Can Frailty Index Factors Predict Postoperative Dispositional Outcomes After Cardiac Surgery?

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Introduction

It is estimated that around 85,000 aortic valve replacements and 400,000 CABG procedures are performed annually in the United States with the average age of patients typically ranging between 53 and 92 years old.[1–3] While age can often give physicians a preoperative estimation of a patient's surgical outlook, recovery time and discharge disposition, it does not however entirely account for variation in markers of patient frailty.

Standardized indexes and tools for frailty assessment are largely established and vary greatly in terms of combining frailty markers, however no standard frailty tool has been declared in the cardiovascular surgery field. Additionally, only a select few studies and reviews on frailty address patient-centric goals in regard to a cardiac surgery's direct impact on discharge disposition, postoperative quality of life and long-term therapy predictions.[4–10] This pilot study thus hopes to address a few of the noted field wide lapses in regards to frailty and patient-centric goals after aortic valve replacement or CABG procedures. Ultimately, this study will provide the groundwork for improved preoperative estimates for frail patients and their families about likely postoperative outcomes to help reduce preoperative and postoperative patient stressors.

Aims and Objectives

<u>Aim I:</u> Identify and define a readily available and practical index for assessing frailty

<u>Aim II:</u> Understand how such an index predicts postoperative therapeutic needs in aortic valve replacement and coronary artery bypass graft surgery

<u>Aim III:</u> Depict significant opportunity for using frailty metrics to manage postoperative patient expectations

Methods

This study utilized a programmed retrospective chart review and multivariable logistic regression model with backwards variable selection to determine significant frailty variable relationships with desired patient-centered postoperative outcomes.

- Inclusion Criteria:
  - Consecutive SAVR and CABG procedures
  - Performed at Corewell Royal Oak or Troy Hospitals
  - July 1st, 2021- July 1st, 2023
  - Patients over the age of 18 years
- Exclusion Criteria:
  - Pregnant patients
  - Patient death precludes collection of dependent variables
  - Patient with incomplete data sets pertaining to the variables observed

Results

<u>Table 1:</u> Patient-Centered Outcomes Vs. Significance of Frailty Variables

	Frailty Associated Variables						
	Serum Albumin	Hemoglobin	Number of Comorbidities	Age at Admission	Female Sex	BMI	Number of Medications
Postoperative Disposition	○	○	○	○	✕	✕	✕
LOS with Respect to the Median	○	○	○	✕	✕	✕	✕
Therapy Regimen	○	✕	○	○	○	✕	✕

○ - Significance defined by p-value <0.05.
✕ - No Significance
LOS- Length of Stay, BMI- Body Mass Index

<u>Table 2:</u> Significant Odds Ratios (OR) with Respect to Patient-Centered Outcomes

	Frailty Associated Variables				
	Serum Albumin	Hemoglobin	Number of Comorbidities	Age at Admission	Female Sex
Postoperative Disposition (Home vs. Other)	2.141 (95% CI: 1.571-2.919)	1.156 (95% CI: 1.021-1.308)	0.956 (95% CI: 0.925-0.988)	0.943 (95% CI: 0.922-0.964)	Not Significant
LOS with Respect to the Median (LOS = 7.66 days)	0.594 (95% CI: 0.456-0.774)	0.858 (95% CI: 0.779-0.946)	1.049 (95% CI: 1.018-1.082)	Not Significant	Not Significant
Therapy Regimen (Home vs. Other)	1.813 (95% CI: 1.321-2.487)	Not Significant	0.937 (95% CI: 0.905-0.970)	0.955 (95% CI: 0.934-0.976)	0.563 (95% CI: 0.368-0.861)

Postoperative Disposition- Odds Ratios are in respect to a home disposition (OR>1 depicts increased odds to return home for every 1 unit variable increase). Postoperative disposition 'Other' composite variable includes: 'continued hospitalization/short term hospital stay', 'rehabilitation facility/unit', 'long term acute care (LTAC)', 'Skilled nursing facility/intermediate care', 'Hospice care', and 'discontinued care against medical advice'. Length of Stay (LOS) with Respect to Median- Odds ratios are in respect to a LOS > 7.66 days (OR>1 depicts increased odds to have an LOS > 7.66 days for every 1 unit variable increase). Therapy Regimen- Odds Ratios are in respect to a prescribed home therapy regimen (OR>1 depicts increased odds to receive a home therapy prescription for every 1 unit variable increase). Therapy Regimen 'Other' composite variable includes: 'inpatient rehabilitation', 'subacute rehabilitation (SAR)', 'long term acute care hospitalization (LTACH)', 'physical medicine and rehabilitation (PMR) consultation', and 'patient dependent/patient tolerated'

