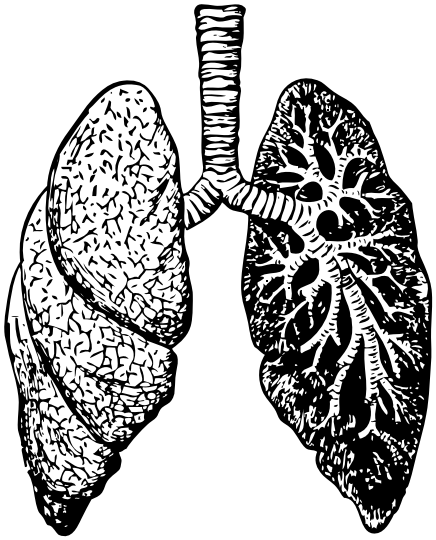
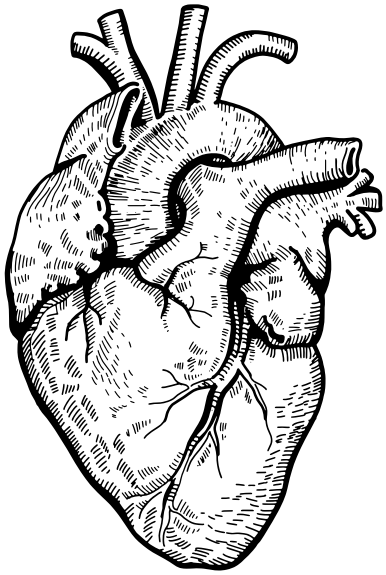
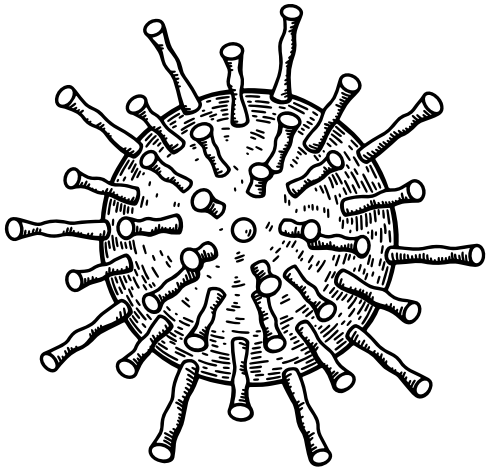






EXCEL Registry Annual Report

2024

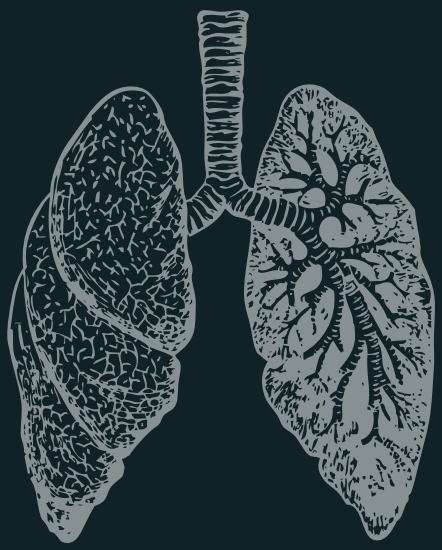
Presented By :

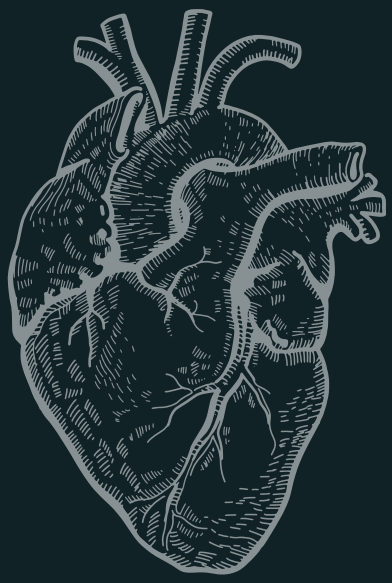
The EXCEL Registry Management Committee

Prepared By :

Prof Carol Hodgson
Dr Andrew Stephens
Dr Patricia Alliegro
Mr Ben Fulcher
Ms Natalie Linke
Mr Simon Cumming

553 St Kilda Road,
Melbourne, Victoria,
Australia





Data period:
1st January 2024 - 31st December 2024

Suggested Citation: Hodgson CL, Alliegro PV, Fulcher BJ, Stephens A, Linke NJ, Cumming S, Anderson S, Bernard S, Board JV, Brodie D, Buhr H, Burrell AJC, Cooper DJ, Dicker, C, Fan E, Fraser JF, Gattas DJ, Higgins AM, Hopper IK, Huckson S, Jones A, Litton E, McGuinness SP, Nair P, Serpa Neto A, Orford N, Parke RL, Pellegrino VA, Pilcher DV, Reddi BAJ, Stub D, Trapani T, Udy AA. The EXCEL Registry Report 2024. Monash University, Australian and New Zealand Intensive Care Research Centre, October 2025. Report No 5, 46 pages.

Any enquiries or comments regarding this publication should be directed to:

The EXCEL ECMO Registry
Australian and New Zealand Intensive Care Research Centre
Level 3, 553 St Kilda Road, Melbourne 3004
(03) 9903 0930

November 2025

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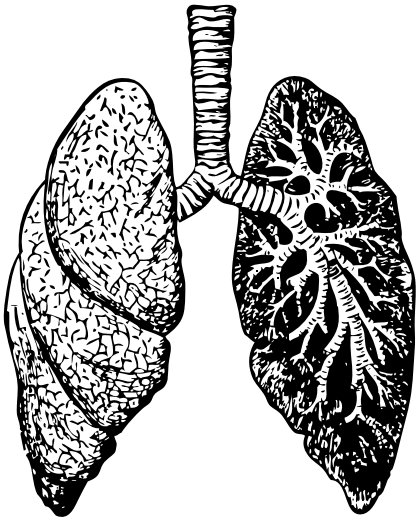

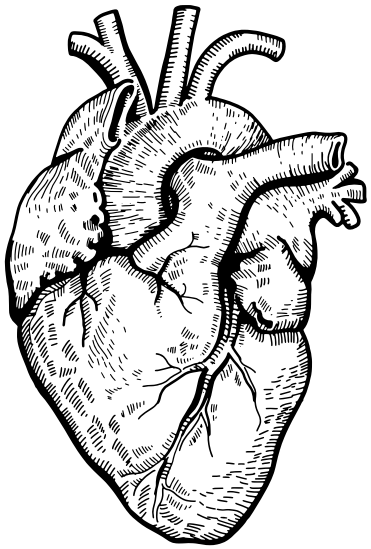

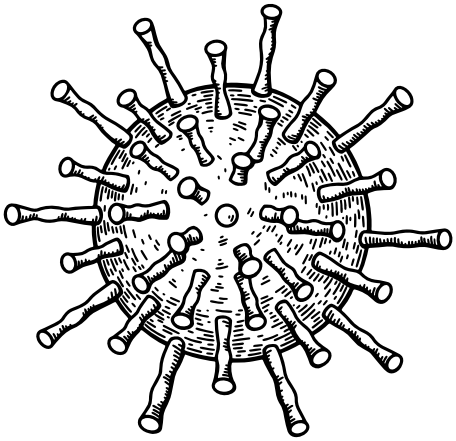

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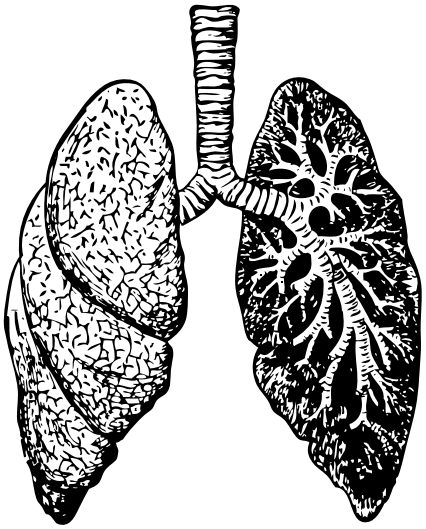

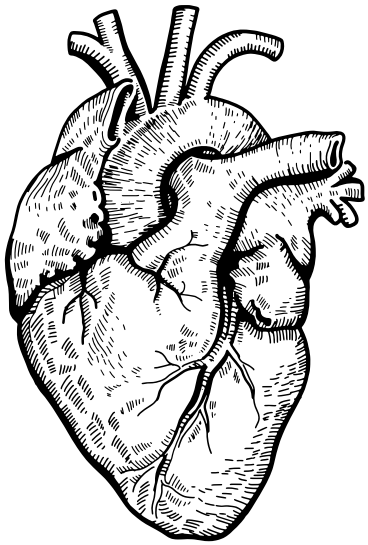

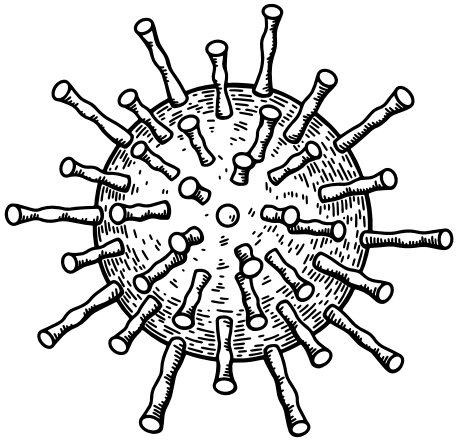

Executive Summary and Chief Principal Investigator Foreword

Introduction

The EXCEL Registry aims to create a binational, multidisciplinary network of integrated care for patients suffering acute cardiac or respiratory failure requiring extracorporeal membrane oxygenation (ECMO). The overarching goal is to monitor long-term outcomes and identify best practices for ECMO treatment. This report provides critical feedback to Australian and New Zealand ECMO sites regarding patient outcomes, offering a comprehensive analysis of data from both local and binational perspectives.

Data Collection and Scope

The EXCEL Registry includes all patients who underwent ECMO during their hospitalisation. This encompasses a broad range of data, including demographic, admission, ECMO, and hospital discharge details, representing patients admitted to the participating ICUs within the reporting period. Furthermore, the report includes patients retrieved to and from these sites. Kaplan-Meier survival curves and follow-up data represent all EXCEL patients at each site entered into the database. It is important to note that all data presented in this report has been meticulously collected by the Investigators and Research Coordinators at each participating site. This data is available for download by Principal Investigators via the EXCEL REDCap database. The information is provided confidentially to the EXCEL Registry and should be shared only with relevant hospital staff, including members of the hospital executive committee. Reproduction of the report is prohibited without prior permission from the EXCEL Management Committee.

Reporting Period and Data Considerations

Data completion reflects data entered for the reporting period 01 January 2024 to 31 December 2024. Data were extracted on 17 November 2025 and any data entered after this date are not represented in this report. In cases where fewer than five patients are reported, we urge caution when interpreting the data, as it may not be statistically significant or generalisable. Fig1 (A) updated v1.1.

Year in Review: ECMO Research and Funding Milestones

The ECMO program has seen significant progress in the last year, marked by new and continued funding, as well as numerous high-impact publications and key project milestones. Notably, Prof. Carol Hodgson was awarded an NHMRC L2 investigator grant to further research long-term ECMO outcomes and contribute to the development of best practice guidelines. Additionally, a pilot study focusing on ECMO survivors, known as the ECMO Prompt, was launched with a $40K grant from the ANZ Intensive Care Foundation. Recruitment for this study has commenced. Furthermore, three trials embedded within the EXCEL registry completed recruitment. These trials included studies on early mobilisation (ECMO-Rehab) and blood transfusion (OBLEX and ROSETTA) for ECMO patients. Several noteworthy publications emerged from the ECMO program in 2024, including:

- A study on oxygen targets in VA-ECMO (BLENDER) published in Intensive Care Medicine *(Burrell, A., Bailey, M. J., et al. (2024). Conservative or liberal oxygen targets in patients on venoarterial extracorporeal membrane oxygenation. Intensive Care Medicine, 50(9), 1470–1483.)*
- A new outcome measure for ECMO patients, the DOSE Score, featured in American Journal of Respiratory and Critical Care Medicine *(Serpa Neto, A., Higgins, L., Lorenzi, E., Berry, L., Ryan, E., Heritier, S., Anderson, S., Orosz, J., Burrell, A., McQuilten, Z., Nair, P., et al. (2024). Development of a new longitudinal ordinal outcome for clinical trials in extracorporeal membrane oxygenation patients. American Journal of Respiratory and Critical Care Medicine, 211(7).)*
- Research on machine learning for risk prediction in VA-ECMO (ECMO-PAL) published in Intensive Care Medicine *(Stephens, A. F., Šeman, M., Diehl, A., Pilcher, D., Barbaro, R. P., Brodie, D., Pellegrino, V., Kaye, D. M., Gregory, S. D., & Hodgson, C. on behalf of the Extracorporeal Life Support Organization Member Centres. (2023). ECMO PAL: Using deep neural networks for survival prediction in venoarterial extracorporeal membrane oxygenation. Intensive Care Medicine, 49, 1090–1099.)*
- A study on hospital-level ECMO volumes in Australia, published in Critical Care and Resuscitation *(Ertugrul, A. D., Serpa Neto, A., Fulcher, B. J., et al. (2024). Hospital-level volume in extracorporeal membrane oxygenation cases and death or disability at 6 months. Critical Care and Resuscitation, 26(4), 262–270.)*

Additionally, systematic reviews on mobilisation in ECMO (in CCE) and qualitative research on nurses' perceptions of workload (in AUCC) were also accepted. Please see complete list of publications on page 14.

Executive Summary and Chief Principal Investigator Foreword

Growth of the EXCEL Registry

The EXCEL Registry continues to expand with 7 embedded studies and its largest-ever enrolment, now exceeding 2400 patients. The third annual EXCEL symposium, held in February 2024, brought together over 150 attendees, marking a significant milestone for the network. This year also saw the inaugural peer support group meeting, with 7 ECMO Patients participating.

Ongoing Research

We are pleased to recognize the ongoing contributions of postgraduate researchers within the ECMO program, including Alastair Brown, Vinay Bharatula, and Vicki Papanikolaou, whose work continues to shape the future of ECMO-related research.

Acknowledgements

The progress outlined in this report would not be possible without the dedication and hard work of the Investigators, Research Coordinators, and staff at the participating ECMO sites. We would also like to extend our thanks to Dr. Andrew Stephens and the Australian and New Zealand Intensive Care Research Centre for their ongoing support. For more information about the EXCEL Registry, please visit the website: https://www.monash.edu/medicine/sphpm/excel.

Conclusion

The year 2024 has been a pivotal year for the EXCEL Registry and the ECMO program. We remain committed to advancing research, improving patient care, and fostering collaboration across our binational network. As always, we are grateful for the continued engagement and efforts of all involved. On behalf of the EXCEL Management Committee, thank you for your continued support and commitment to excellence in ECMO care and research.

Professor Carol Hodgson
EXCEL Registry Chief Principal Investigator

Executive Director, Monash Partners Academic Health Science Centre
Head of the Division of Clinical Trials and Cohort Studies
Deputy Director of the Australian and New Zealand Intensive Care-Research Centre

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ACKNOWLEDGEMENTS

The EXCEL Registry is supported by funding from:
National Health and Medical Research Council (NHMRC)
International ECMO Network (ECMO-Net)
Heart Foundation
The Alfred
Barwon Health Critical
Care Research Group Royal
Prince Alfred Hospital
St Vincent's Hospital Sydney
The Dicker Family

EXCEL Registry Management Committee

Carol Hodgson (Chair), Patricia Alliegro, Shannah Anderson, Steve Bernard, Daniel Brodie, Heidi Buhr, Aidan Burrell, Jamie Cooper, Craig Dicker, Eddy Fan, Ben Fulcher, John Fraser, David Gattas, Lisa Higgins, Ingrid Hopper, Sue Huckson, Natalie Linke, Chris Allen, Shay McGuiness, Priya Nair, Neil Orford, Rachael Parke, Vin Pellegrino, David Pilcher, Benjamin Reddi, Ary Serpa Neto, Dion Stub, Tony Trapani, Andrew Udy, Elliott Worku

We would like to thank the participating ECMO centres and patients for their time and generous contribution to this work. The EXCEL Registry is coordinated by the Australian and New Zealand Intensive Care Research Centre (ANZIC-RC) in the School of Public Health and Preventive Medicine, Monash University.

Bi-National Approach

The EXCEL Partnership represents a novel, coordinated effort to create a high-quality, detailed, prospective registry of patients requiring ECMO at ECMO centres. It can be used to address specific safety concerns, clinical questions and process of care issues. As a result, EXCEL can be designed and implemented to answer new investigator-initiated, hypothesis driven clinical questions.

