

Emergency care practitioners' views on the use of ultrasound in pre-hospital acute care settings

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ABSTRACT

Background: Ultrasound may assist in the detection of life-threatening conditions and evolving pathologies. South African emergency care practitioners (ECPs) working in pre-hospital contexts have historically not used ultrasound to diagnose and treat patients. However, recently published clinical practice guidelines from the Health Professions Council of South Africa (HPCSA) suggest that ultrasound be considered as an adjunct in the provision of pre-hospital emergency care. Our study investigated ECPs' views and perceptions of introducing ultrasound to their scope of practice.

Methods: A qualitative prospective approach was followed, using semi-structured interviews with a purposefully selected sample of practising ECPs to investigate and describe their views and perceptions of the use of ultrasound in local pre-hospital emergency care contexts. The interviews were audio recorded and transcribed. Transcripts were critically read before being manually coded to identify core themes and categories.

Results: ECPs recognise the potential value of ultrasound for a subset of patients within specific pre-hospital contexts. Concerns around the introduction of ultrasound as a diagnostic adjunct included the potential to create delays in treatment and transportation. Implementation challenges included cost implications and the need for additional education and training.

Conclusion: ECPs practising in South African pre-hospital acute care contexts support the use of ultrasound, provided they are adequately trained, and its use does not lead to delays in treatment and arrival at receiving facilities. Additional training on the use of ultrasound may be necessary for ECPs. Further research is required to explore the benefits of ultrasound concerning patient-specific outcomes and the associated costs in resource-constrained pre-hospital emergency care settings.

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BACKGROUND

Ultrasound is a non-invasive, cost-effective diagnostic tool that may assist in the detection of life-threatening conditions and evolving pathologies.^{1,2} Using portable sonography devices in pre-

hospital emergency care settings could potentially enhance acute care providers' diagnostic accuracy and monitoring capabilities. While the use of ultrasound in the pre-hospital environment is recognised and acknowledged in several coun-

tries, South African emergency care practitioners (ECPs) have historically not used portable ultrasound devices to diagnose and treat. Recently published Professional Board for Emergency Care (PBEC) clinical practice guidelines suggest that ultrasonography may be useful in certain clinical circumstances and contexts.³

Recent references to ultrasound in local clinical practice guidelines should be seen within a context where the use of ultrasound in the pre-hospital environment continues to be debated and questioned; specifically regarding its appropriateness as a diagnostic adjunct in out-of-hospital emergency medical service (EMS) acute care settings.⁴ Consequently, many researchers have explored the potential therapeutic and diagnostic benefits of using portable ultrasound devices in pre-hospital settings against the time taken to perform the procedure and the training required to properly use the modality.^{2,5-7} Such studies are important for the practice of pre-hospital emergency care to remain contextual, with the level of care provided being affected and influenced by several factors. These include:

- The model of EMS followed, including how well-developed and resourced the EMS service is;
- Whether the service operates in an urban or rural setting;
- Response times and distances between appropriate receiving facilities (arguably most critically); and
- The levels of education and training of pre-hospital emergency care providers.

In South Africa, ECPs are the highest qualified cadre of emergency care providers. ECPs register with the Health Professions Council of South Africa (HPCSA) as independent practitioners, having completed a four-year full-time professional bachelor's degree in emergency medical care through an accredited university.⁸ Our study focused on exploring the views of a sample of South African ECPs regarding their use of ultrasound in South African pre-hospital acute and critical care settings.

Context of the Authors

At the time of the study, the principal researcher was a final-year ECP student. Both the supervisor and author were academics with over 20 years of pre-hospital emergency care experience. They were actively involved in teaching and research within an emergency medical care department at a local university. The motivation and interest to undertake this study arose from the re-

lease of updated clinical practice guidelines by the PBEC, which contained sections that introduced the potential for ECPs to perform pre-hospital ultrasounds.

DESIGN & METHODS

Study Design

A prospective qualitative design was followed. Data were gathered by conducting several semi-structured interviews with a sample of practising ECPs.

Sampling Strategy

To be eligible to participate in the study, prospective participants had to be registered with the HPCSA as an ECP, currently practising in South Africa. From this pool, those invited to be interviewed were purposefully selected based on their historical and current placements within the local EMS system. The purposive approach was used to identify participants to ensure those interviewed had sufficient insights and experiences from different areas or fields of pre-hospital emergency care practice. These areas included helicopter emergency medical services (HEMS), front-line operational ambulance and medical response services, and fixed-wing aeromedical and critical care transport teams.

