessing or searching for relevant evidence, appraising evidence for reliability and validity, applying evidence to patient care, and lastly assessing clinical practice regularly.

Please complete all questions in this questionnaire. As a reminder, this questionnaire is anonymous, and we encourage you to answer truthfully.

SECTION B: EVIDENCE-BASED PRACTICE (EBP) BELIEFS SCALE

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
I believe that EBP results in the best clinical care for patients.					
I am clear about the steps of EBP.					
I am sure that I can implement EBP.					
I believe that critically appraising evidence is an important step in the EBP process.					
I am sure that evidence-based guidelines can improve clinical care.					
I believe that I can search for the best evidence to answer clinical questions in a time efficient way.					
I believe that I can overcome barriers in implementing EBP.					
I am sure that I can implement EBP in a time efficient way.					
I am sure that implementing EBP will improve the care that I deliver to my patients.					
I am sure about how to measure the outcomes of clinical care.					
I believe that EBP takes too much time.					

I am sure that I can access the best resources in order to implement EBP.					
I believe EBP is difficult.					
I know how to implement EBP sufficiently enough to make practice changes.					
I am confident about my ability to implement EBP where I work.					
I believe the care that I deliver is evidence-based.					

SECTION C: EVIDENCE-BASED PRACTICE IMPLEMENTATION SCALE

For each time listed below, indicate how often you have performed that activity **in the last 8 weeks**.

	Not performed	**1-2 times**	**3-4 times**	**5-8 times**	**>8 times**
Used evidence to change my clinical practice.					
Critically appraised evidence from a research study.					
Generated a PICO question about my clinical practice.					
Informally discussed evidence from a research study with a colleague.					
Collected data on a patient problem.					
Shared evidence from a study/ies in the form of a report/presentation to >2 colleagues.					
Evaluated the outcomes of a practice change.					
Shared an EBP guideline with a colleague.					
Shared evidence from a research study with a patient/family member.					
Shared evidence from a research study with a multidisciplinary team member.					

Read and critically appraised a clinical research study.					
Accessed the Cochrane database of systematic reviews.					
Accessed the Clinical Practice Guidelines.					
Used an EBP guideline or systematic review to change clinical practice where I work,					
Evaluated a care initiative by collecting patient outcome data.					
Shared the outcome data collected with colleagues.					
Changed practice based on patient outcome data.					
Promoted the use of EBP to my colleagues.					

SECTION D: PARTICIPANT DEMOGRAPHICS

Please complete all questions in this section.

1. Gender:

2. Age (years):

3. Prehospital care education (Please tick all that apply):

Basic Ambulance Assistant (BAA)	
Ambulance Emergency Assistant (AEA)	
Emergency Care Assistant (ECA)	
Paramedics (CCA, ALS, NDip)	
Emergency Care Practitioner -BEMC; BTech; BHSc – EMC (ECP)	
Coursework and Dissertation Master's Degree in Emergency Care	
Research only Master's Degree in Emergency Care	
Master's degree (not in Emergency Care)	
PhD	

4. Number of year's experience in the following domains:

Domain	**Number of years**
Operational paramedic	
Mid- to senior management	

Teaching and education	

5. Have you previously been exposed to the principles of evidence-based practice during any of the following activities (Yes/no)? Please tick all that apply:
    a. Undergraduate training
    b. Postgraduate studies
    c. Continuing Professional Development training
    d. Reading academic literature

SECTION E: BARRIERS AND FACILITATORS OF EVIDENCE-BASED PRACTICE

The 5 key steps in evidence-based practice are listed below. For each of these steps, provide the factors (work related or personal) that make it challenging to implement.

1 Ask a clinical research question. _____

2 Acquire the best evidence. _____

3 Appraise the evidence. _____

4 Apply the evidence to your patient. _____

5 Evaluate the outcomes. _____

The 5 key steps in evidence-based practice are listed below. For each of these steps, provide any factors (work related or personal) that would support implementation:

1 Ask a clinical research question. _____

2 Acquire the best evidence. _____

3 Appraise the evidence. _____

4 Apply the evidence to your patient. _____

5 Evaluate the outcomes. _____

Appendix 3: Ethical approval letter

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/home/human-research-ethics

29 April 2024

HREC REF: 236/2024

Dr C Saunders
Division of Emergency Medicine
F-51 OMB
Email: colleen.saunders@uct.ac.za
Student: DLMZAM017@myuct.ac.za

Dear Dr Saunders

PROJECT TITLE: EMERGENCY MEDICAL SERVICE PERSONNEL PERCEPTIONS OF RESEARCH AND EVIDENCE-BASED PRACTICE-
MASTER OF PHILOSOPHY-CLINICAL EMERGENCY CARE-MS ZAMASIBA DLAMINI

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.

Approval is granted for one year until the 30 April 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: Ms Zamasiba Dlamini will also be involved in this study.

Please quote HREC REF 236/2024 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

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

Appendix 4: STROBE Statement—Checklist

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Page number
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract Observational, cross-sectional study as stated in the Abstract and article methods	Page 23
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found Provided in Abstract	Page 23
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported Included in the Article background	Page 24 and 25
Objectives	3	State specific objectives, including any prespecified hypotheses Included in the Background	Page 24
Methods			
Study design	4	Present key elements of study design early in the paper Included in the Methodology	Page 25
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection Included in the Methodology	Page 25
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants Included in the Methodology	Page 25, 43 and 44
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable Included in the Methodology	Page 25, 43 and 44
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group Included in the Methodology	Page 25, 26, 43 and 44
Bias	9	Describe any efforts to address potential sources of bias Addressed in the limitations paragraph starting at the bottom of page 33 in the Discussion.	Page 33
Study size	10	Explain how the study size was arrived at Included in the Methodology	Page 25
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why Included in the Methodology	Page 25 and 26

Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding Included in the Methodology	Page 25 and 26
		(*b*) Describe any methods used to examine subgroups and interactions Included in the Methodology	Page 25 and 26
		(*c*) Explain how missing data were addressed Included in the Methodology	Page 25 and 26
		(*d*) If applicable, describe analytical methods taking account of sampling strategy Included in the Methodology	Page 25 and 26
		(*e*) Describe any sensitivity analyses Not applicable.	
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed Included in the Results	Page 26 and 27
		(b) Give reasons for non-participation at each stage Not applicable.	
		(c) Consider use of a flow diagram Not required.	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders Included in the Results	Page 26 and 27
		(b) Indicate number of participants with missing data for each variable of interest Included in the Results	Page 26 and 27
Outcome data	15*	Report numbers of outcome events or summary measures Included in the Results on pages 26 and 27, and summarized in Tables 1, 2 and 3.	Pages 27, 28 and 30
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included Included in the Results on pages 26, 27, 28, 29 and 30, and summarized in Tables 1, 2 and 3.	Pages 26 to 30
		(*b*) Report category boundaries when continuous variables were categorized Included in the Results	Pages 26 to 30
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period Included in the Results	Pages 26 to 30

Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses Not applicable.	
Discussion			
Key results	18	Summarise key results with reference to study objectives Included in the Discussion	Page 31 to 33
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias Included in the Discussion	Page 31 to 33
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence Included in the Discussion	Page 31 to 33
Generalisability	21	Discuss the generalisability (external validity) of the study results Included in the Discussion	Page 31 to 33
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based Not applicable	

*Give information separately for exposed and unexposed groups.