Participating Hospitals 2019 - 2024

ACT

The Canberra Hospital

NSW

John Hunter Hospital
Liverpool Hospital
Prince of Wales Hospital
Royal North Shore Hospital
Royal Prince Alfred
St George Hospital
St Vincent's Hospital Sydney
Westmead Hospital

SA

Flinders Medical Centre
Royal Adelaide Hospital

TAS

Launceston General Hospital

VIC

Alfred Hospital
Austin Hospital
Box Hill Hospital
Epworth Hospital Richmond
Monash Medical Centre
Royal Melbourne Hospital
St Vincent's Hospital Melbourne
University Hospital Geelong
Victorian Heart Hospital

WA

Fiona Stanley Hospital
Sir Charles Gairdner Hospital

QLD

Gold Coast University Hospital
Prince Charles Hospital
Princess Alexandra Hospital
Royal Brisbane and Women's Hospital
Sunshine Coast University Hospital
Townsville University Hospital

NZ

Auckland City Hospital

2024 KEY FINDINGS

DEMOGRAPHICS

30 Participant sites

2024

69.7% Male

48.9 mean age (years)

Overall

2405 Participants overall

1.8% Procedural ECMO overall

ECMO MODE AND MAIN INDICATIONS

42% Cardiac Support (**VA**)

36% Pulmonary Support (**VV**)

22% **ECPR**

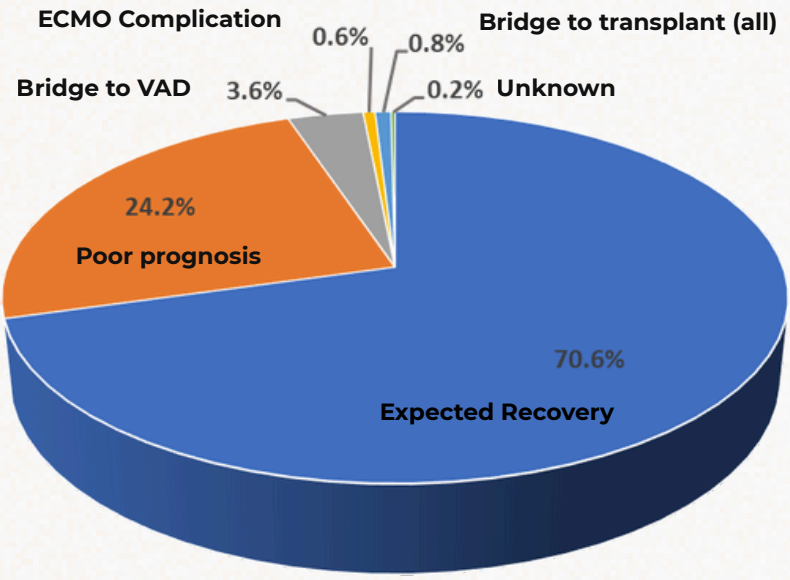
31.8% VA ECMO patients had acute heart failure

56% VV ECMO patients had ARDS

55.8% ECPR patients had acute myocardial infarction

2024 OUTCOMES*

ECMO Discontinuation reason



Mortality - Hospital Discharge

VA
28.9% Deceased

VV
25.9% Deceased

ECPR
59.1% Deceased

***percentages calculated based on the data available at hospital discharge at the time of the data extraction**

2024 SUPPORT DURATION (Mean)

ECMO

8.1 days

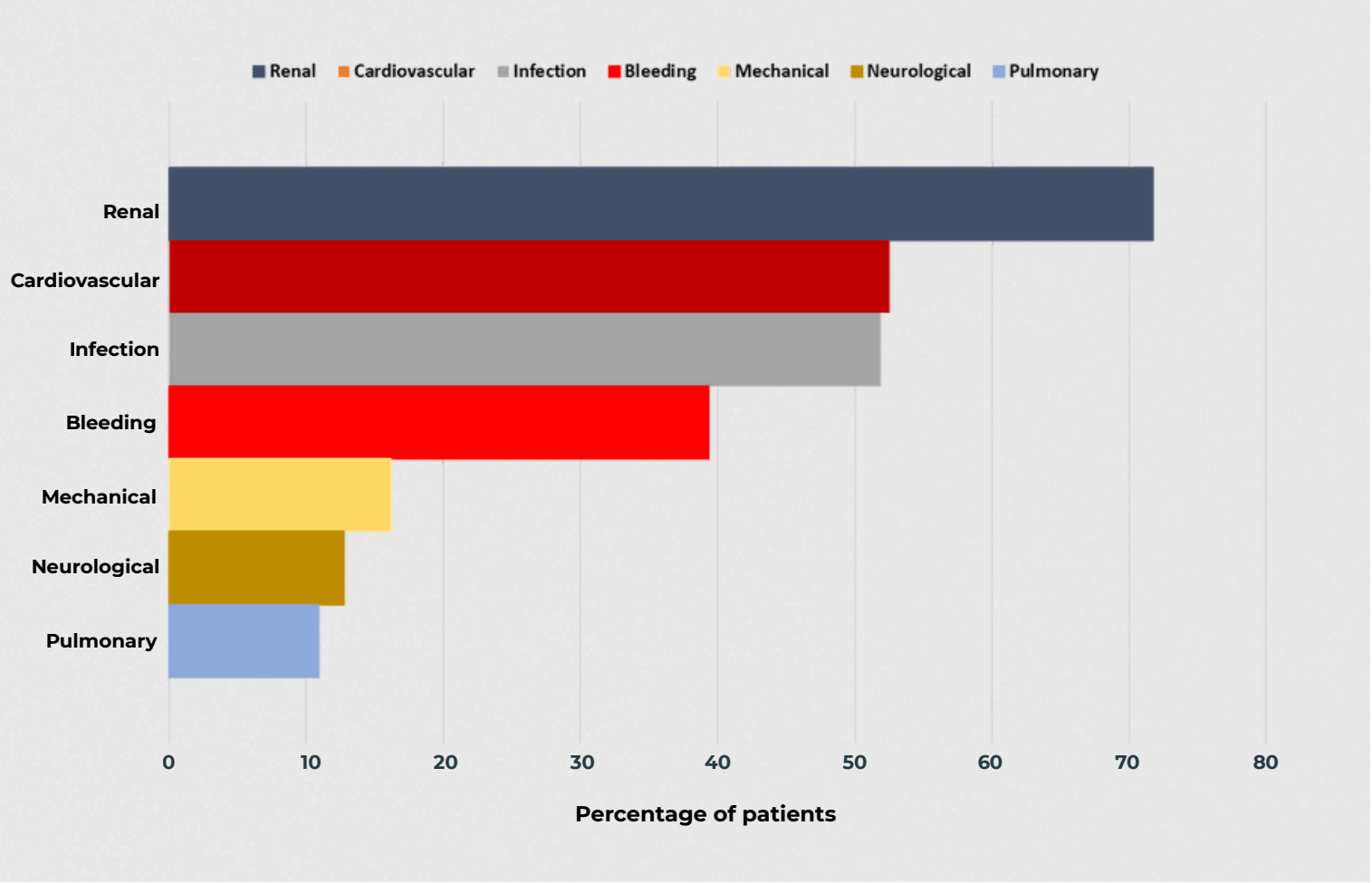
ICU LOS

22.4 days

Hospital LOS

37.0 days

COMPLICATION RATES



EXCEL Patient Advisory Group

The EXCEL Patient Advisory Group is a critical component of the EXCEL Registry, ensuring that the perspectives and priorities of patients, families, and the broader community are meaningfully integrated into the development, governance, and application of registry data. Involving ECMO patients helps to promote transparency, trust, and ethical oversight, while also enhancing the relevance and impact of the registry's outputs. An example of our collaboration was the development of a new longitudinal ordinal outcome for clinical trials in ECMO patients. https://pubmed.ncbi.nlm.nih.gov/40153559/

The EXCEL Registry has listened to needs of ECMO patients and developed a dedicated ECMO Peer Support Group. This group is co-designed with ECMO patients and provides a platform for ECMO patients, their families, and caregivers to share experiences, offer mutual support, and contribute valuable insights into the recovery and rehabilitation process.

At the EXCEL Symposium, Maree shared her ECMO experience and recovery in Queensland. Maree's presentation is available for ECMO patients and their loved ones to view on the EXCEL website.

ANZIC-RC Lived Experience Statement

We acknowledge the individual and collective expertise of those with a lived experience of critical illness, and those who love and care for them.

We value the contribution of those that share their perspectives to improve research outcomes and we are committed to listening, learning and continuously improving.

REGISTRY OVERVIEW

ETHICS APPROVAL

The EXCEL Partnership represents a novel, coordinated effort to create a high-quality, detailed, prospective registry of patients requiring ECMO at ECMO centres. It can be used to address specific safety concerns, clinical questions and process of care issues. As a result, EXCEL can be designed and implemented to answer new investigator-initiated, hypothesis driven clinical questions.

EXCEL collects, stores and analyses health information about patients on ECMO across sites in Australia and New Zealand.

All patients receiving ECMO at participating sites will have their hospital data included in the registry under a waiver of consent, in line with the National Statement and the NHMRC Ethical Considerations in Quality Assurance and Evaluation Activities, 2014. Once it is determined likely that the patient will survive to hospital discharge, the research staff, invites the patient or their surrogate decision maker to participate in the day 180 and day 365 telephone interview.
An information brochure is provided to them, along with details how to opt-out of the follow-up interview. For patients under the age of 18 who are admitted to an adult hospital for ECMO, both the patient and legal guardian will be required to consent to participation to the day 180 and day 365 telephone interview. In the event that a patient under the age of 18 does not have a legal guardian, they may be included if the clinician deems them as able to make competent decisions regarding participation.

As part of local research governance processes, it is a requirement for all sites registered to obtain ethics approval and local research governance authorisation prior to commencing data collection.

Protocol Version 1.5 1st October 2023.

GOVERNANCE

The Registry custodian is the School of Public Health and Preventive Medicine (SPHPM), Monash University, and it is operated under the leadership of Professor Carol Hodgson.

The EXCEL Management Committee provides strategic guidance to ensure the objectives, outcomes and deliverables of the Registry. This committee consists of representatives of key stakeholder organisations including intensivists, cardiologists, research staff, and consumer representatives, and is working to support research initiatives and any registry related activities.

Research ethics approval is obtained prior to the start of the study at each institution or national HREC. In Australia ethics approval is sought under National Mutual Acceptance scheme for single ethical review for multi–centre clinical trials. Each participating site will submit the protocol and any relevant study documentation to the responsible local governance office for site specific assessment.
This study is also approved at Monash University. The HREC approved documents need to be approved by the Research Governance Office at each site.

The EXCEL coordinating centre and data management centre are responsible for the overall management of the trial and the EXCEL Management Committee oversees all aspects of the study management.
Data in The EXCEL Registry is governed by the EXCEL Management Committee. The project manager oversees the project and the database manager manages the central database. Research coordinators collect patient data and appropriately trained staff conduct follow-up interviews.

DATA MANAGEMENT

Data are collected using a REDCap database. Each patient is given a unique identifier.
The registry is certified according to the ISO27001 standards. The database accepts direct entry via a web interface. Data management is performed by Monash University. The registry is capable of collecting high volumes of patient data. Data are entered by participating sites. In order to provide accurate and coherent data, patient records that are transferred between EXCEL active sites are placed into a specific REDCap data access group (DAG). These DAGs are specific to the transferring and retrieving ECMO centres, and only allow users from these two particular sites to access and enter relevant data. This is relevant in order to capture data that can be omitted within the process of transferring patients between REDCap DAGs.

The EXCEL Registry allows data entry staff to generate varying levels of information based on identified quality indicators. Access to the EXCEL database is based on the defined role of the user. The EXCEL project manager and data analyst have access to all data contained in the database and the ability to assign access to new users. The database is reviewed periodically as the EXCEL Registry increases in size. The EXCEL management team focused on reducing data burden by establishing the joint data access groups, changing the REDCap database to reduce data entry and improve functionality, and working on EMR and other data linkage processes - a data request was sent to the ANZICS APD to support the integration of linked data using the SLK-581 identifier.

Monash Registry Database security is maintained using encryption of data, a managed and audited protocol for access, training and accreditation of personnel, role-based access and authentication of data. Monash Registry Databases are housed and managed in an ISO 27001 certified environment. The ISO 27001 certification incorporates the Privacy Act (1988) and Health Records Act (2001) within its Applicability Statement.

The EXCEL Registry provides feedback to ECMO sites about their own results on a regular basis, in the form of an automatically generated report from the EXCEL database. We also provide a publicly released annual report.

DATA ACCESS AND PUBLICATION POLICY

Individuals and institutions must submit any potential publications, presentations and publicity to the EXCEL management committee for review prior to submission to a peer reviewed journal, scientific conference, media release or equivalent in order to:

- Certify that data provided has been understood and interpreted accurately.
- Ensure appropriate acknowledgement of the EXCEL Registry as well as individuals and/or institutions involved.
- Ensure that the majority (80%) of the members of the EXCEL Management Committee support the scientific validity of research and the conclusions made. In circumstances where MC consensus cannot be reached, the requestee will be given an opportunity to amend the publication/presentation/media release for further review. If consensus is still not reached, support for use of the data request will be withdrawn by the EXCEL MC, and any associated publication/presentation/media release will be unable to proceed with EXCEL data. If applicable, they may explore alternative avenues for publication that do not involve EXCEL data or submit a revised request in the future that aligns with the committee's feedback.
- Certify that any potential conflicts of interest have been disclosed.

All data requests will undergo initial screening for level of risk in line with the 'EXCEL Registry Data Request Risk Matrix'

Process for Publications and Presentations using EXCEL data, including Scientific Meetings and Media:

- Requests for data must be submitted via **Qualtrics survey: https://monash.az1.qualtrics.com/jfe/form/SV_aXeY6DT84z4H3n0**
- The EXCEL Data Request Form requires the following information:

i. A clear outline of the purpose for requesting EXCEL data,
ii. List of the variables requested from the EXCEL dataset
iii. Submission of a study protocol and ethics approval (data requests meant for publication and classified as low risk may submit the protocol to their local Ethics Committee for approval; high risk data requests need to be submitted to one of the Registered and Certified Ethics Committees for approval)
iv. Identification of how data and analyses will be stored upon receiving and at completion of the intended purpose.

- For the EXCEL Data Acknowledgements and Authorship Form see "Specific Guidelines for Acknowledgements and Authorship"
- Submissions will be forwarded to select members of the EXCEL management committee (i.e. the EXCEL data committee) who will be responsible for reviewing material.
- In the case that rapid approval is required (e.g. approval to include EXCEL data in an interview), where possible, contact the EXCEL CPI directly.
- For any accepted publication, citation details should be forwarded via email to the EXCEL PM or EXCEL CPI.

Participating Site Access to Own Data held in the EXCEL Registry

- Participating sites that contribute data to the EXCEL Registry have the right to access their own data, which can be accessed directly from the EXCEL REDCap database.
- Single site data for internal audits, quality projects and publications: participant sites are welcome to use their own data for audits, quality projects and publications. No further permission needs to be given for that. Publication should include acknowledgement of the use of the EXCEL Registry data.

Post Approval - Publication Data Terms and Conditions

- Only ONE published manuscript per data request is allowed.
- Investigators are afforded 12-months of exclusive access to the data which pertains to their specific proposal.
- Data provided by EXCEL must ONLY be used for the purpose as outlined within the investigators data request. Any change to the objectives for use of the data must be preceded by a subsequent data request that will need review and approval from the EXCEL data committee.
- In rare cases where progress is significantly delayed, the EXCEL CPI reserves the right to inform the appropriate investigators that the data may no longer be used for the previously approved request. This ensures that delayed publication does not prevent the release of data within subsequent data requests from other investigators.

Specific Guidelines for Acknowledgements and Authorship

- Publications must include a statement of approval from an associated Human Research Ethics Committee.
- ALL requests for data with an intention to publish must submit a 'Data Acknowledgement and Authorship Form' along with a completed data request form.
- Publications, presentations and media releases with identifying information, such as individuals or institutions in research findings, must comply with the Data Access Policy.
- The EXCEL registry, EXCEL research funders and research participants should be acknowledged in all publications and presentations, as well as media (where possible). Such acknowledgements should include "The EXCEL Study Investigators", "EXCEL research funders" and "EXCEL research participants". Where appropriate, a list of EXCEL Management Committee members, participating institutions, site principal investigators, and research coordinators should also be included. A list can be obtained from the EXCEL PM.
- At least one member of the EXCEL management committee must be included as an author on any publication using EXCEL data, to ensure accurate interpretation. This should be negotiated at the time of the formal data request.

For further details, please consult the *EXCEL Registry Data Access and Publication Policy* **https://www.monash.edu/__data/assets/pdf_file/0004/3021871/excel-registry-data-access-and-publication-policy-v-1.4.pdf**

PUBLICATIONS

1. Linke, N. J., Fulcher, B. J., Engeler, D. M., et al. (2020). A survey of extracorporeal membrane oxygenation practice in 23 Australian adult intensive care units. Critical Care and Resuscitation, 22(2), 166–170. PMID: 32389109.

2. Fulcher, B. J., Nicholson, A. J., Linke, N. J., Berkovic, D., Hodgson, C. L., et al. (2020). The perceived barriers and facilitators to implementation of ECMO services in acute hospitals. Intensive Care Medicine, 46(11), 2115–2117. PMID: 32705292.

3. ECMO-PT Study Investigators, & International ECMO Network. (2020). Early mobilisation during extracorporeal membrane oxygenation was safe and feasible: A pilot randomised controlled trial. Intensive Care Medicine, 46(5), 1057–1059. PMID: 32179935.

