P-94 Ambulatory Status at Discharge Predicts Long-Term Survival in VA-ECMO: A Two-Stage ML Model

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Background

- **Outcomes** after veno-arterial extracorporeal membrane oxygenation (VA-ECMO) **remain poor**, with substantial long-term mortality and disability even among hospital survivors.
- Discharge ambulation has been recognized **as a clinically meaningful functional marker** associated with **long-term outcomes**, but tools for **early prediction of patients at risk for** non-ambulation at ECMO initiation **remain limited**.
- **Early identification of high-risk patients** may enable **targeted** and **timely rehabilitation strategies**.
- Therefore, **we aimed to evaluate the association between** discharge ambulation and long-term survival, and to develop a two-stage risk stratification model to **predict** non-ambulation **using ECMO-course data**.

Methods

- **Subjects**
  - A retrospective single-center cohort study **of 373 adults who survived to hospital discharge after VA-ECMO**
  - Categorized as ambulatory vs non-ambulatory at discharge
- **Survival Analysis**
  - Long-term survival was compared using Kaplan–Meier curves and log-rank testing (Fig. 1)
- **Risk stratification**
  - **Stage 1: Baseline Risk Prediction**
    - Machine-learning (ML) models were developed using **variables available at ECMO initiation** to identify key predictors and perform baseline risk stratification
  - **Stage 2: Risk Refinement**
    - ECMO-related complications were incorporated to **refine risk within the high-risk group** identified in Stage 1

Results

Long term survival

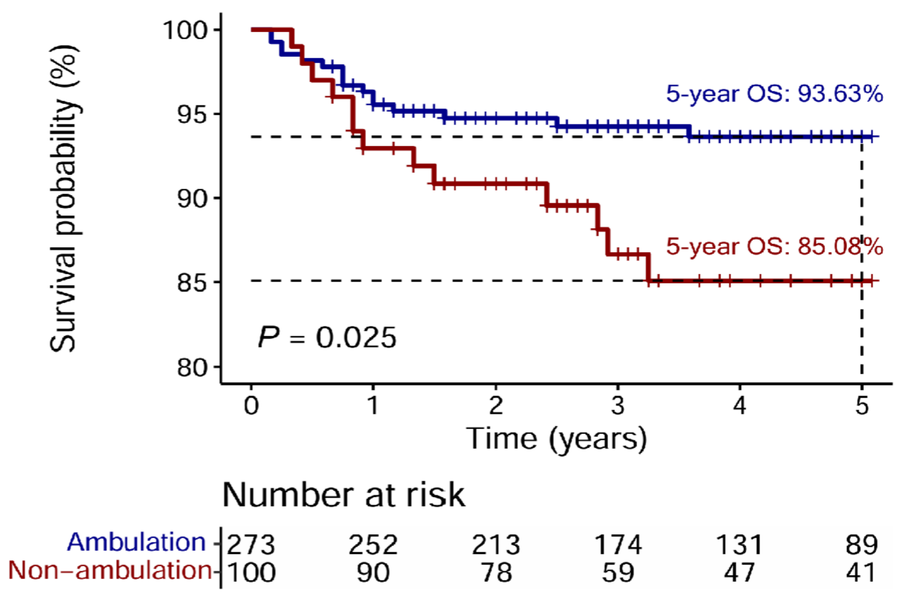
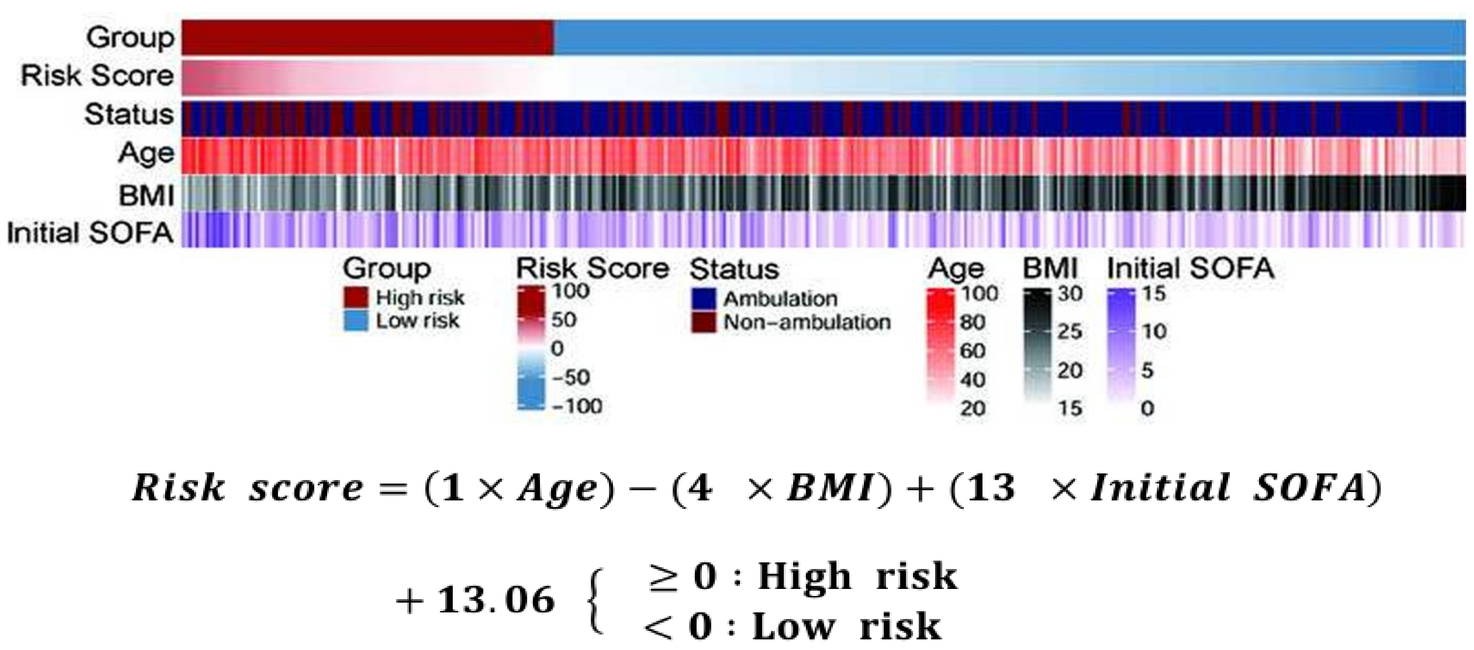


