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Brief research report

Extracorporeal membrane oxygenation and Extracorporeal Membrane Oxygenation Cardiopulmonary Resuscitation (ECPR) research priorities in Australia: A clinician survey

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ABSTRACT

Background: The use of extracorporeal membrane oxygenation (ECMO) for cardiorespiratory failure and during cardiopulmonary resuscitation has increased significantly and is resource intensive. High-quality evidence to guide management of patients on ECMO is limited.

Objectives: The objective of this study was to determine the research priorities of clinicians for ECMO and Extracorporeal Membrane Oxygenation Cardiopulmonary Resuscitation (ECPR) in Australia and New Zealand.

Methods: A prospective, binational survey of clinicians was conducted in May 2022.

Results: There were 133 respondents; 110 (84%) worked at an Australian ECMO centre; 28 (21%) were emergency, 45 (34%) were intensive care, and 41 (31%) were nursing clinicians. All aspects of ECMO care were identified by respondents as being important for further research; however, appropriate patient selection and determining long-term outcomes were ranked the highest. While most believed ECMO was efficacious, they felt that there was insufficient evidence to determine cost-effectiveness. There was uncertainty of the best model of ECPR provision. Equipose exists for randomised studies into anti-coagulation, blood product usage, and ECPR.

Conclusions: This survey found strong support amongst clinicians for further research into the optimal use of ECMO and ECPR and provides a frame work for prioritising future clinical trials and research agendas.

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1. Introduction

Extracorporeal membrane oxygenation (ECMO) use for cardiorespiratory failure and cardiac arrest has increased substantially, with an average cost for a single admission in Australia more than \$180,000.¹ Moreover, mortality in this group of patients is high, approximately 43% for respiratory failure and 68% for cardiac failure.^{2,3} There is a lack of high-quality research to guide many aspects of ECMO care.⁴ In order to focus future research, we surveyed Australian and New Zealand-based clinicians involved in ECMO provision.

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2. Methods

2.1. Study design

A prospective electronic survey was conducted in May 2022 ([Online Appendix](#)). Topics were selected following a literature review, with item reduction (2 rounds) using content experts to ensure manageable survey length. Four ECMO clinicians piloted the survey, and the survey was refined based on feedback provided.

2.2. Participant population

Respondents were identified through the Australian and New Zealand Intensive Care Society Clinical Trials Group distribution list

with subsequent snowball sampling.⁵ Each survey requested the respondent to reflect on practice and the evidence as at the time of completion of the survey.

2.3. Statistical analysis

Data collected were analysed using SPSS, version 25, Armonk, NY: IBM Corp. Statistics, version 25 (IBM). Categorical data were reported as the number and percentage of responses. Likert-scale responses of importance were using a scale ranked from 1 to 5 scale summarised using a weighted average.

2.4. Ethics approval

This study was completed in accordance to Royal Prince Alfred Human Research and Ethics X22-0003 & 2022/ETH00012.

3. Results

There were 133 respondents: 28 (21%) emergency, 45 (34%) intensive care, 41 (31%) nursing clinicians and 19 (14%) 'other'. Eighty-seven (65%) respondents were from New South Wales. One hundred and twenty (90%) worked at city hospitals, 101 (80%) from institutions currently offering ECMO services, with 12 (10%) from institutions considering an ECMO service and 82 (64%) from locations where Extracorporeal Membrane Oxygenation Cardiopulmonary Resuscitation (ECPR) was already being conducted. All respondents felt additional research into ECMO and ECPR was required. Patient selection and functional/long-term follow-up were identified as the most important areas of future research, though all areas were deemed important (see Table 1).

Eighty-five (66%) respondents believed ECPR is efficacious, and 37 (29%) were unsure. Eighty-nine (81%) respondents believed more research was required for prehospital ECPR. Thirty-three (30%), 15 (14%), and 27 (24%) believed hospital-based ECPR (Fig. 1), rendezvous ECPR, or pre-hospital ECPR was the most efficacious way to deliver ECPR, respectively. Seventy-eight (61%) did not believe that there are enough data to decide on ECPR cost-effectiveness, and 21 (16%) thought ECPR was not cost-effective.