4. Hodgson, C. L., Burrell, A. J. C., Engeler, D. M., Pellegrino, V. A., Brodie, D., Fan, E., et al. (2019). Core outcome measures for research in critically ill patients receiving extracorporeal membrane oxygenation for acute respiratory or cardiac failure: An international, multidisciplinary, modified Delphi consensus study. Critical Care Medicine, 47(11), 1557–1563. PMID: 31389837.

5. Hodgson, C. L., Fulcher, B., Mariajoseph, F. P., Burrell, A., Pellegrino, V., Brodie, D., Fan, E., & SCOPE Study Investigators on behalf of the International ECMO Network. (2021). A core outcome set for research in patients on extracorporeal membrane oxygenation. Critical Care Medicine, 49(12), e1252–e1254.

6. Thiara, S., Hodgson, C. L., et al. (2022). Association of respiratory parameters at venovenous extracorporeal membrane oxygenation liberation with duration of mechanical ventilation and ICU length of stay: A prospective cohort study. Critical Care Explorations, 4(5), e0689.

7. Hodgson, C. L., Higgins, A. M., Bailey, M. J., et al. (2022). Incidence of death or disability at 6 months after extracorporeal membrane oxygenation in Australia: A prospective, multicentre, registry-embedded cohort study. The Lancet Respiratory Medicine, 10(11), 1038–1048.

8. Joyce, P. R., Hodgson, C. L., Bellomo, R., et al. (2023). Smaller return cannula in venoarterial ECMO does not increase hemolysis: A single-center, cohort study. ASAIO Journal. PMID: 37549666.

9. Ross, P., Watterson, J., et al. (2023). Nursing workforce, education, and training challenges to implementing extracorporeal membrane oxygenation services in Australian intensive care units: A qualitative substudy. Australian Critical Care, 36(1), 114–118.

10. Stephens, A. F., Šeman, M., Diehl, A., Pilcher, D., Barbaro, R. P., Brodie, D., Pellegrino, V., Kaye, D. M., Gregory, S. D., & Hodgson, C. on behalf of the Extracorporeal Life Support Organization Member Centres. (2023). ECMO PAL: Using deep neural networks for survival prediction in venoarterial extracorporeal membrane oxygenation. Intensive Care Medicine, 49, 1090–1099.

11. Serpa Neto, A., Higgins, L., Lorenzi, E., Berry, L., Ryan, E., Heritier, S., Anderson, S., Orosz, J., Burrell, A., McQuilten, Z., Nair, P., et al. (2024). Development of a new longitudinal ordinal outcome for clinical trials in extracorporeal membrane oxygenation patients. American Journal of Respiratory and Critical Care Medicine, 211(7).

12. Burrell, A., Bailey, M. J., et al. (2024). Conservative or liberal oxygen targets in patients on venoarterial extracorporeal membrane oxygenation. Intensive Care Medicine, 50(9), 1470–1483.

13. Pound, G., Hodgson, C. L., et al. (2024). Long-term outcomes of patients who received extracorporeal cardiopulmonary resuscitation (ECPR) following in-hospital cardiac arrest: Analysis of EXCEL registry data. Critical Care and Resuscitation. Advance online publication. (2024, November 21).

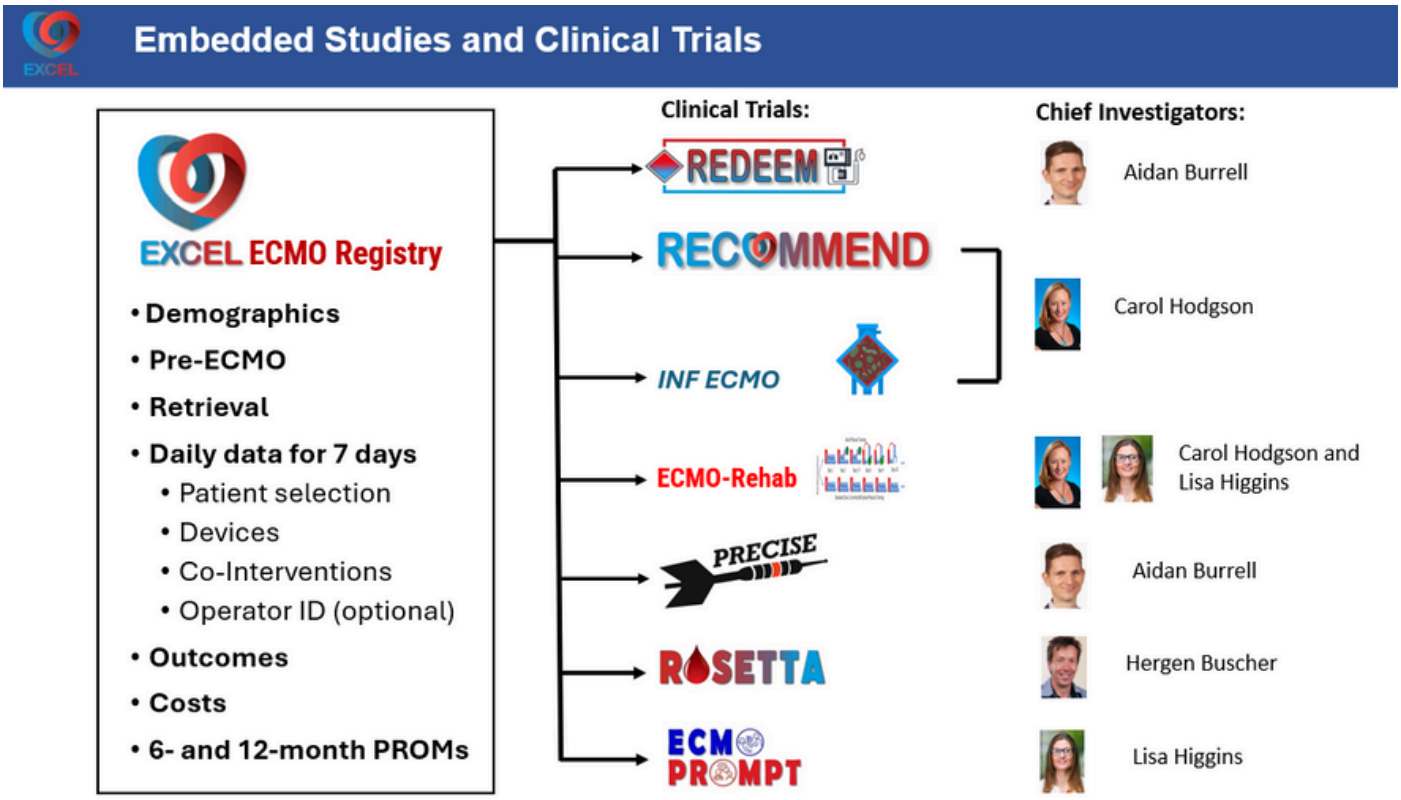
14. Ertugrul, A. D., Serpa Neto, A., Fulcher, B. J., et al. (2024). Hospital-level volume in extracorporeal membrane oxygenation cases and death or disability at 6 months. Critical Care and Resuscitation, 26(4), 262–270.

REGISTRY EMBEDDED STUDIES AND FUTURE INITIATIVES

As the EXCEL Registry moves towards maturity, the data are becoming more valuable for monitoring ECMO in Australia. We have been working on testing and refining algorithms to identify outliers, device performance, safety signals, risk prediction and patient outcomes.

The data from the EXCEL Registry is becoming increasingly important to drive continuous quality improvement in healthcare. We have been providing detailed reports back to sites and funders including their choice of process measures of care. We will continue to work with stakeholders, including consumers, to raise awareness about the registry within Australia. This report is designed to provide feedback to Australian and New Zealand ECMO sites about patient outcomes and to inform healthcare providers about the national use and outcomes of ECMO.

We have been fortunate to receive partnership funding from the NHMRC, Heart Foundation, the International ECMO Network (ECMO-Net), The Dicker Family, Critical Care Research Group (CCRG), and major Australian ECMO sites including The Alfred, St Vincent's Hospital Sydney, The University Hospital Geelong, and Royal Prince Alfred Hospital. We will be exploring alternate funding models within the Commonwealth, and look forward to engaging with stakeholders to measure and report on new models of care. The EXCEL Registry will continue to work with our research collaborators, including the existing studies that are embedded within the registry:



ROSETTA Pilot completed recruitment, and data from the pilot is rolling into the first domain of RECOMMEND. EXCEL data has been utilised for DOSE score calculation

EXCEL supports investigator-led research demonstrated by the completion of 29 data requests from 2019-2024. This research has resulted in publications highlighting ECMO concomitant therapies, long term outcomes and practice in Australia and New Zealand.

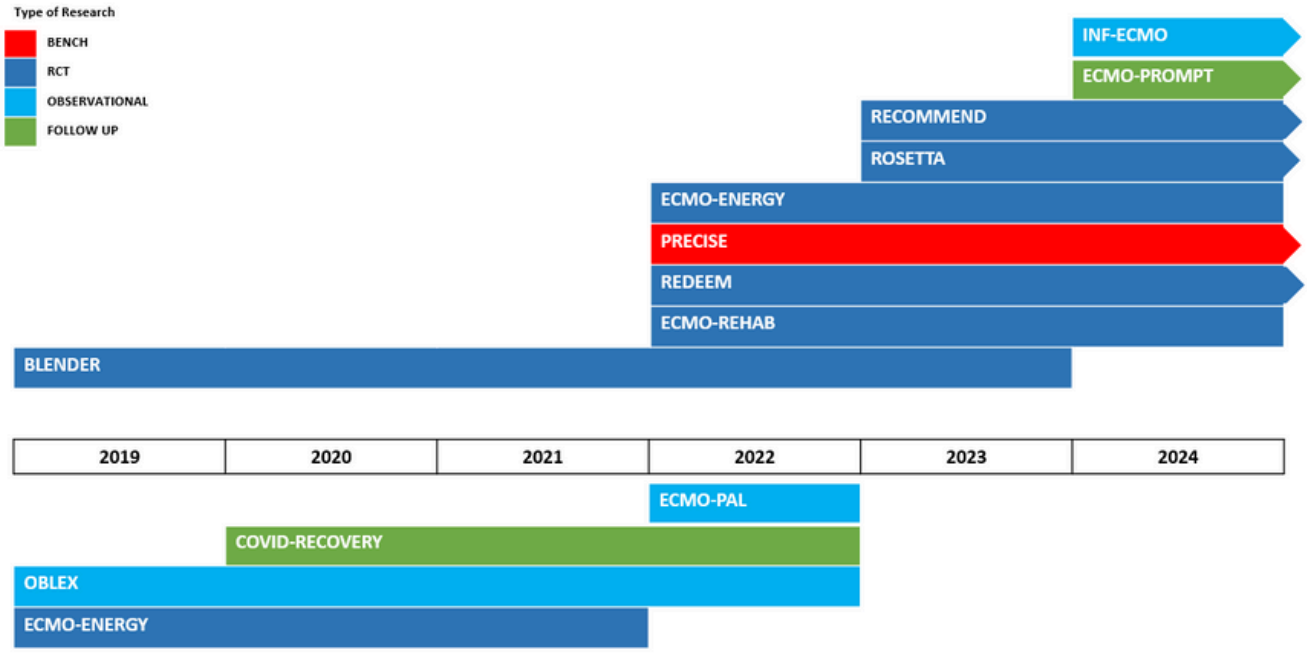


Figure 20: Studies supported by EXCEL 2019-2024

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ABBREVIATIONS AND ACRONYMS

Table 1: Abbreviations and Acronyms

AMI	Acute myocardial infarction
ARDS	Acute respiratory distress syndrome
CNS	Central nervous system
CPR	Cardiopulmonary resuscitation
DVT	Deep vein thromboembolism
ECPR	Extracorporeal cardiopulmonary resuscitation
GI	Gastrointestinal
LVD	Left ventricular distention
RESP	Respiratory ECMO Survival Prediction Score
SAVE	Survival Prediction after Veno-Arterial ECMO Score
TBI	Traumatic brain injury
V-A	Venoarterial ECMO used for cardiac indication
V-V	Venovenous ECMO used for a respiratory indication

SITE ENROLMENT

The EXCEL Registry continues to engage eligible sites in Australia and New Zealand to contribute data to the registry. An eligible site is defined as a site currently undertaking ECMO as identified by Australian modification of the International statistical classification of diseases and health related problems, 10th revision (ICD-10-AM) coding data provided by the Australian Government Department of Health, or as reported by external sources (internet search, surgeons or site staff). The list of eligible sites is dynamic and updated regularly. The EXCEL Registry maintains a 'watch list' of sites identified as having the potential to undertake occasional ECMO. A participating site is defined as any site that has been granted ethics and governance approval and data collection for the registry has commenced. The total number of participating sites throughout 2024 was 28 of the 31 sites (Figure 1). Transferred patients show up as datapoints at their site of ECMO initiation.

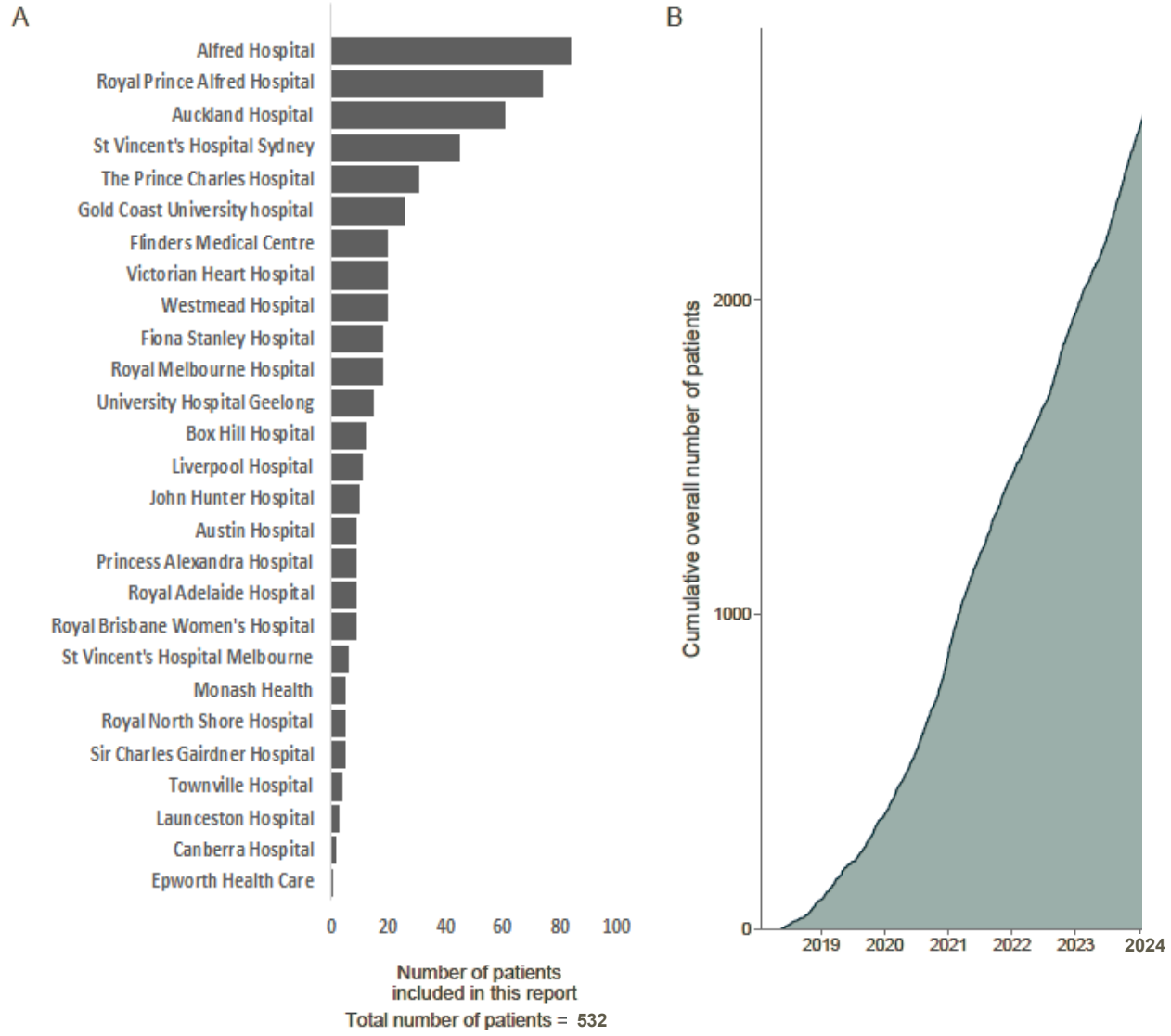

Figure 1: Number of patients included between January 2024 and December 2024 (A)*updated v1.1 , Cumulative overallsite enrolment from 2019 to 2024 (B)

DATA COMPLETION

All data entered in this report has been collected by Investigators and Research Coordinators at each of the participating sites. Over 75% of data was completed for all forms within the registry, with over 95% of data completed for most forms. This work would not have been possible without the ongoing efforts of the many intensive care specialists, nurses, research coordinators and other hospital staff who contribute data to the EXCEL Registry. We would like to thank them for their commitment. We would also like to thank the patients who allow the EXCEL Registry to retain their data (Figure 2).