Fig. 1 Kaplan-Meier Survival Curves Depicting 5-year Survival Probability in ECMO Survivors Based on Ambulatory Status.



$$Risk\ score = (1 \times Age) - (4 \times BMI) + (13 \times Initial\ SOFA)$$

$$+13.06 \begin{cases} \geq 0 : \text{High risk} \\ < 0 : \text{Low risk} \end{cases}$$

Fig. 3 Patient-Level Visualization of Model I Risk Scores, Baseline Predictors, and Risk Stratification for Discharge Ambulation

Risk stratification

-**Stage 1:** Across multiple ML algorithms, age, BMI, and initial SOFA score were consistently identified as the **most important predictors**, stratifying patients into **low-risk (n = 265) and high-risk (n = 108)** groups (AUC 0.7259).

-In the **low-risk group, 81.9% were ambulatory** at discharge, compared with **51.9% in the high-risk group** (Fig. 2, 3, 4)

-**Stage 2:** cannulation-site bleeding provided the **most informative refinement within the high-risk group**;

only 11.1% of high-risk patients with bleeding were ambulatory at discharge.

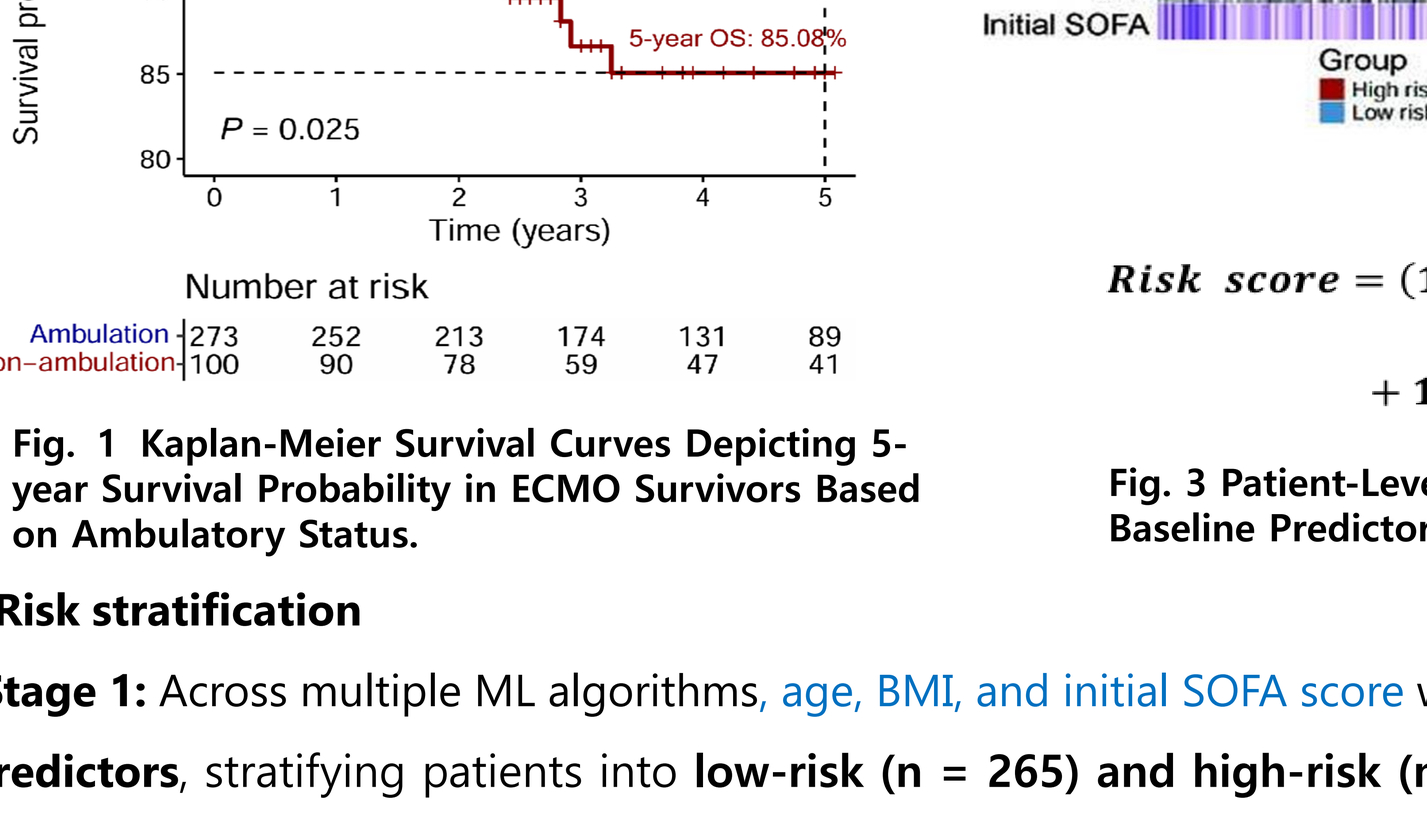


Fig. 2 Key baseline predictors of discharge ambulation identified across machine-learning models at ECMO initiation

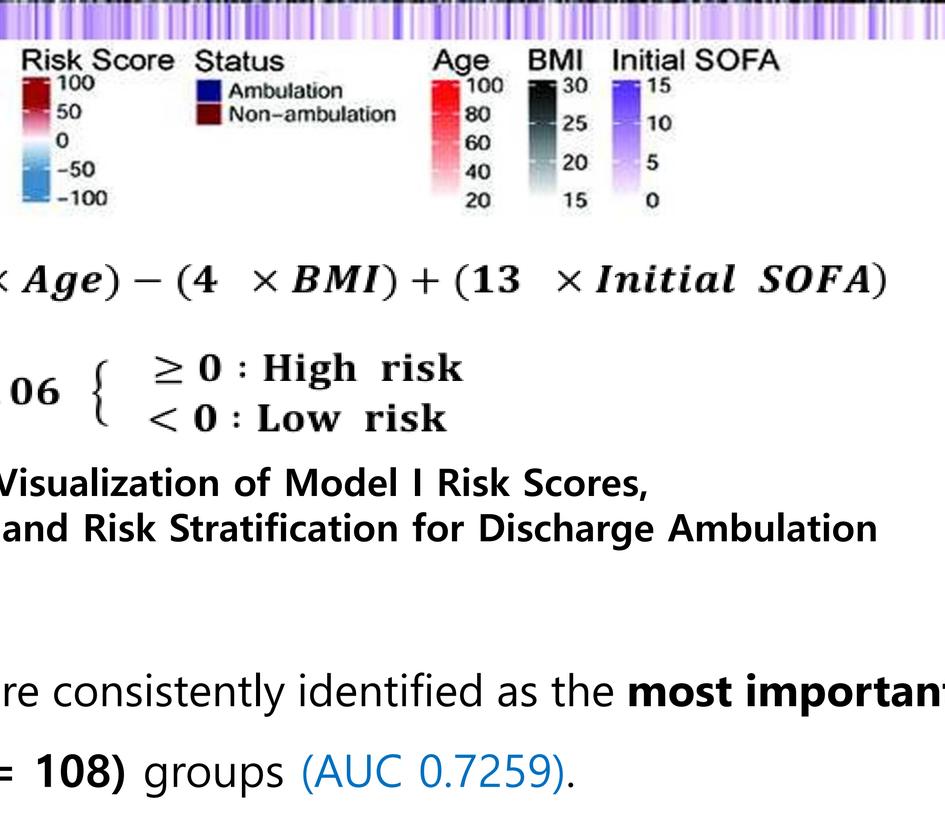


Fig. 4 ROC curve calibration plot for Model I (Baseline risk model). AUC, area under the curve

Conclusion

- Discharge ambulation was associated with improved long-term survival among VA-ECMO survivors.
- A two-stage approach identified **a vulnerable subgroup** (high baseline risk with cannulation-site bleeding), in whom **bedrest necessitated by** cannulation-site bleeding may **limit rehabilitation** and **impair ambulation** at discharge.
- These findings highlight the **need for individualized rehabilitation planning**, **feasible strategies during bed rest**, and **appropriate cannulation-site management**.