With regards to ECMO support, 93 (92%) respondents either did not know or did not believe there was an optimal anticoagulant for use whilst on ECMO. Of the respondents directly responsible for ECMO management, 98% thought that there was equipoise for a randomised trial comparing anticoagulants, 91% comparing anticoagulation monitoring and 80% comparing red blood cell transfusion triggers.

4. Discussion

This binational survey of clinicians identified significant uncertainty around key aspects of ECMO management and overall cost benefit. It has identified important research priorities that will guide future research to improve outcomes.

We found that all major areas of ECMO management required additional research, reflecting the lack of high-quality research available to guide ECMO provision. Patient selection and long-term follow-up with quality-of-life assessment were ranked the most highly for future research. Whilst there exists a significant amount of research on patient selection with scoring systems published,^{2,3,6} accurate prognostication of patients commencing ECMO remains a challenge. Integration of biomarkers to guide optimal selection and to complement clinical prognostication may refine scoring systems. Long-term outcome data on ECMO patients remain scarce; however, recent local registry-based datasets are beginning to address this (NCT03793257).

Table 1
Rankings of importance of fields of ECMO/OHCA research.

| | Not important—no research required | | Not that important | | Somewhat important | | Very important | | Critically important | | Total | | Weighted average |
|---|------------------------------------|---|--------------------|----|--------------------|----|----------------|----|----------------------|----|-------|------|------------------|
| | % | n | % | n | % | n | % | n | % | n | % | n | |
| Patient identification and selection | 0.00% | 0 | 0.00% | 0 | 6.87% | 9 | 37.40% | 49 | 55.73% | 73 | 131 | 4.49 | |
| Cannulation technique and strategies | 0.77% | 1 | 12.31% | 16 | 30.77% | 40 | 31.54% | 41 | 24.62% | 32 | 130 | 3.67 | |
| Bleeding and thrombosis monitoring and prevention | 0.00% | 0 | 3.05% | 4 | 22.90% | 30 | 46.56% | 61 | 27.48% | 36 | 131 | 3.98 | |
| Anticoagulation whilst on ECMO | 0.00% | 0 | 3.82% | 5 | 30.53% | 40 | 41.22% | 54 | 24.43% | 32 | 131 | 3.86 | |
| Respiratory management whilst on ECMO | 0.00% | 0 | 9.92% | 13 | 30.53% | 40 | 41.22% | 54 | 18.32% | 24 | 131 | 3.68 | |
| Decannulation processes and protocols | 0.00% | 0 | 10.94% | 14 | 38.28% | 49 | 32.81% | 42 | 17.97% | 23 | 128 | 3.58 | |
| Functional and long-term outcome follow-up | 0.00% | 0 | 1.52% | 2 | 5.30% | 7 | 36.36% | 48 | 56.82% | 75 | 132 | 4.48 | |
| Complication prevention whilst on ECMO | 0.00% | 0 | 1.53% | 2 | 12.98% | 17 | 48.09% | 63 | 37.40% | 49 | 131 | 4.21 | |

ECMO, extracorporeal membrane oxygenation.