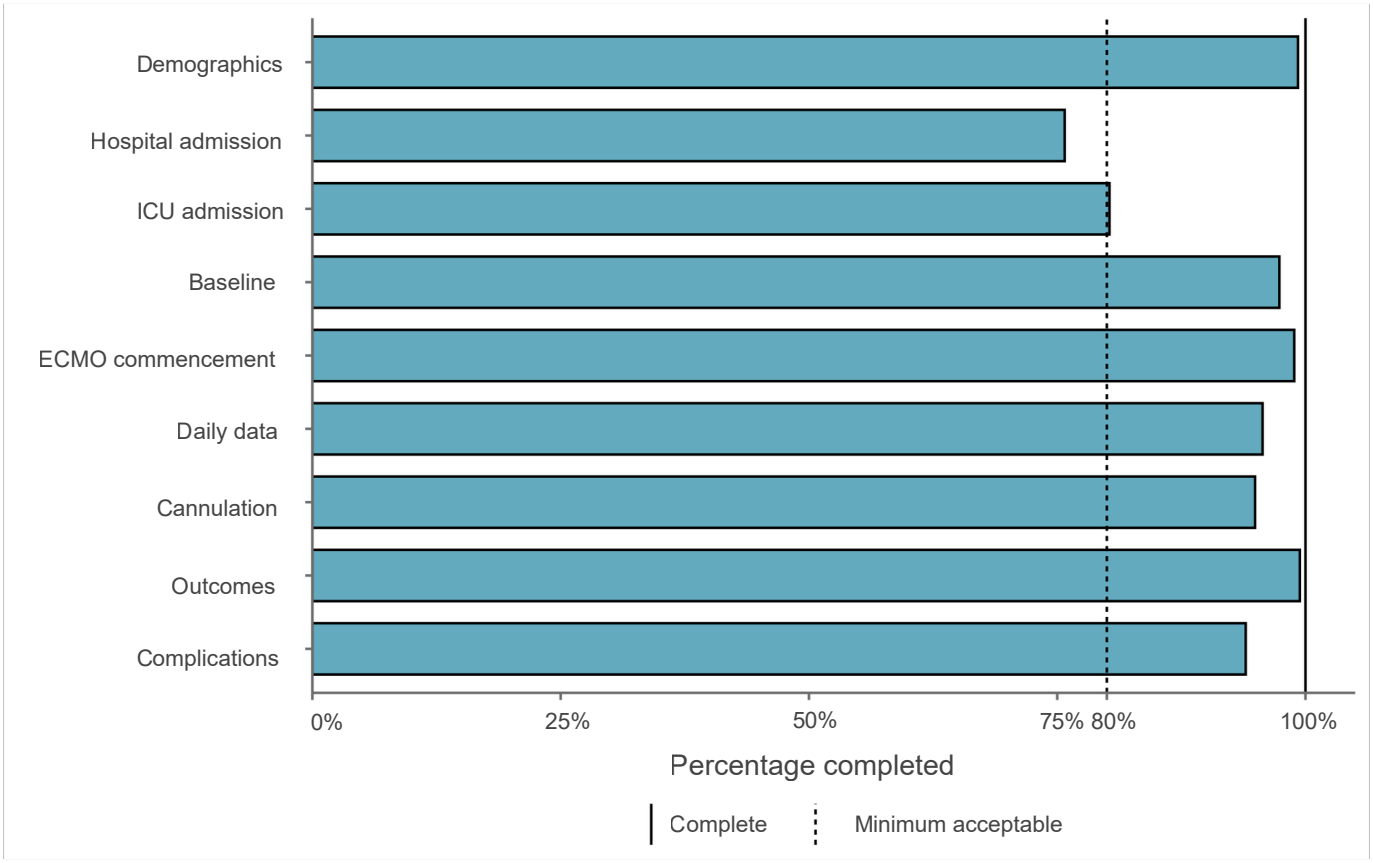

Figure 2: Data completion: EXCEL registry forms

SUMMARY DATA

Table 2 shows the summary data across all sites, separated for the type of ECMO (VV-ECMO, VA-ECMO and ECPR). There were 11 (2%) patients who were diagnosed with COVID-19 who received ECMO in this period.

Table 2: Summary information by ECMO mode

	V-V (N=191)	V-A (N=226)	ECPR (N=115)	Total (N=532)
COVID-19 status				
- Confirmed COVID-19 patients	3 (1.6%)	8 (3.5%)	0 (0.0%)	11 (2.1%)
- Other patients	188 (98.4%)	218 (96.5%)	114 (100.0%)	520 (97.9%)
- Total	191	226	114	531
- Missing	0	0	1	1
Age				
- Mean (SD)	45.5 (15.6)	49.9 (15.9)	52.5 (13.3)	48.9 (15.5)
- Median (IQR)	46.0 (33.0, 56.5)	52.0 (40.0, 61.8)	54.0 (47.0, 61.5)	51.0 (38.0, 60.2)
- Range	15.0 - 80.0	5.0 - 79.0	11.0 - 78.0	5.0 - 80.0
- Missing	0	0	0	0
ECMO commencement location				
- Bedside	144 (75.4%)	105 (46.5%)	75 (65.2%)	324 (60.9%)
- Operative theatre	46 (24.1%)	98 (43.4%)	5 (4.3%)	149 (28.0%)
- Cath lab	0 (0.0%)	22 (9.7%)	20 (17.4%)	42 (7.9%)
- At scene	1 (0.5%)	1 (0.4%)	15 (13.0%)	17 (3.2%)
- Total	191	226	115	532
- Missing	0	0	0	0
ECMO outcome				
- Deceased	49 (25.7%)	65 (29.4%)	68 (59.1%)	182 (34.5%)
- Survived	142 (74.3%)	156 (71.6%)	47 (40.9%)	345 (65.5%)
- Total	191	221	115	527
- Missing	0	5	0	5
ECMO duration				
- Mean (SD)	12.7 (32.4)	7.7 (24.5)	4.8 (4.6)	8.9 (25.4)
- Median (IQR)	7.0 (3.8, 12.9)	4.9 (3.0, 7.4)	3.8 (1.7, 6.4)	5.1 (2.9, 8.9)
- Range	0.0 - 427.1	0.0 - 365.1	0.0 - 27.0	0.0 - 427.1
- Missing	1	3	1	5
ICU length of stay (days)				
- Mean (SD)	30.4 (43.4)	20.7 (24.7)	12.6 (16.3)	22.4 (32.1)
- Median (IQR)	18.8 (11.5, 35.9)	14.0 (8.6, 25.2)	7.0 (1.9, 18.1)	14.9 (7.5, 26.3)
- Range	0.0 - 410.6	0.0 - 261.1	0.0 - 99.2	0.0 - 410.6
- Missing	4	5	1	10
Hospital length of stay (days)				
- Mean (SD)	47.2 (48.6)	37.5 (39.9)	19.4 (22.2)	37.0 (41.6)
- Median (IQR)	33.5 (18.2, 58.1)	25.0 (15.2, 45.7)	11.7 (3.3, 26.7)	24.9 (13.1, 47.4)
- Range	1.0 - 373.8	0.3 - 297.5	0.1 - 99.2	0.1 - 373.8
- Missing	14	18	7	39

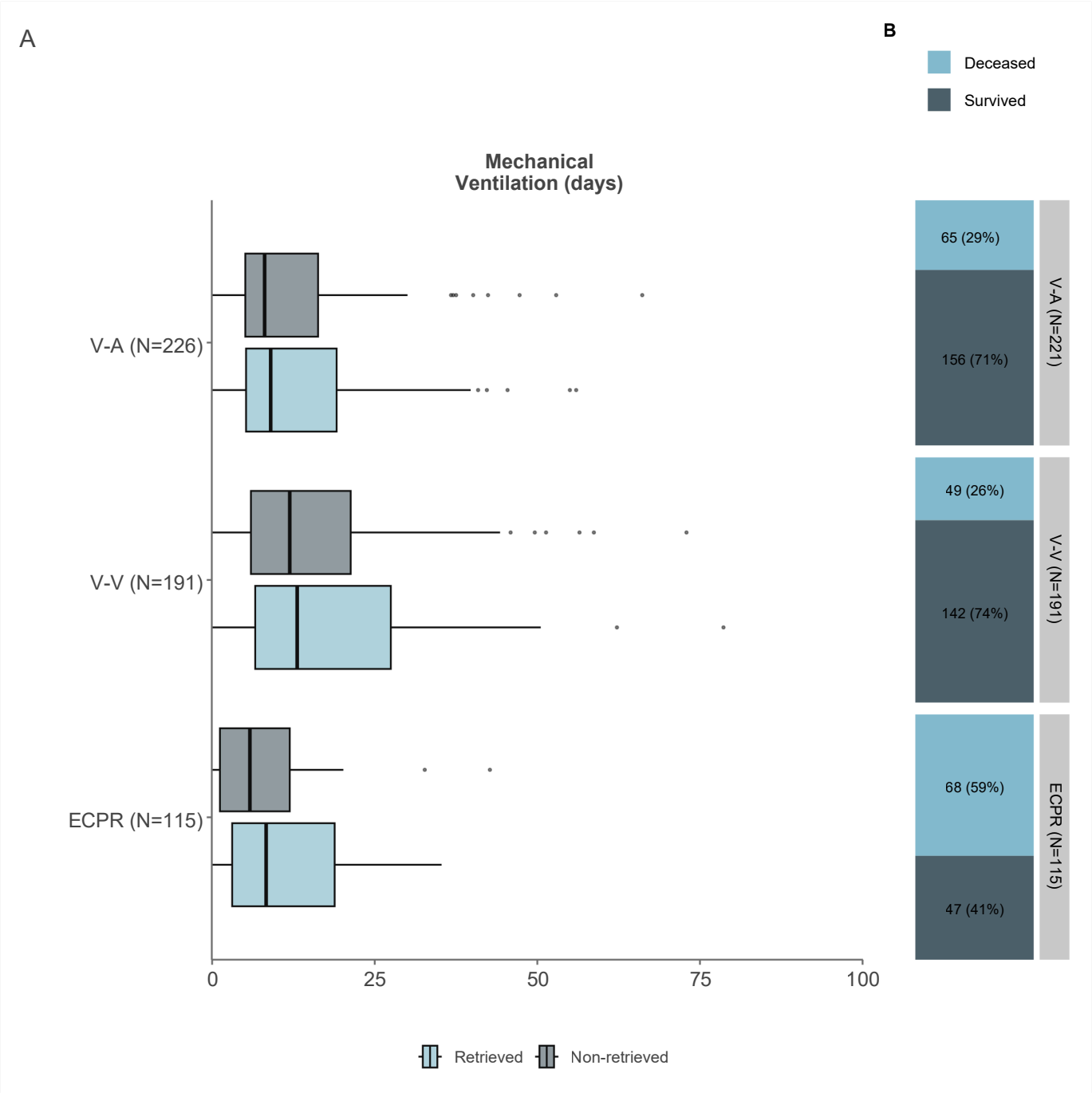

Figure 3: Summary data for mechanical ventilation by ECMO Mode. Note, ventilation days after 100 days are not presented on this graph.

Pre-ECMO DATA

Data collected immediately prior to ECMO commencement.

Indications

Tables 3, 4 and 5 show the indication for ECMO. For VV-ECMO, VA-ECMO and ECPR respectively, the most common indication was ARDS (56%), acute decompensated heart failure (32%) and acute myocardial infarction (56%). VV-ECMO was used post lung transplant (9%) and VA-ECMO was used post heart transplant (6%).

Table 3: ECMO indication (V-V)

	Overall (N=191)
Respiratory indication	
- ARDS (risk factor)	103 (56.0%)
- Asthma	15 (8.2%)
- Chronic end stage lung disease	8 (4.3%)
- Direct lung trauma	8 (4.3%)
- Drug/toxin pulmonary disease	0 (0.0%)
- Focal lung disease (not ARDS)	18 (9.8%)
- Management of airway obstruction	9 (4.9%)
- Post lung transplant	17 (9.2%)
- Pulmonary vasculitis/haemorrhage	6 (3.3%)
- Total	184
- Missing	7

Table 4: ECMO indication (V-A)

	Overall (N=226)
Cardiac indication	
- Acute decompensated heart failure	71 (31.8%)
- Peri-operative support	38 (17.0%)
- Acute myocardial infarction (AMI)	37 (16.6%)
- Myocarditis	23 (10.3%)
- Pulmonary embolism	16 (7.2%)
- Post heart transplant	14 (6.3%)
- Chronic cardiomyopathy	7 (3.1%)
- Primary arrhythmia (Channelopathy)	7 (3.1%)
- Septic shock	6 (2.7%)
- Toxic	3 (1.3%)
- Congenital heart disease	1 (0.4%)
- Total	223
- Missing	3

Table 5: ECMO indication (ECPR)

	Overall (N=115)
Indication	
- Acute myocardial infarction (AMI)	63 (55.8%)
- Primary arrhythmia (Channelopathy)	14 (12.4%)
- Pulmonary embolism	10 (8.8%)
- Acute decompensated heart failure	9 (8.0%)
- Toxic	6 (5.3%)
- Myocarditis	4 (3.5%)
- Peri-operative support	3 (2.7%)
- Chronic cardiomyopathy	1 (0.9%)
- Congenital heart disease	1 (0.9%)
- Septic shock	1 (0.9%)
- Advanced pulmonary hypertension	1 (0.9%)
- Post lung transplant	0 (0.0%)
- ARDS (risk factor)	0 (0.0%)
- Pulmonary vasculitis/haemorrhage	0 (0.0%)
- Post heart transplant	0 (0.0%)
- Chronic end stage lung disease	0 (0.0%)
- Management of airway obstruction	0 (0.0%)
- Direct lung trauma	0 (0.0%)
- Asthma	0 (0.0%)
- Focal lung disease (not ARDS)	0 (0.0%)
- Total	113
- Missing	2

Admission

Table 6: Hospital and ICU admission source

	Overall (N=532)
Hospital admission source	
- Home	280 (52.6%)
- Other acute hospital ICU	157 (29.5%)
- Other acute hospital (not ICU/ED)	55 (10.3%)
- Other hospital ED (like ICU above)	38 (7.1%)
- Rehabilitation	1 (0.2%)
- Mental health	1 (0.2%)
- Total	532
- Missing	0
ICU admission source	
- ED	122 (23.6%)
- ICU, other hospital	121 (23.4%)
- Operative theatre/recovery	113 (21.9%)
- Ward	64 (12.4%)
- Catheter lab	55 (10.6%)
- Other hospital	36 (7.0%)
- ICU, same hospital	5 (1.0%)
- Direct ICU admission (from home)	1 (0.2%)
- Total	517
- Missing	15

ECMO DATA

Length of stay

Table 7 describes the duration of time on EMCO and the length of stay in ICU and in hospital for each type of ECMO (VV-ECMO, VA-ECMO and ECPR). Patients on V-V-ECMO had the longest ECMO run (median 7 days) and the longest ICU and hospital stay (median 18.8 and 33.5 respectively).

Table 8 describes the length of stay stratified by transfer status (retrieved versus non-retrieved patients).