<u>Postoperative Discharge Disposition:</u>

- 795 patient charts (819 for reduced model) that fit analysis criteria
  - 622 patients received a 'Home' disposition; 173 patients received an 'Other' disposition
- **'Serum albumin' provides the highest clinical significance:**
  - For every 1 g/dL increase in serum albumin preoperatively, patients are 2.141 times the odds more likely to return home postoperatively
  - 50% of all patients between **3.4 g/dL and 4.2 g/dL**
- **'Hemoglobin' provides a prospect for clinically significant findings:**
  - For every 1 g/dL increase predicting 1.156 times the odds that a patient will return home postoperatively
- Odds ratios for 'age at admit' (OR=0.943) and 'number of comorbidities' (OR=0.956)
  - Negative relationship to outcome

<u>Length of Postoperative Hospital Stay:</u>

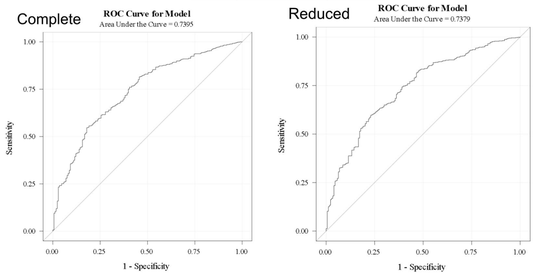
- 795 patient charts (819 for reduced model) that fit analysis criteria
  - Median postoperative length of stay (LOS) was **7.66 days**
- **'Serum albumin' again an excellent clinical indicator:**
  - For every 1g/gL increase in the value of 'serum albumin' the patient is 0.594 times the odds to exceed the median LOS of 7.66 days
- **'Hemoglobin' provides prospect:**
  - For every 1g/dL increase in hemoglobin the patient is 0.858 times the odds as likely to exceed the median LOS of 7.66 days.
- 'Number of comorbidities'
  - OR=1.049 (95% CI: 1.018-1.082)

<u>Prescribed Postoperative Therapy Regimen:</u>

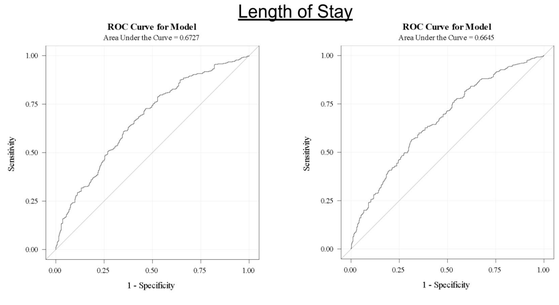
- 757 patient charts (781 for reduced model) that fit analysis criteria
  - 597 patients received a 'Home' therapy; 160 patients received an 'Other' therapy
- **'Serum albumin':**
  - For every increase of 1g/dL serum albumin resulted in 1.813 times the odds that the patient will be prescribed a home therapy regimen
- Odds ratios for 'Age at admit' (OR= 0.955) and 'number of comorbidities' (OR=0.937):
  - Both convey a negative relationship to outcome
- **'Female Sex':**
  - Female sex of the patient was associated with 0.563 times the odds of male counterparts that they will be prescribed a home therapy regimen

<u>Figure 1</u>: ROC Curves for Measured Outcomes

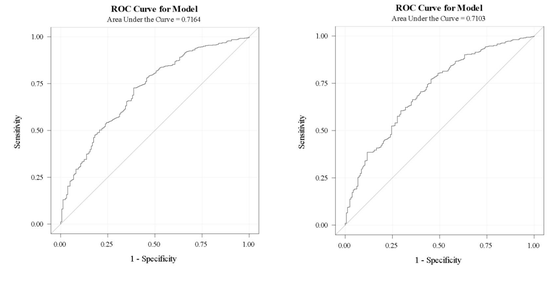
<u>Postoperative Disposition</u>



<u>Length of Stay</u>



<u>Suggested Therapy Regimen</u>



Conclusions

Through backwards selection and usage of a multivariable logistic regression, this study identified measurable frailty markers that can predict patient-centered care outcomes after SAVR and CABG procedures.

- Frailty markers found to be significantly associated with specific measured care outcomes included serum albumin, hemoglobin, number of comorbidities, age at admission, and female sex
- Serum albumin reveals itself as an excellent clinical and statistical metric with higher preoperative values associated with all desired patient-centered outcomes
- Hemoglobin levels additionally offer a significant and intuitive measure to predict patient disposition and length of postoperative stay in regards to the median
- More data will be needed to determine the impact of preoperative, intraoperative and postoperative transfusion on patient outcomes
- Evidence supports the feasibility of utilizing a reduced model frailty index in terms of predictability
- Further studies should be conducted to identify valuable scales, mean values and critical values in predicting patient-centered outcomes
- Further studies are needed to understand impact of female sex, BMI and medications on outcomes
- More studies should additionally be conducted prospectively and expanded to include other identified and more specific measures of frailty

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