Assessment of the Risk Analysis Index for Evaluating Frailty of Patients Undergoing High-Risk Surgery

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Introduction

- Caring for complex patient populations requires effective ways to evaluate a patient's physical candidacy for surgery. Research has shown an association between frailty and adverse postoperative outcomes, including readmission,[1] discharge to location other than home,[2] serious complications and mortality.[3,4]
- **Frailty**: A syndrome of reduced physiologic reserve and increased vulnerability to stressors leading to early decline with and increased risk of mortality.[5,6]
- A consensus on the most effective tool has not been established. Proposed tools include:

5-variable modified Frailty Index (mFI-5)[7]:	**Administrative Risk Analysis Index (RAI-A)**[8]:	**Revised Administrative Risk Analysis Index (RAI-rev)**[9]:
• 5 variables, validated in National Surgical Quality Improvement Program (NSQIP) database	• 14 variables adapted to Veterans Affairs Surgical Quality Improvement Program (VASQIP) database • Validated in a VA cohort of elective surgery patients	• Original 14 variables reweighted • Internally validated in a VA cohort • Externally validated in a NSQIP cohort

Objective

- To determine the accuracy of the **mFI-5**, **RAI-A,** and **RAI-rev** for predicting postoperative morbidity and mortality in patients undergoing high-risk operations.

Methods

- Retrospective cohort study of 2006-2017 NSQIP patients 18 years and older who underwent 5 high-risk operations, identified by Common Procedural Terminology codes:
  - **Colectomy/proctectomy**
  - **Coronary artery bypass graft (CABG)**
  - **Pancreaticoduodenectomy**
  - **Lung resection**
  - **Esophagectomy**
- mFI-5, RAI-A, RAI-rev scores were calculated for each patient.
- The RAI-A and RAI-rev indices used 3 NSQIP/VASIP variables to identify a patient with cancer. Because the utilized variables for advanced cancer underestimated the prevalence of all cancer, the cancer indicator variable in the RAI-rev was corrected to ICD-9 codes for a primary diagnosis of selected cancers. An additional RAI-rev (cancer-corrected) score was calculated for each patient and included in the analyses.

Methods (cont.)

- Factors included in each index:

mFI-5[7]	**RAI-A**[8] **and RAI-rev**[9]	**RAI-rev (cancer corrected)**
Functional status Diabetes COPD CHF HTN	Cancer: • Disseminated cancer • Chemotherapy 30 days before surgery • Radiotherapy 90 days before surgery	Cancer: • ICD-9 codes for primary diagnosis of cancer: lung, esophageal, colorectal, pancreatic, small bowel, biliary
	Sex, age, weight loss, renal failure, CHF, poor appetite, dyspnea at rest, non-independent living, cognitive deterioration, activities of daily living (ADL)	Sex, age, weight loss, renal failure, CHF, poor appetite, dyspnea at rest, non-independent living, cognitive deterioration, activities of daily living (ADL)

- **Primary outcomes:** 30-day mortality and morbidity (any complication except UTI and superficial surgical site infection)
- **Statistical analyses:** C-statistics were used to analyze the predictive ability of each index. A *p*-value <0.05 was statistically significant.

Results

	All patients 283,545 (100%)
Male sex	146,547 (51.7%)
Age	64 (54-73)
Caucasian	200,222 (70.6%)
Cancer diagnosis	27,289 (9.6%)
Corrected cancer diagnosis	136,562 (48.2%)
Weight loss	21,170 (7.5%)
Renal failure	3,084 (1.2%)
Congestive heart failure	4,328 (1.5%)
Poor appetite	21,170 (7.5%)
Dyspnea at rest	3,168 (1.1%)
Non-independent living	16,489 (5.8%)
Cognitive deterioration	2,390 (0.8%)
Independent on ADL	271,284 (95.7%)
30-day mortality	2.6%
Postoperative complication	27.8%

TABLE 1. **Patient characteristics**. Correcting the cancer indicator variable to ICD-9 codes increased the prevalence of cancer.

Results (cont.)

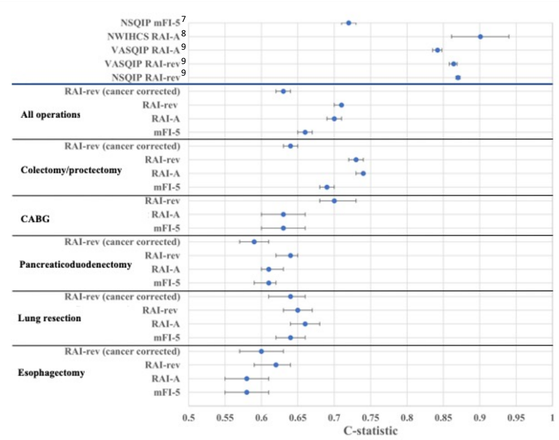

FIGURE 1. **C-statistics analysis of RAI-rev (cancer corrected), RAI-rev, RAI-A, and mFI-5 for postoperative 30-day mortality stratified by operation cohorts.** The RAI-rev was a fair predictor for colectomy and CABG patients. The RAI-rev showed improved performance over the RAI-A only in CABG patients. Correcting the cancer diagnosis variable in the RAI-rev did not improve its performance.

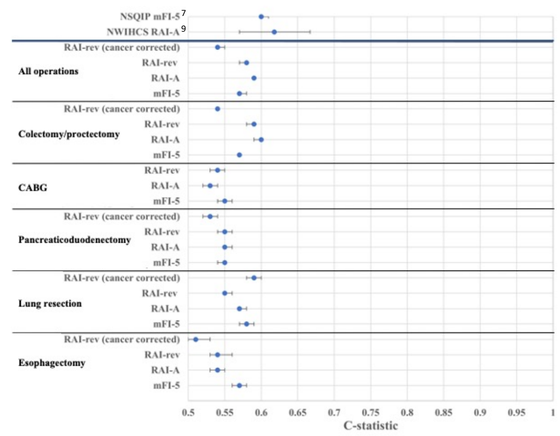

FIGURE 2. **C-statistics analysis of RAI-rev (cancer corrected), RAI-rev, RAI-A, and mFI-5 for postoperative 30-day morbidity stratified by operation cohorts**. All indices performed poorly for the total cohort and all operation cohorts. The RAI-rev did not show improved performance over the RAI-A. Correcting the cancer diagnosis variable in the RAI-rev did not improve its performance.

Conclusions

- The mFI-5, RAI-A, and RAI-rev are not suitable for predicting mortality and morbidity for patients undergoing high-risk operations.
- Correcting the cancer diagnosis indicator variable in the RAI-rev did not improve its predictive ability.
- Study limitations: We cannot analyze the indices' ability to predict outcomes beyond 30 days. NSQIP lacks granular oncological data for more specific characterization of cancer diagnoses. The retrospective nature of the study may preclude an accurate assessment of frailty.
- Further investigation is needed to establish the optimal tool for frailty assessments for this cohort. Future studies should focus on developing prospective measures of frailty.

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