Table 7: Length of stay (days) stratified by ECMO type

	V-V (N=191)	V-A (N=226)	ECPR (N=115)	Total (N=532)
ECMO duration				
- Median (IQR)	7.0 (3.8, 12.9)	4.9 (3.0, 7.4)	3.8 (1.7, 6.4)	5.1 (2.9, 8.9)
- Total	190	223	114	527
- Missing	1	3	1	5
ICU length of stay (days)				
- Median (IQR)	18.8 (11.5, 35.9)	14.0 (8.6, 25.2)	7.0 (1.9, 18.1)	14.9 (7.5, 26.3)
- Total	187	221	114	522
- Missing	4	5	1	10
Hospital length of stay (days)				
- Median (IQR)	33.5 (18.2, 58.1)	25.0 (15.2, 45.7)	11.7 (3.3, 26.7)	24.9 (13.1, 47.4)
- Total	177	208	108	493
- Missing	14	18	7	39

Table 8: Length of stay (days) stratified by transfer status

Type of ECMO		Retrieved (N=273)	Non-retrieved (N=249)	Total (N=522)
V-V	ECMO duration			
	- Median (IQR)	8.2 (4.7, 14.8)	6.1 (3.1, 10.9)	7.0 (3.8, 12.8)
	- Total	102	88	190
	- Missing	1	0	1
	ICU length of stay (days)			
	- Median (IQR)	19.9 (12.7, 37.2)	17.9 (8.6, 33.7)	18.8 (11.5, 35.9)
	- Total	99	88	187
	- Missing	4	0	4
	Hospital length of stay (days)			
	- Median (IQR)	32.4 (19.0, 49.3)	36.0 (18.1, 70.1)	33.5 (18.2, 58.1)
	- Total	90	87	177
	- Missing	13	1	14
V-A	ECMO duration			
	- Median (IQR)	5.6 (3.8, 8.9)	4.1 (2.6, 5.9)	4.9 (3.0, 7.4)
	- Total	124	95	219
	- Missing	1	0	1
	ICU length of stay (days)			
	- Median (IQR)	15.2 (9.7, 27.1)	13.9 (7.6, 22.9)	14.6 (8.8, 25.5)
	- Total	121	95	216
	- Missing	4	0	4
	Hospital length of stay (days)			
	- Median (IQR)	25.0 (17.4, 47.0)	25.5 (14.1, 46.7)	25.2 (16.1, 47.2)
	- Total	112	91	203
	- Missing	13	4	17
ECPR	ECMO duration			
	- Median (IQR)	4.6 (2.4, 6.9)	3.3 (1.1, 6.0)	3.9 (1.9, 6.5)
	- Total	45	66	111
	- Missing	0	0	0
	ICU length of stay (days)			
	- Median (IQR)	9.9 (3.0, 24.9)	6.6 (1.8, 16.2)	7.6 (2.3, 18.3)
	- Total	44	66	110
	- Missing	1	0	1
	Hospital length of stay (days)			
	- Median (IQR)	14.2 (4.2, 28.8)	12.5 (3.3, 26.4)	13.1 (3.5, 28.8)
	- Total	40	64	104
	- Missing	5	2	7

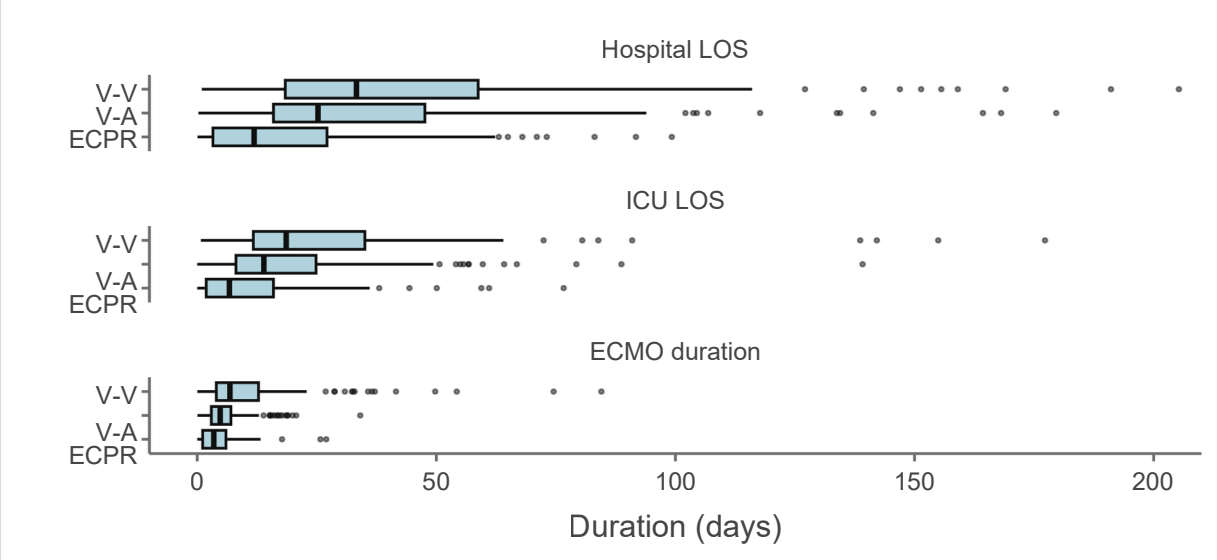

Figure 4: Distribution of length of stay stratified by ECMO mode

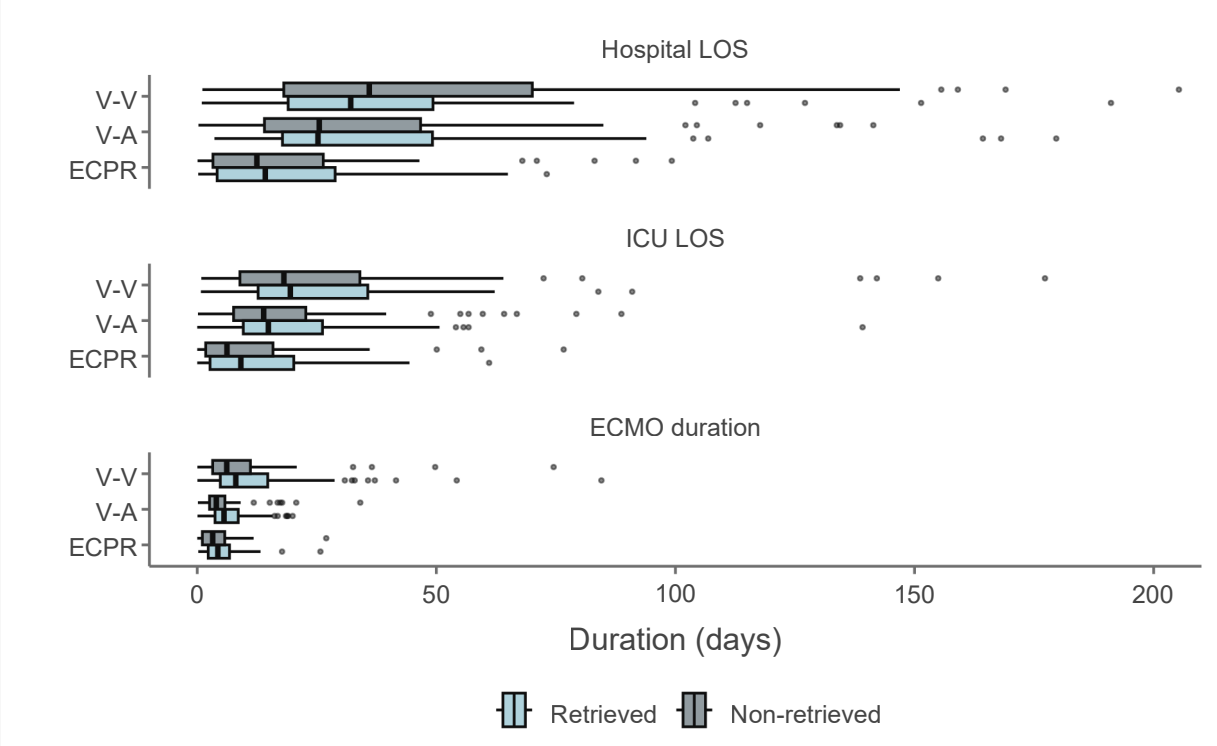

Figure 5: Distribution of length of stay stratified by transfer status

ECMO trips

Table 9: Number of trips while on ECMO stratified by ECMO type

	V-V (N=191)	V-A (N=226)	ECPR (N=115)	Total (N=532)
Number of operative theatre trips[1]				
-Mean(SD)	1.5 (1.1)	2.6 (1.5)	1.8 (0.9)	2.1 (1.4)
-Range	1.0 - 8.0	1.0 - 10.0	1.0 - 6.0	1.0 - 10.0
-Missing	64	65	31	160
Number of radiology trips[1]				
-Mean(SD)	2.3 (2.1)	1.5 (1.2)	2.0 (1.5)	1.9 (1.6)
-Range	1.0 - 13.0	1.0 - 7.0	1.0 - 7.0	1.0-13.0
-Missing	64	68	31	163

[1] Trips occur when a patient is physically transferred to another location to facilitate imaging and/or procedure. This data point has been discontinued.

ECMO discontinuation

Table 10: ECMO discontinuation reason stratified by ECMO type

	V-V (N=191)	V-A (N=226)	ECPR (N=115)	Total (N=532)
ECMO discontinuation reason				
- Expected recovery	149 (78.8%)	164 (73.9%)	57 (50.4%)	370 (70.6%)
- Poor prognosis	35 (18.5%)	39 (17.6%)	53 (46.9%)	127 (24.2%)
- Bridge to VAD	1 (0.5%)	16 (7.2%)	2 (1.8%)	19 (3.6%)
- ECMO complication	1 (0.5%)	1 (0.5%)	1 (0.9%)	3 (0.6%)
- Bridge to lung transplant	2 (1.1%)	0 (0.0%)	0 (0.0%)	2 (0.4%)
- Bridge to heart transplant	0 (0.0%)	1 (0.5%)	0 (0.0%)	1 (0.2%)
- Bridge to heart/lung transplant	1 (0.5%)	0 (0.0%)	0 (0.0%)	1 (0.2%)
- Unknown	0 (0.0%)	1 (0.5%)	0 (0.0%)	1 (0.2%)
- Total	189	222	113	524
- Missing	2	4	2	8

ICU therapies

Table 11: ICU therapies

	V-V (N=191)	V-A (N=226)	ECPR (N=115)
Second ECMO Run			
-Yes	2 (1.0%)	9 (4.1%)	0 (0.0%)
-No	189 (99.0%)	209 (95.9%)	111 (100.0%)
- Missing	0	8	4
Renal Replacement Therapy			
-Yes	87 (45.5%)	125 (55.8%)	56 (48.7%)
-No	104 (54.5%)	99 (44.2%)	59 (51.3%)
- Missing	0	2	0

COMPLICATIONS

Table 12: Proportion of patients with complications

Complications category	
Renal	71.7%
Cardiovascular	52.5%
Infection	51.8%
Bleeding	39.3%
Mechanical	16.2%
Neurological	12.7%
Pulmonary	10.9%

Major complications are reported to the registry under 7 main categories, renal, cardiovascular, infection, bleeding, mechanical, neurological and pulmonary (Table 12). The most common complications were renal (71.7%), cardiovascular (52.5%), infection (51.8%) and bleeding (39.3%).

Figures 6, 7 and 8 report complications for each type of ECMO (VV-ECMO, VA-ECMO and ECPR). Renal replacement therapy was the most common complication across all types of ECMO. Lung infection was also common among all types of ECMO. Regarding cardiovascular complications, VA-ECMO and ECPR patients commonly experienced cardiac arrythmia.

Figure 9 describes the differences in major complications between patients who were retrieved and non-retrieved. Blood stream infections were more common in retrieved patients.

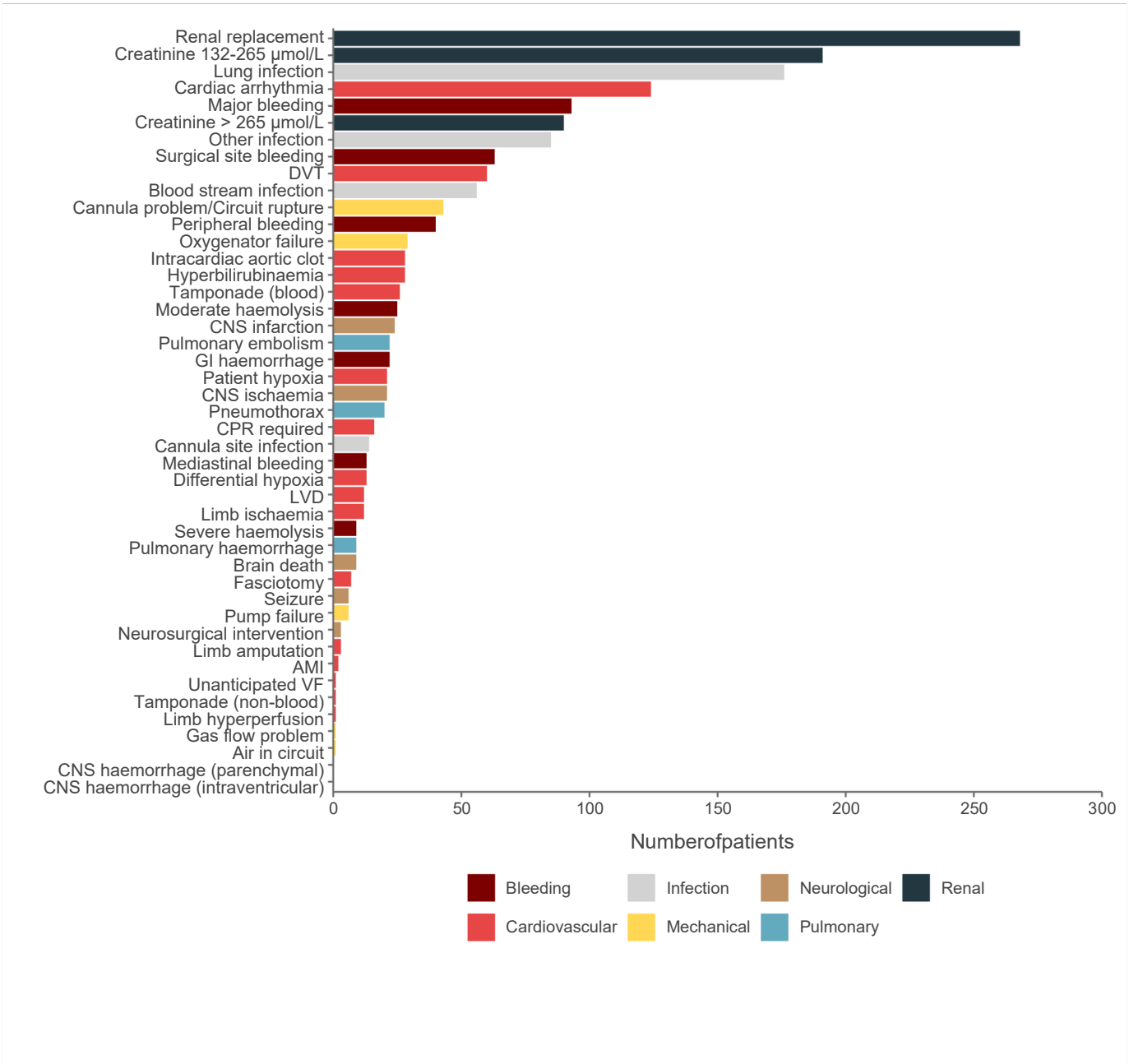

Figure 6: Distribution of post-ECMO complications

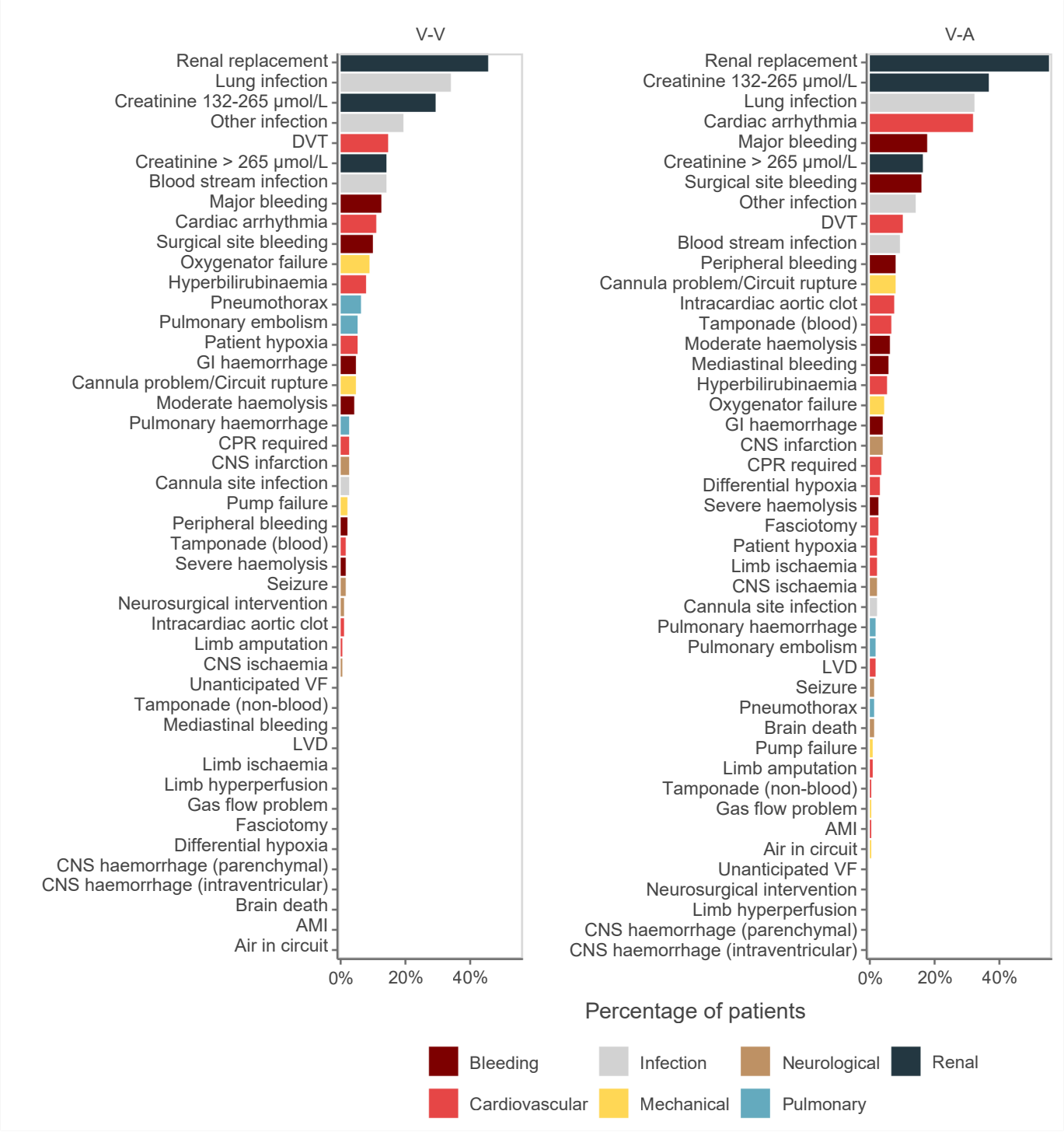

Figure 7: Distribution of post-ECMO complications stratified by ECMO mode (V-V and V-A)