Procedure & Data Analysis

The interview agenda and questions were critically considered and designed to specifically investigate and describe participants' views and perceptions of their use of ultrasound in pre-hospital emergency care contexts. The interviews were audio recorded and transcribed verbatim. Transcripts from the interviews were read line-by-line by the researcher and research supervisor. By the end of the eighth interview, data saturation was confirmed as no new experiences, ideas, or concepts appeared to emerge. Following this, the narrated experiences and ideas captured in the transcripts were manually coded by the researcher and research supervisor, separately. These were then grouped together to derive common categories.

Ethical Considerations

Ethical approval for the study was obtained from the University of Johannesburg, Faculty of Health Sciences Research Ethics Committee (REC-01-72-2018).

Trustworthiness

To enhance trustworthiness, strategies were implemented to ensure the credibility, transferability,

dependability, and confirmability of the findings.⁹ Credibility is defended considering the researcher, supervisor, and author's prolonged engagement in the field. Transferability was ensured by providing a description of the participants' backgrounds and the rationale for their purposive selection. Moreover, a description of the emerging themes and categories, supported by direct quotations, was provided where applicable. Dependability was ensured by providing a description of the method and approach used to analyse the transcripts and manual coding procedure. Confirmability was ensured since interviews were audio recorded and transcripts were electronically stored with field notes, thereby providing a chain of evidence of the research process.

RESULTS

Responses to the interview questions showed that our participants – while experienced pre-hospital ECPs – had limited personal experiences using ultrasound as a diagnostic adjunct in out-of-hospital settings. Their views and perceptions were consequently informed (in the main) by sporadic exposure to the modality, mostly within emergency departments at receiving facilities. That said, all the participants indicated they would be willing to be further educated on the use of portable ultrasound devices provided this will be of benefit to their patients. Four categories emerged around the central theme relating to perceived benefits, important considerations and potential challenges associated with the introduction of ultrasound in local EMS contexts. These were:

- Potential for improvements in diagnostic ability
- Informing decisions on treatment and clinical interventions
- Creating the potential for delays in treatment and transportation
- Challenges around implementation

Potential for improvements in diagnostic ability

Our participants believed ultrasound devices could potentially improve their diagnostic capability, especially with regard to penetrating traumas, internal bleeding, and abdominal trauma. This could, in turn, help them tailor their treatment.

"...[ultrasound could] give us a more definitive answer..."

"...so if I... trust my diagnoses and I say this persons got an intra-abdominal bleed, unstable vitals and I respond to the hospital that's got surgery capabilities then

they can quickly prep that patient for surgery."

"... especially to the HEMS environment we are unable to auscultate in the Heli so this will give us a unique ability to see what is happening within the lung in terms of lung sliding and also identifies the size of pneumothorax or if there is. Ag it is limitless what it can tell us."

Informing decisions on treatment and clinical interventions

Varying views were expressed that ultrasound may influence decisions on whether to perform certain procedures that could be beneficial or detrimental to the patient's health.

"... my fluid management will be completely different"

"... help tailor our treatment specifically with regards to fluid therapy looking for the causes of shock..."

Creating the potential for delays in treatment and transportation

Participants shared a concern that there might be instances where ultrasound gets performed on patients who require urgent definitive treatment. They also worried that their arrival at the receiving facility could become delayed due to the time taken for the ultrasound to be performed on the scene.

"... taking time away from those patients getting to a facility faster, getting the help they need quicker..."

"... if you are new at doing the skill and you aren't 100% confident you could delay treatment..."

"... you need to be clinically allowed to give an opinion on an ultrasound machine on an ultrasound if you done level one and two ultrasound and you've maybe seen you attempted to scan 20 patients or 10 patients whatever the case might be."

Challenges around implementation

Our participants identified a number of potential challenges associated with the implementation of ultrasound in the local pre-hospital emergency care environment. These challenges included cost, inexperience, and lack of training. A feeling was expressed that the current pre-hospital environment is already resource-strained. Consequently, the funding associated with portable ultrasound machines may be better spent getting "basic" equipment onto all the vehicles.

"... its going to be a massive expense."

"[we are]... treating quite large population that we are currently unable to treat correctly, simply because of the cost factor..."

Finally, our participants also expressed the opinion that training ECPs to use ultrasound in contextually relevant ways may be challenging as there is currently a shortage of expertise and experience in this field.

