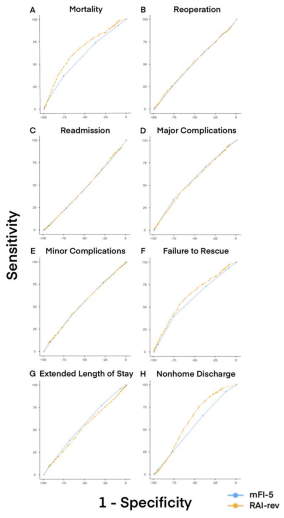
# The Risk Analysis Index is a Better Preoperative Assessment Tool for Complication Risk Following an Amputation due to Critical Limb Ischemia

Hannah Janelle Grimmett, Omar Sbaih, Hikmat R Chmait, Connor Tupper, Geoffrey I Phillips

INTRODUCTION:
Critical limb ischemia (CLI) due to severe atherosclerosis is a relatively common diagnosis amongst the elderly, and amputation may become a necessary surgical intervention. Frailty is an established risk factor for adverse postoperative amputation outcomes, including higher rates of mortality, failure to rescue, and readmission rates. This study seeks to assess the performance of the Risk Analysis Index (RAI-Rev) and the 5-Factor Modified Frailty Index (mFI-5) in preoperative stratification in patients undergoing an amputation due to CLI.
METHODS: A query from The American College of Surgeons National Surgical Quality Improvement Program (NSQIP) was performed for patients undergoing an amputation due to CLI between 2016 and 2022. The RAI-Rev and the mFI-5 frailty scores were calculated for each patient. Outcomes included mortality, reoperation, readmission within 30 days, major complications, minor complications, failure to rescue (FTR), extended length of stay, and nonhome discharge (NHD). T-test or Mann-Whitney U test were used, and binary logistic regression assessed associations with frailty scores and outcomes. Predictability was evaluated through multivariate regression analysis; its discriminative accuracy was measured using receiver operating curve (ROC) analysis and C-statistics (Cs).
RESULTS: A total of 7,663 patients were included (median age: 69 [IQR 52-86]). Within the cohort, 64.2% were female and 67.2% exhibited non-home discharge. With increasing severity in the RAI-Rev, the association with mortality and FTR were significantly increased. The RAI-Rev demonstrated superior discriminatory accuracy when compared to mFI-5 for NHD (Cs: 0.610 vs 0.540, p<0.001), mortality (Cs: 0.657 vs 0.586, p<0.001), and FTR (Cs: 0.632 vs 0.589, p=0.029).
DISCUSSION AND CONCLUSION: The RAI-Rev is more accurate than the mFI-5 for predicting mortality, NHD, and FTR following an amputation due to CLI. These findings highlight potential clinical benefits associated with incorporating frailty into preoperative assessment in patients undergoing an amputation due to CLI.

| | C-statistic | | |
|---|---|---|---|
| | **RAI-Rev** | **mFI-5** | **p-value** |
| Mortality | 0.657 | 0.586 | <0.001 |
| Reoperation | 0.521 | 0.518 | 0.757 |
| Readmission | 0.525 | 0.528 | 0.777 |
| Major Complications | 0.557 | 0.566 | 0.431 |
| Minor Complications | 0.544 | 0.545 | 0.955 |
| Failure to Rescue | 0.632 | 0.589 | <0.001 |
| Extended Length of Stay | 0.526 | 0.556 | <0.001 |
| Nonhome Discharge | 0.610 | 0.540 | <0.001 |




| | Odds Ratio (95% Confidence Interval) | |
|---|---|---|
| | **RAI-Rev** | **p-value** |
| Mortality | 1.05 (1.04–1.06) | <0.001 |
| Reoperation | 0.99 (0.98-1.00) | 0.190 |
| Readmission | 1.01 (1.00–1.02) | 0.035 |
| Major Complications | 1.02 (1.01–1.02) | <0.001 |
| Minor Complications | 1.02 (1.01–1.03) | <0.001 |
| Failure to Rescue | 1.04 (1.03–1.05) | <0.001 |
| Extended Length of Stay | 1.03 (1.02–1.04) | <0.001 |
| Nonhome Discharge | 1.03 (1.02–1.03) | <0.001 |
| | **mFI-5** | **p-value** |
| Mortality | 1.38 (1.26–1.50) | <0.001 |
| Reoperation | 1.01 (1.00–1.02) | 0.077 |
| Readmission | 1.09 (1.02–1.16) | 0.008 |
| Major Complications | 1.25 (1.17–1.34) | <0.001 |
| Minor Complications | 1.16 (1.11–1.22) | <0.001 |
| Failure to Rescue | 1.36 (1.21–1.53) | <0.001 |
| Extended Length of Stay | 1.23 (1.17–1.30) | <0.001 |
| Nonhome Discharge | 1.12 (1.07–1.18) | <0.001 |