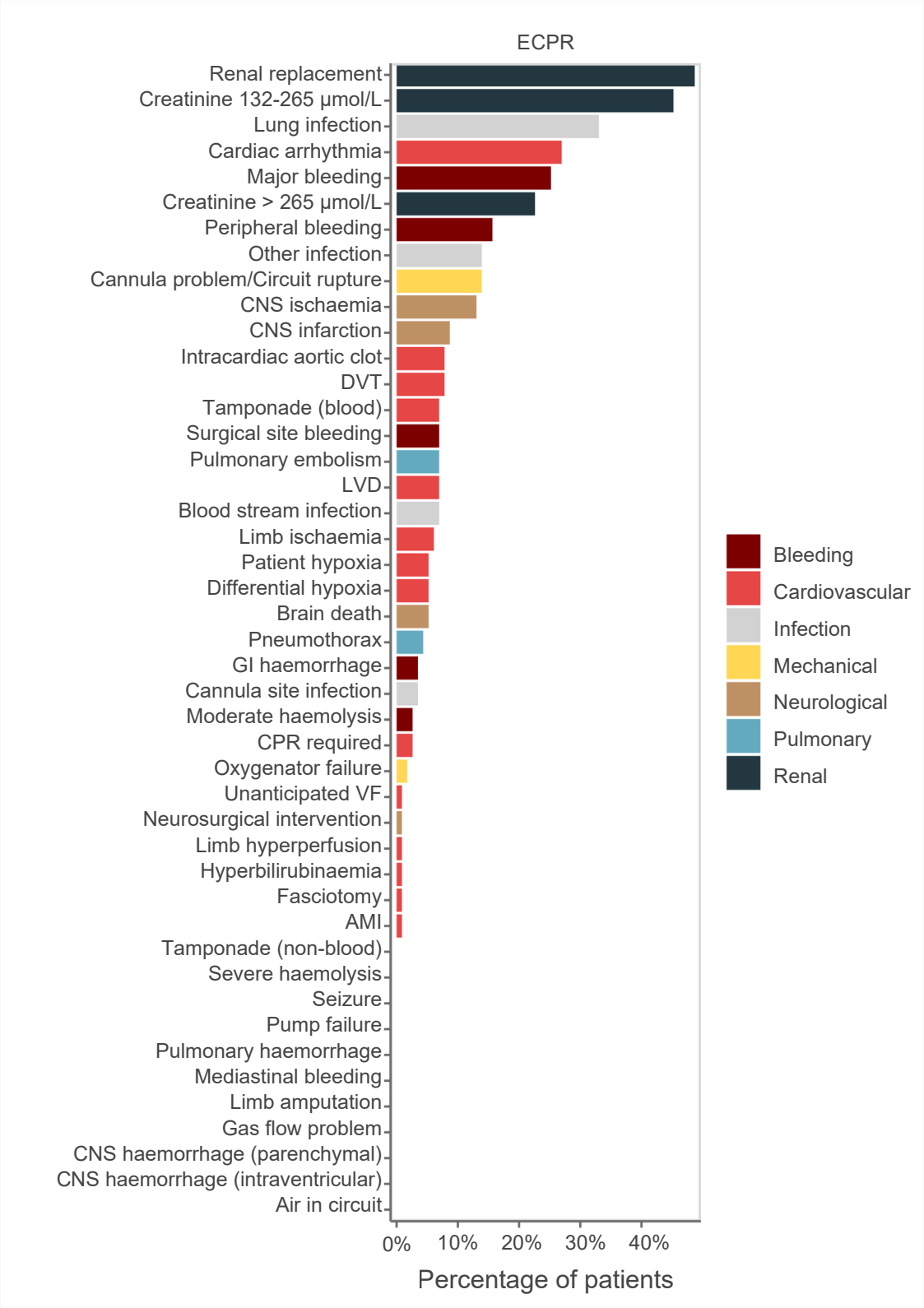

Figure 8: Distribution of post-ECMO complications stratified by ECMO mode (ECPR)

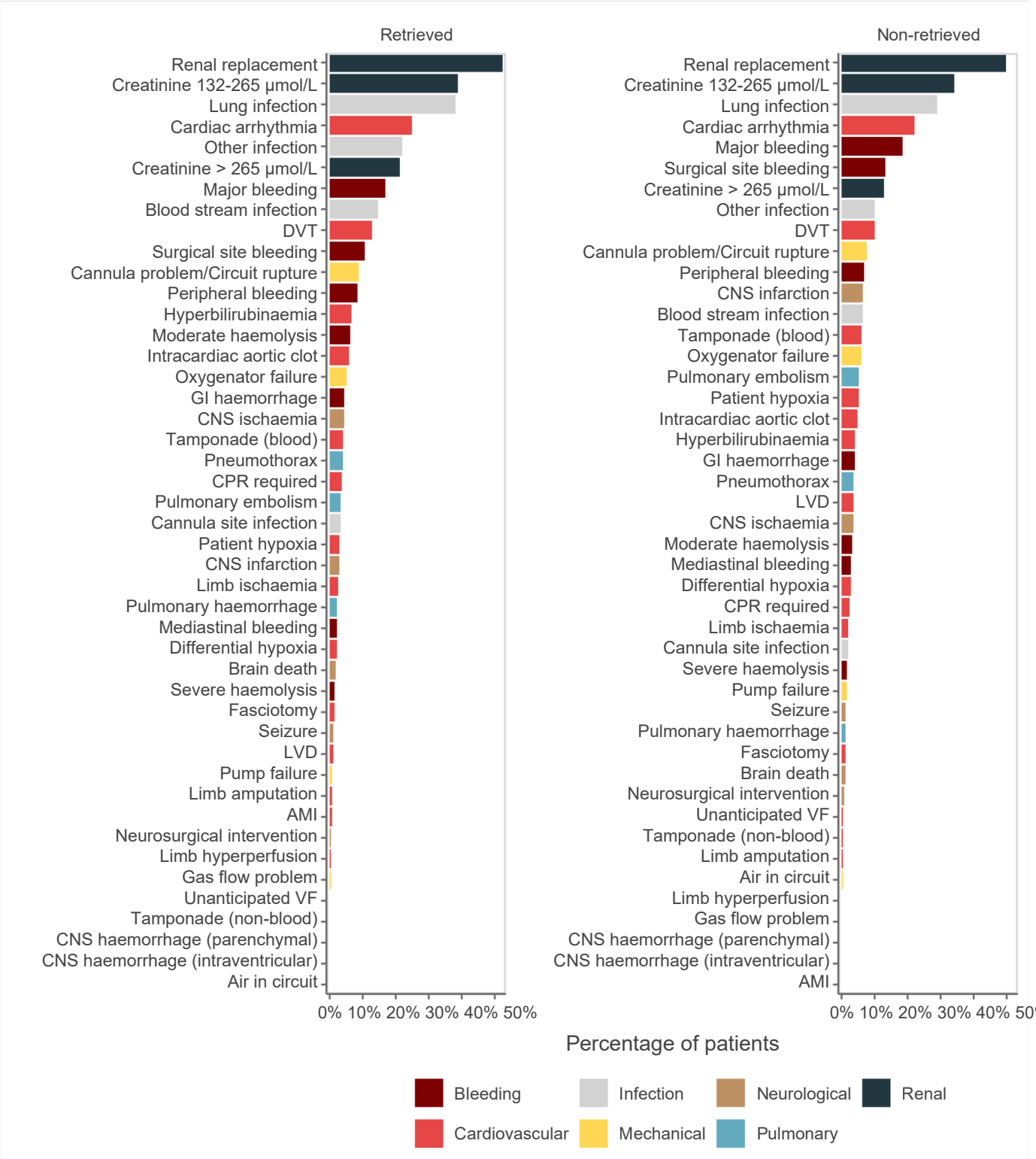

Figure 9: Distribution of post-ECMO complications stratified by transfer status

OUTCOME DATA

Proximate cause of death

Table 13: Proximate cause of death stratified by ECMO type

	V-V (N=191)	V-A (N=226)	ECPR (N=115)	Total (N=532)
Proximate cause of death				
-Cardiogenic shock	3 (6.2%)	28 (45.2%)	21 (32.8%)	52 (29.9%)
-Other	13 (27.1%)	9 (14.5%)	13 (20.3%)	35 (20.1%)
-Distributive (Septic) shock	9 (18.8%)	10 (16.1%)	4 (6.2%)	23 (13.2%)
-Hypoxic respiratory failure	17 (35.4%)	1 (1.6%)	0 (0.0%)	18 (10.3%)
-Neurological no TBI with brain death	1 (2.1%)	4 (6.5%)	11 (17.2%)	16 (9.2%)
-Neurological noTBI without brain death	3 (6.2%)	4 (6.5%)	9 (14.1%)	16 (9.2%)
-Arrhythmia	0 (0.0%)	2 (3.2%)	4 (6.2%)	6 (3.4%)
-Hypovolaemic shock	2 (4.2%)	3 (4.8%)	1 (1.6%)	6 (3.4%)
-Metabolic	0 (0.0%)	1 (1.6%)	1 (1.6%)	2 (1.1%)
-Total	48	62	64	174

The most common cause of death was cardiogenic shock 52 (29.9%) and other 35 (20.1%). There were 16 (9.2%) patients who suffered a neurological event that resulted in brain death during or after ECMO. A further 16 (9.2%) died because of a neurological event that did not cause brain death.

Discharge destination

Table 14: Discharge destination post-ECMO stratified by ECMO type

	V-V (N=191)	V-A (N=226)	ECPR (N=115)	Total (N=532)
ICU discharge destination				
-Ward	113 (59.2%)	145 (66.5%)	45 (40.5%)	303 (58.3%)
-Deceased	48 (25.1%)	58 (26.6%)	63 (56.8%)	169 (32.5%)
-Other hospital ICU	19 (9.9%)	11 (5.0%)	3 (2.7%)	33 (6.3%)
-Home	4 (2.1%)	2 (0.9%)	0 (0.0%)	6 (1.2%)
-Other ICU, same hospital	6 (3.1%)	0 (0.0%)	0 (0.0%)	6 (1.2%)
-Other	1(0.5%)	2 (0.9%)	0 (0.0%)	3 (0.6%)
-Total	191	218	111	520
-Missing	0	8	4	12
Hospital discharge destination				
-Home	86 (45.5%)	81 (36.0%)	25 (21.7%)	192 (36.3%)
-Deceased	49 (25.9%)	65 (28.9%)	68 (59.1%)	182 (34.4%)
-Transferred to another hospital	28 (14.8%)	38 (16.9%)	9 (7.8%)	75 (14.2%)
-Transferred to rehab	21 (11.1%)	35 (15.6%)	12 (10.4%)	68 (12.9%)
-Other	3 (1.6%)	5 (2.2%)	1 (0.9%)	9 (1.7%)
-Transferred to hospice	2 (1.1%)	1 (0.4%)	0 (0.0%)	3 (0.6%)
-Total	189	225	115	529
-Missing	2	1	0	3

Overall, most patients were discharged from ICU to the ward 303 (58.3%), but 169 (32.5%) were deceased and 33 (6.3%) were discharged to an ICU in another hospital. After hospital discharge, 192 (36.3%) were discharged home and 68 (12.9%) were transferred to a rehabilitation facility.

Survival

We have shown survival to 180-days in Kaplan-Meier plots stratified by type of ECMO (Figure 10) and by type of ECMO and retrieval status (Figure 11). Patients receiving VV-ECMO are most likely to survive overall and patients receiving ECPR are least likely to survive.

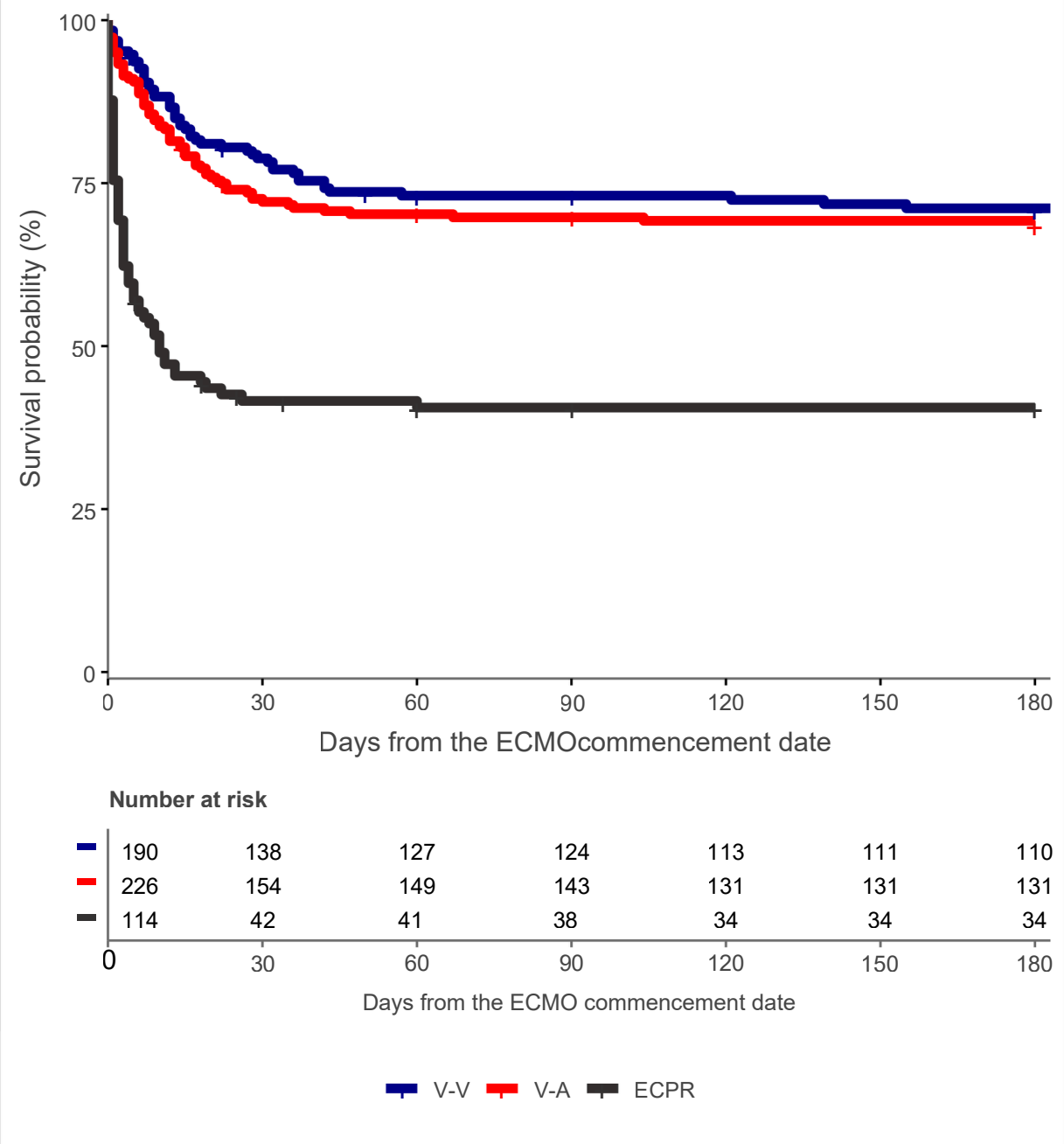

Figure 10: Kaplan-Meier plot of survival stratified by ECMO type

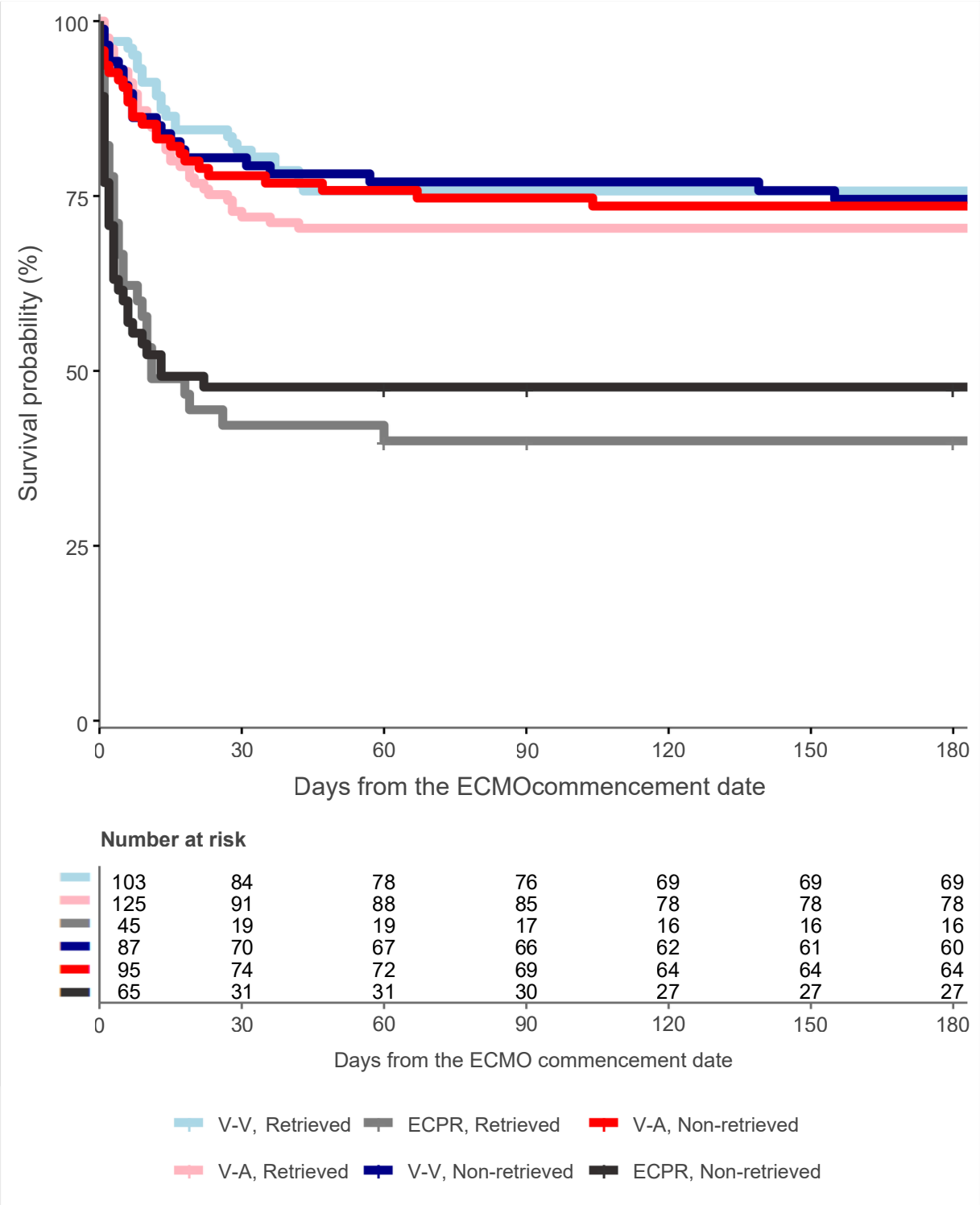

Figure 11: Kaplan-Meier plot of survival stratified by transfer status and ECMO type

Funnel plots

We provide standardised mortality ratio for VV-patients (using the RESP score), for VA-patients (using the SAVE score) and for ECPR patients (also using the SAVE score). Each dot represents a site, and the outer limits represent the 95% and the 99.8% control limits. In reports to each site biannually, the site is identified using a different colour to allow interpretation of outliers.