DISCUSSION

Participants in our study felt that the use of portable sonography devices within pre-hospital settings might increase their diagnostic capability and could lead to the earlier diagnosis of time-sensitive internal injuries. This could, in turn, reduce morbidity and improve outcomes in patients with time-critical conditions. Such views are supported by several publications focusing on using ultrasound in acute care settings. Some describe what is known as a "Focused Assessment with Sonography in Trauma" (FAST) in pre-hospital EMS settings. In these studies, researchers found similar sensitivity and specificity in diagnoses compared to diagnoses made in in-hospital emergency department settings.^{5,10,11} Another interesting study, this time with physicians who scanned 302 patients in an out-of-hospital setting, reported improvements in diagnostic confidence and accuracy with the use of ultrasound.⁵ Our participants concurred, expressing that an improved diagnosis (as a result of ultrasound) may lead to changes in their triage, treatment, and management strategies. In this regard, we noted a study was conducted after the Turkish earthquake in 1999, where healthcare providers successfully used ultrasound as a triage tool to evaluate patients with crush injuries. It allowed them to make better-informed decisions on approaches to fluid resuscitation and related interventions.¹⁰

Notwithstanding the potential benefits described above, our participants expressed a concern that the implementation of ultrasound as a diagnostic adjunct could extend on-scene time, thus delaying transportation and arrival at the receiving facility. Appropriate training, including the development of guidelines and protocols to guide ECPs on the appropriate contextual use of the modality may assist in addressing such concerns. Interestingly, a 2006 study completed in Germany reported pre-hospital ultrasound findings resulted in a 20% change in hospital destination decision-making.¹² Other authors suggest that paramedics could potentially perform ultrasounds with sufficient quality and accuracy in the back of a moving ambulance.⁵ If this is the case, then concerns about extending on-scene times may be mitigated. There is also additional evidence that suggests when ultrasound is used in the pre-hospital environment, the time to operating theatre may be decreased

compared to patients who only receive an ultrasound when they arrive at the receiving facility.^{1,5}

A French study explored the feasibility of using ultrasound in a helicopter ambulance service. A portable ultrasound was deployed in the helicopter, and an experienced physician scanned 15 patients for haemothorax, pneumothorax, haemopericardium, haemoperitoneum and flattened inferior vena cava. The results showed it was possible to assess for peritoneal and pleural fluid in all the above-mentioned cases, and patients could be scanned in less than three minutes.^{2,10}

Despite the seemingly general agreement between the literature and our participants' views, there remain challenges to the introduction of ultrasound in the local South African EMS context. The cost of procuring the devices, including the need for better training, was correctly identified by our participants as some of these challenges. This view is consistent with studies showing the implementation of this modality is indeed hampered by factors like portability, cost, lack of training and technical experience, including time limitations.²

Regarding additional training, we found examples of paramedic training in the USA on the performance of a FAST exam. This training included lectures, hands-on scanning and objective structured clinical examinations (OSCEs). Data from pre and post-course testing showed significantly improved participant knowledge and recognition of images with just six hours of contact time.¹⁰ Similar studies concluded that advanced life support practitioners could perform basic ultrasound and pattern recognition with limited additional training.^{2,5,10,13}

CONCLUSION

Ultrasound may assist in the detection of life-threatening conditions and evolving pathologies. A more accurate diagnosis could be useful to better inform decisions about pre-hospital treatment interventions and the selection of appropriate receiving facilities. South African ECPs working in pre-hospital contexts have historically not used ultrasound to diagnose and treat. However, recently published clinical practice guidelines from the HPCSA suggest ultrasound be considered an adjunct in the provision of pre-hospital emergency care. ECPs practising in South African pre-hospital acute care contexts support the use of ultrasound, provided they are adequately trained, and its use does not lead to delays in treatment and arrival at receiving facilities. Further research needs to be conducted on the benefits of ultrasound in re-

lation to patient outcomes and associated costs in resource-constrained pre-hospital emergency care settings.

CONFLICTS OF INTEREST

The authors report no conflicts of interest.

AUTHOR CONTRIBUTIONS

EM conceptualised the study, collected the data, analysed the data and revised and approved the final version of the manuscript. CL contributed to data analysis, drafted the manuscript and revised and approved the final version of the manuscript. BvN contributed to data analysis and revised and approved the final version of the manuscript.

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