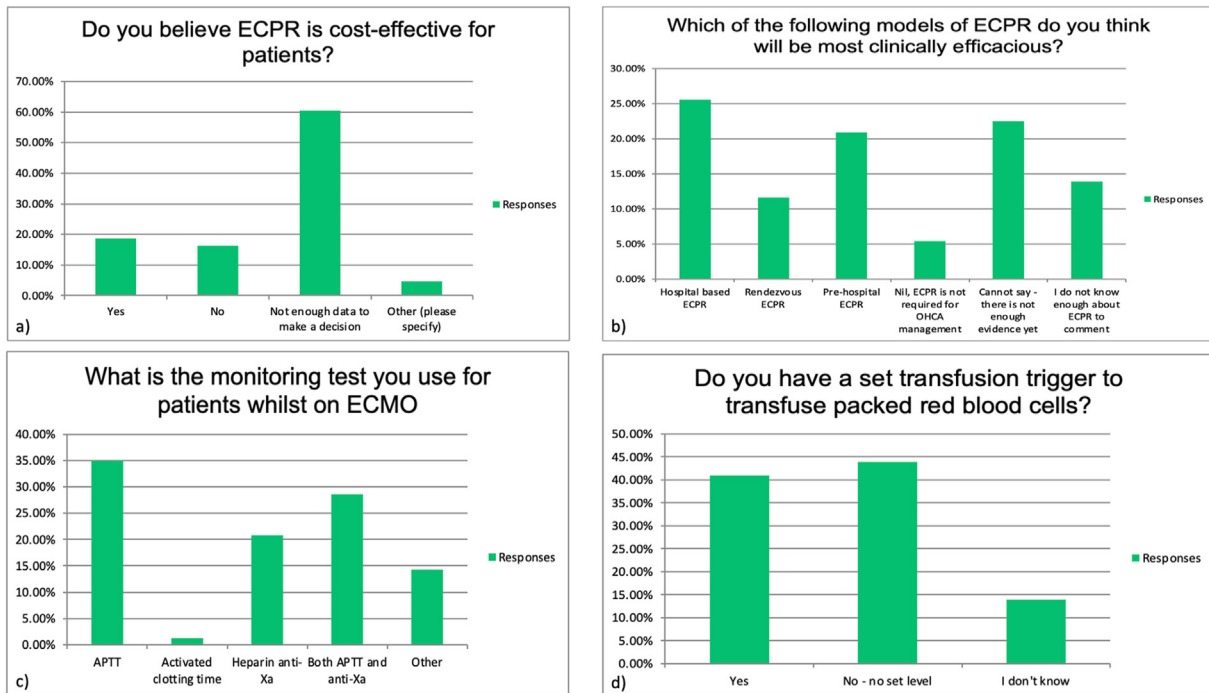


Fig. 1. Selected survey responses of major ECMO practice areas. Survey responses to (a) ECPR cost-effectiveness, (b) ECPR delivery models, (c) anticoagulation monitoring tests, and (d) packed red blood cell transfusion triggers and practice. Substantial variability in responses reflects the uncertainty as to best practice in ECMO management and the critical need for high-quality targeted research. ECMO, extracorporeal membrane oxygenation.

The use of ECPR has grown rapidly despite uncertainty in the results of the two major ECPR trials.^{7,8} Whilst a majority of respondents believed ECPR was efficacious in appropriately selected patients, a significant proportion remained undecided. Further, respondents were split as to the best delivery strategy for ECPR and were unclear as to its cost-effectiveness, a view supported by a recent systematic review that revealed the paucity of health economics data.⁹ Substantial work is required to inform best practice and value-based healthcare delivery in ECPR.

Bleeding and thrombosis whilst on ECMO remain a substantial clinical issue and respondents clearly identified a lack of clarity on and quite disparate practices (Fig. 1). Therefore, there is a requirement for research, as to the optimal anticoagulation, anticoagulation monitoring, and blood product administration targets. Whilst some of these questions are beginning to be addressed (e.g., the recent high-quality PROTECT V-V ECMO transfusion practice prospective observational study), more high-quality trial data (ideally randomised) are required to address these issues identified by clinicians.

4.1. Study limitations

As the survey included snowball sampling, it is not possible to identify the response rate. However, the study has a higher number of respondents than previously published ECMO surveys. Whilst 84% of respondents already work at established ECMO centres, from a limited number of states, and may bias results, the survey was informed by a literature review and expert, multidisciplinary clinician review.

5. Conclusion

Our binational survey identified and prioritised evidence gaps that can be addressed with future research into the management and outcomes of patients requiring ECMO.

Data availability statement

The authors confirm that the data supporting the findings of this study are available within the article and/or its supplementary materials.

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CRediT authorship contribution statement

Mark Dennis: Conceptualisation, methodology, investigation, writing the original draft, visualisation, editing. **Timothy Southwood:** Investigation, resources, data curation, visualisation, project administration. **Matthew Oliver:** Methodology, validation, writing - review and editing. **Alistair Nichol:** Conceptualisation, methodology, validation, writing - review and editing. **Aidan Burrell:** Methodology, validation, writing - review and editing. **Carol Hodgson:** Conceptualisation, methodology, validation, writing - review and editing.

Conflict of interest

The authors report no conflict of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.aucc.2022.11.009>.

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