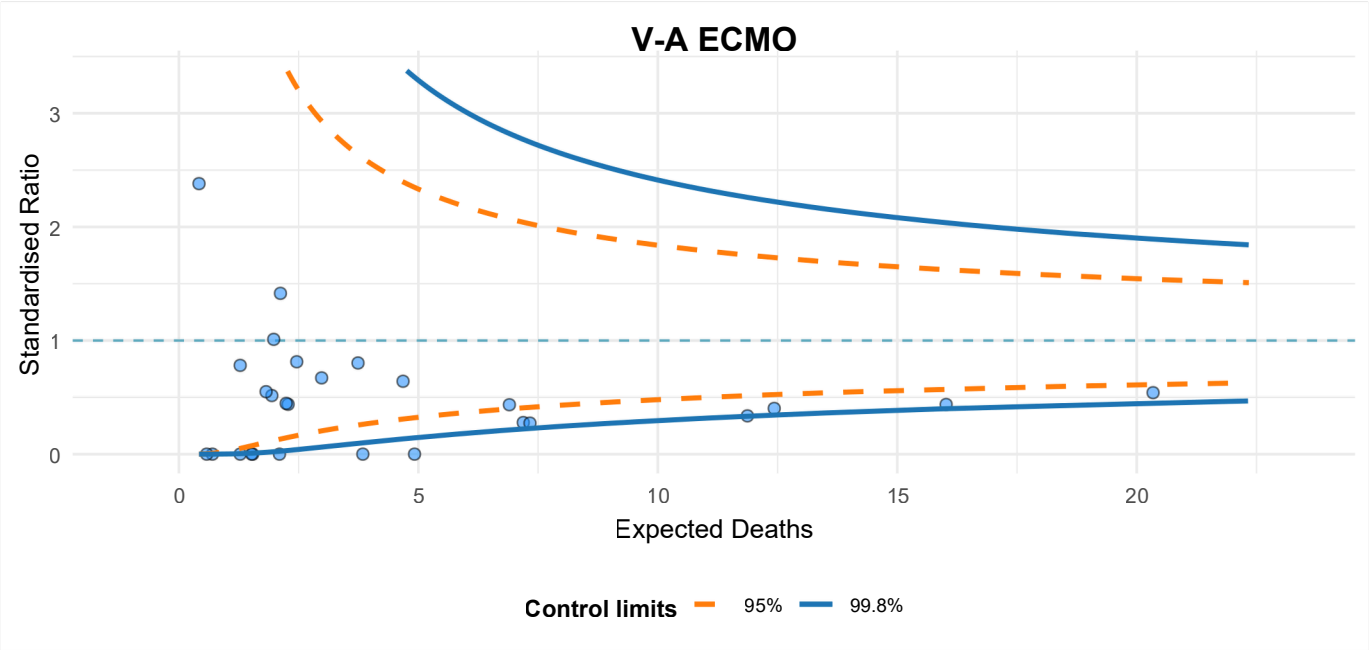

Figure 12: Risk adjusted mortality rate for V-A patients. Values above 1 indicate higher mortality than expected.

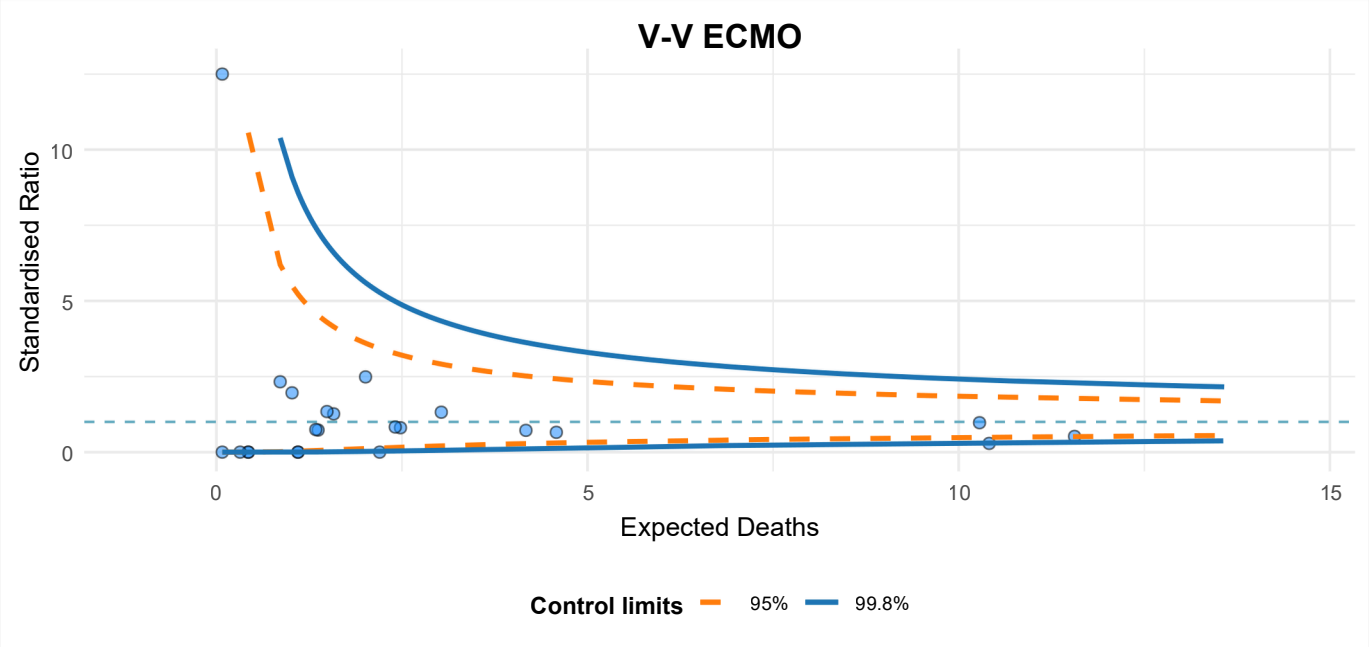

Figure 13: Risk adjusted standardized mortality ratio for V-V patients. Values above 1 indicate higher mortality than expected.

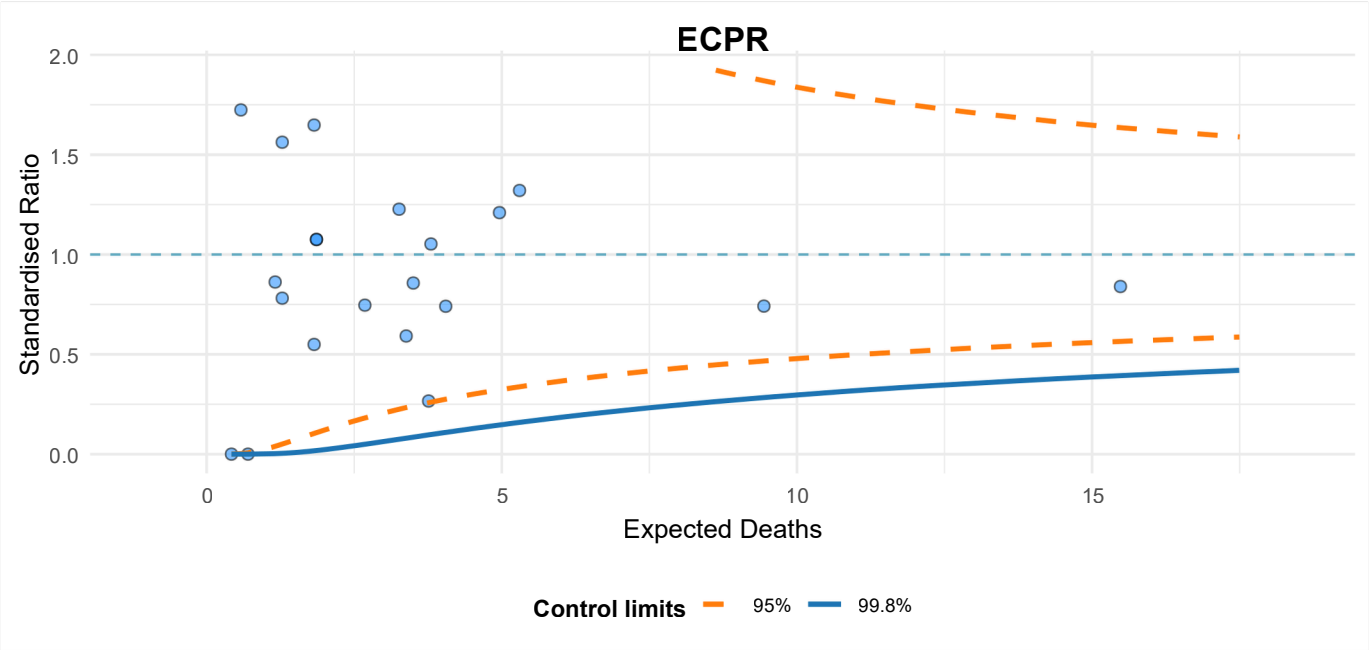

Figure 14: Risk adjusted standardized mortality ratio for ECPR patients. Values above 1 indicate higher mortality than expected.

FOLLOW-UP (6 months post ECMO)

We follow-up each surviving patient at 6 and 12 months by telephone from the Australian and New Zealand Intensive Care Research Centre using trained personnel. The patient reported outcome measures (PROMS) used include:

- The 12-item WHODAS 2.0 score scores from 0 (no difficulty) to 4 (extreme difficulty) for each item and a total WHODAS score ranges from 0 to 48, with higher scores representing greater disability. The total score is divided by 48 and multiplied by 100 to convert it to a percentage of maximum disability.

- The Lawton IADL Scale is a valid and reliable functional assessment instrument which assesses independent living skills across 8 domains of function. A summary score ranges between from 0 and 8 with higher scores indicating greater levels of independence.

- The Barthel Index measures functional disability in 10 ADLs by quantifying patient performance. 5-point increments are used in scoring, with a maximal score of 100 indicating full independence in physical functioning whilst a lowest score of 0 indicating a patient with a complete bed-bound state.

- The EQ-5D-5L is a generic preference-based instrument that measures health related quality of life. It is comprised of five dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. The EQ Visual Analogue Scale provides a single global rating of self-perceived health and is scored on a 0 to 100 scale representing "the worst…" and "the best health you can imagine", respectively

Table 15: Follow-up functional outcome measures and ECMO mode

	V-V (N=326)	V-A (N=346)	ECPR (N=301)	Total (N=973)
WHODAS 2.0 12L				
-Mean(SD)	23.9 (21.2)	25.5 (22.8)	25.3 (22.0)	24.9 (22.0)
-Median(IQR)	18.8 (6.2, 37.5)	20.8 (6.2, 39.6)	20.8 (6.2, 39.6)	18.8 (6.2, 39.6)
-Range	0.0 - 100.0	0.0 - 100.0	0.0 - 100.0	0.0 - 100.0
-Missing	46	47	46	139
IADL				
-Mean(SD)	6.8 (1.9)	6.6 (2.1)	6.7 (2.0)	6.7 (2.0)
-Median(IQR)	8.0 (6.0, 8.0)	8.0 (6.0, 8.0)	8.0 (6.0, 8.0)	8.0 (6.0, 8.0)
-Range	0.0 - 8.0	0.0 - 8.0	0.0 - 8.0	0.0 - 8.0
-Missing	68	72	69	209
Barthel index				
-Mean(SD)	95.1 (15.0)	94.2 (15.8)	94.1 (15.9)	94.5 (15.5)
-Median(IQR)	100.0 (100.0,100.0)	100.0 (95.0,100.0)	100.0 (95.0,100.0)	100.0 (95.0,100.0)
-Range	0.0 - 100.0	0.0 - 100.0	0.0 - 100.0	0.0 - 100.0
-Missing	65	70	67	202
Health related quality of life				
-Mean(SD)	69.0 (19.8)	68.1 (20.0)	68.3 (19.5)	68.5 (19.8)
-Median(IQR)	70.0 (60.0, 85.0)	70.0 (56.5, 80.0)	70.0 (59.2, 80.5)	70.0 (60.0, 80.0)
-Range	5.0 - 100.0	5.0 - 100.0	5.0 - 100.0	5.0 - 100.0
-Missing	45	46	45	136

While recovery at 6-months is variable, the majority of survivors report mild to moderate disability. This is despite being able to independently manage their daily activities. Health related quality of life is similar to other survivors of critical illness.

This follow-up dataset comprises patients who began ECMO treatment between 2019 and 2024 and survived to 180 days following ECMO initiation.

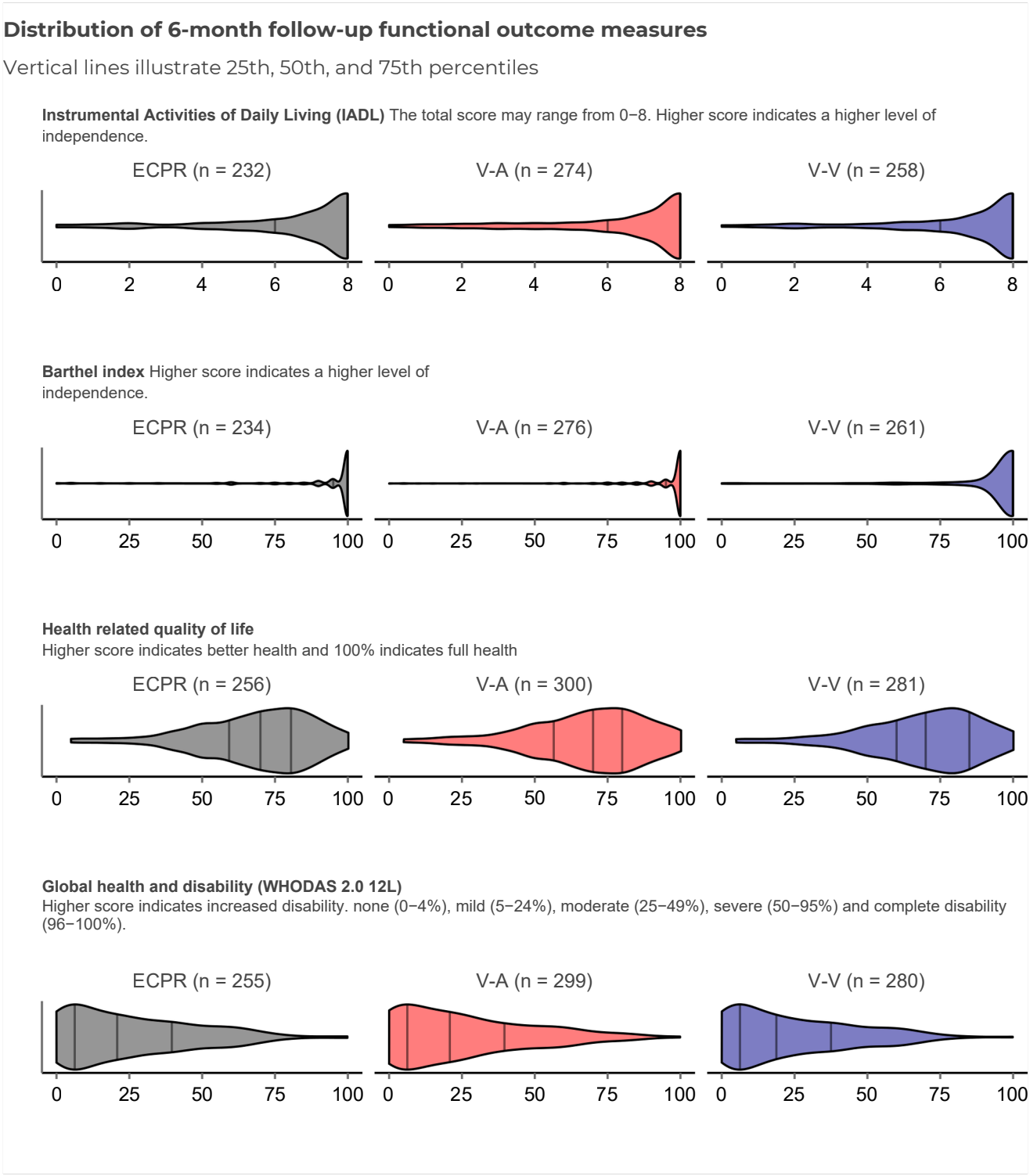

Figure 15: Distribution of follow-up functional outcome measures and ECMO mode

COVID-19 PATIENTS

In 2020 we added additional data points to determine the use of ECMO in patients with COVID-19, aligned with the data in the international registry (ELSO). There were 11 (2%) patients diagnosed with COVID-19 during this period. Patients with COVID-19 had a shorter duration of ECMO, shorter ICU and hospital length of stay (Figure 17). Survival of patients with COVID-19 was lower than other patients on VV-ECMO (Figure 19).

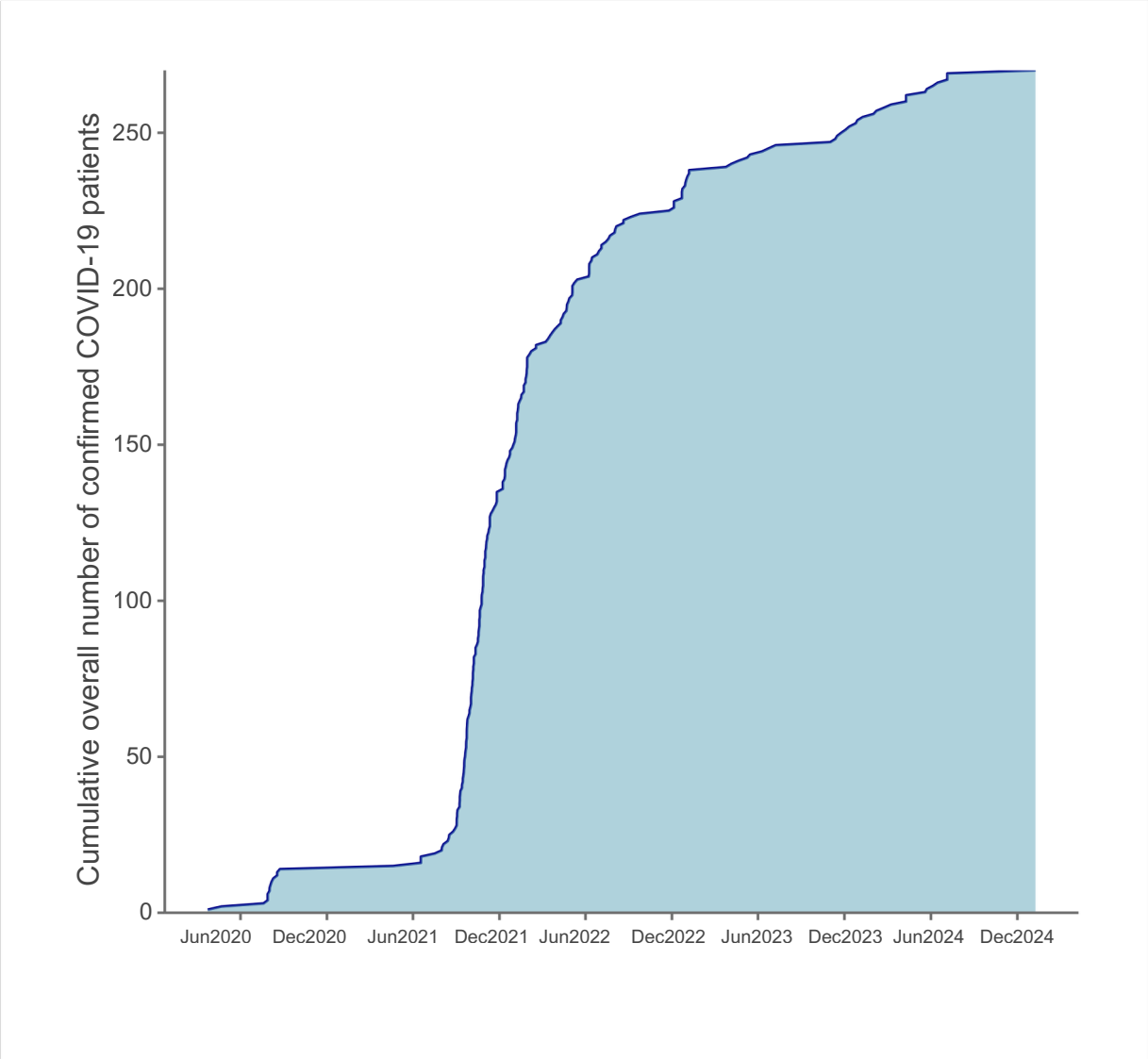

Figure 16: Cumulative overall confirmed COVID-19 patients

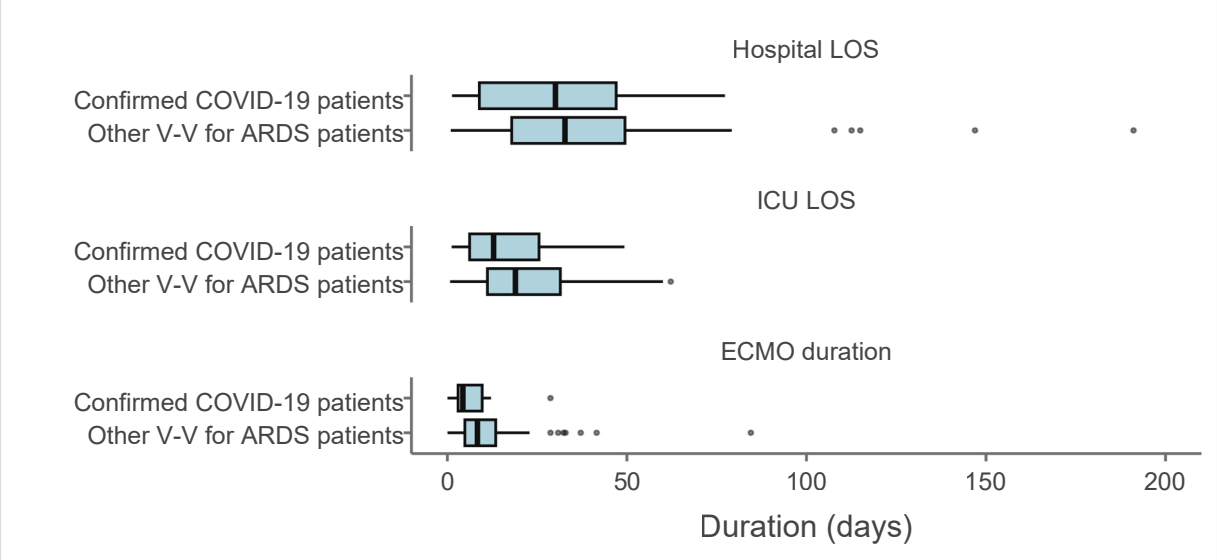

Figure 17: Distribution of length of stay stratified by COVID-19 status

Table 16: Discharge destination post-ECMO stratified by COVID-19 status

	Confirmed COVID-19 patients (N=11)	Other V-V for ARDS patients (N=101)	Total (N=112)
ICU discharge destination			
- Ward	7 (63.6%)	51 (50.5%)	58 (51.8%)
- Deceased	4 (36.4%)	32 (31.7%)	36 (32.1%)
- Other hospital ICU	0 (0.0%)	14 (13.9%)	14 (12.5%)
- Other ICU, same hospital	0 (0.0%)	3 (3.0%)	3 (2.7%)
- Home	0 (0.0%)	1 (1.0%)	1 (0.9%)
- Total	11	101	112
- Missing	0	0	0
Hospital discharge destination			
- Deceased	4 (36.4%)	33 (32.7%)	37 (33.0%)
- Home	1 (9.1%)	35 (34.7%)	36 (32.1%)
- Transferred to another hospital	3 (27.3%)	22 (21.8%)	25 (22.3%)
- Transferred to rehab	3 (27.3%)	9 (8.9%)	12 (10.7%)
- Other	0 (0.0%)	2 (2.0%)	2(1.8%)
- Total	11	101	112
- Missing	0	0	0

Figure 18: Distribution of post-ECMO complications stratified by COVID-19 status

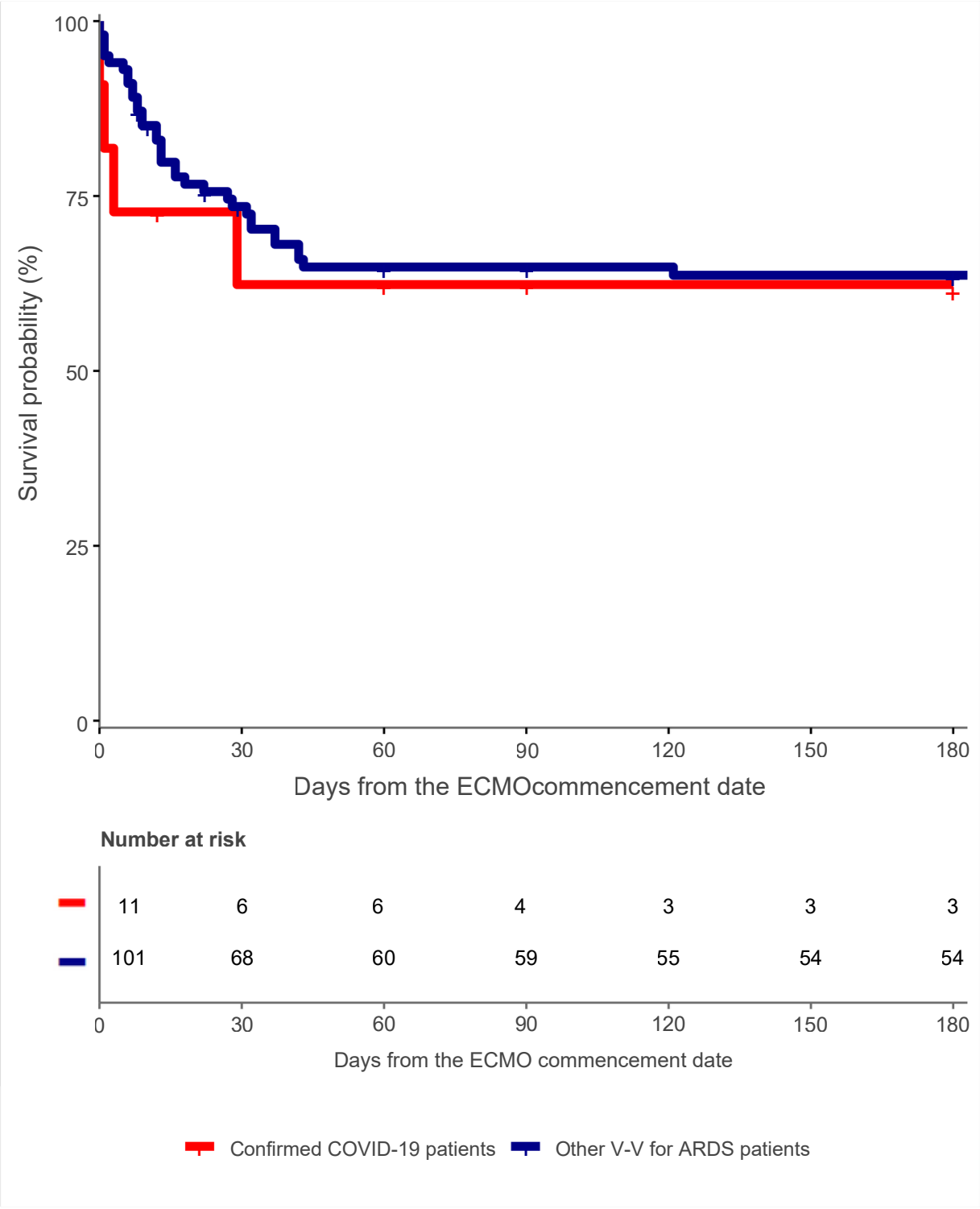

Figure 19: Kaplan-Meier plot of survival stratified by COVID-19 status

APPENDIX

Complications

The EXCEL Registry currently collects a range of complications that both clinicians and researchers feel are important to know when a patient undergoes ECMO. These data will help to drive both improvement and identification of complications that present most notability within specific ECMO populations, as well as the ECMO cohort as a whole. The definitions for these complications have recently been updated with regard to new research evidence decided upon by the international ECMO community (e.g. core outcome set - Hodgson et al, Crit Care Med, 2021). Captured complications are listed below.

Mechanical Complications

Relates directly to components within the ECMO circuit that are used to deliver extracorporeal support. These can include:

- Oxygenator and pump failure requiring exchange of these components
- Cannula problems and circuit rupture.
- Formation of clots within the circuit's components (connectors, bridges, pigtails) or within the haemofilter
- Disruption of gas flow and air within the circuit
- Heat exchanger malfunction

Haemorrhagic Complications

Due to the high acuity and often post-operative status of these patients, we collect an extensive range of bleeding complications. These include:

- GI haemorrhage (upper or lower GI)
- Peripheral and mediastinal site bleeding
- Surgical site bleeding (other than the cannulation sites)
- Major bleeding which can include fatal or symptomatic bleeds within critical areas or regions, as well as a fall in haemoglobin or transfusion has occurred

Renal Complications

- Creatinine serum measurement of >132
- Use of renal replacement therapy

Cardiovascular Complications

A large proportion of ECMO patients undergo intervention based upon a cardiovascular related diagnosis. The following complications seek to elucidate the further development of cardiac conditions following institution of ECMO.

- Cardiac arrest requiring CPR
- Cardiac arrythmia requiring antiarrhythmic medications, overdrive pacing, cardioversion or defibrillation
- Tamponade
- Acute myocardial infarction
- Left ventricular distension requiring decompression of the left ventricle after initiation of VA-ECMO
- Unanticipated ventricle fibrillation.
- Intracardiac/aortic clot confirmed by echocardiography

Pulmonary Complications

- Pneumothorax requiring insertion of chest drain
- Pulmonary haemorrhage requiring a packed red blood cell transfusion
- Pulmonary embolism diagnosed with contrast angiography, ventilation perfusion scan, isotope scanning or CTPA.

Metabolic Complications

ECMO patients are also noted to undergo serious metabolic changes and complications during the intervention.

- Hyperbilirubinemia – Based on total bilirubin or conjugated bilirubin, or the need for extracorporeal purification
- Moderate and severe haemolysis – Peaks in plasma haemoglobin sustained for 2 recordings 4 hours apart
- Patient hypoxia – Oxygen saturation level below 80% lasting more than 5 minutes or requiring an emergency response
- Differential hypoxia – Lower oxygen saturation readings on one side of the body when compared to the other

Limb Complications

Extended stays within ICU as well as peripheral limb cannulation sites can develop into a number of limb complications for the ECMO patient.

- Fasciotomy – Performed secondary to compartment syndrome from ECMO cannulation
- Pressure injury – Localised damage to the skin and underlying tissue caused by pressure or shearing force
- Limb amputation – Secondary to complications experienced during ECMO run
- Limb ischaemia requiring limb perfusion cannula – Post peripheral cannulation, requiring addition of limb reperfusion cannula within 6 hours of cannulation
- Deep vein thrombosis – Diagnosed with imaging (ultrasound or venography)
- Limb hyper-perfusion – Caused by the ECMO cannula, causing increased blood flow in a limb

Neurological Complications

- Brian death or neurological determination of death
- Seizures clinically determined
- Seizures confirmed by EEG
- CNS diffuse ischaemia – CT or MRI demonstrating ischaemic changes
- CNS infarction (US or CT or MRI) OR thrombotic/embolic CVA
- Intracranial haemorrhage – Acute neurological deficit attributable to intracranial haemorrhage
- Neurological intervention performed – For example, intracranial pressure monitor or external ventricular drain inserted

Other Complications

This is a free text field in which clinicians can enter any other complication they believe are a result of the patient being on ECMO. This has assisted in identification of new complications, that have been found to occur within this patient cohort.