## PHILADELPHIA ACADEMY OF SURGERY
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## Analysis of 1,706 complex abdominal wall reconstructions from the 2005-2010 NSQIP datasets—derivation of a validated model to predict post-operative respiratory failure (PRF)

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**Purpose:**

Complex abdominal wall reconstruction often requires component separation to achieve fascial approximation. These reconstructions can be associated significant rates of surgical complications and respiratory events. We aim to characterize and derive a model to predict post-operative respiratory failure (PRF) after complex abdominal wall reconstruction to optimize peri-operative decision-making using the ACS-NSQIP database from 2005-2010.

**Methods:**

We reviewed the 2005-2010 ACS-NSQIP databases identifying encounters for CPT codes for both hernia repair and component separation (complex abdominal wall reconstruction). We defined PRF as either an unplanned intubation or prolonged ventilation (>48 hours). Exploratory univariate analyses of peri-operative patient risk factors were performed. Regression analyses were used to identify predictors of PRF. A model for predicting PRF was created and validated using a bootstrap technique. A simplified risk score with greater clinical accessibility was subsequently constructed using weighted logistic regression coefficients.

**Results:**

1,102 complex abdominal repairs were performed during the study period. The following factors were associated with PRF: age (P=0.007), resident involvement (P=0.02), obesity (P=0.002), diabetes (P=0.01), smoking (P=0.02), dyspnea (P<0.001), functional status (P<0.001), COPD (P<0.001), CHF (P=0.03), weight loss (P=0.04), albumin (P<0.001), malnutrition (P<0.001), wound class (P=0.003), ASA (P<0.001), and operative time (P<0.001). Patients experiencing a respiratory complication stayed on average 10.8 days longer.

Regression analysis revealed that class III obesity (P=0.01), functional status (P=0.03), malnutrition (P=0.01), ASA (P=0.03), and operative time (P=0.02) were independently associated with higher rates of PRF events. Regression modeling was performed using identifiable preoperative risks associated with PRF (Table 1). The logistic regression's c-statistic (measure of discrimination) was 0.75 in the derivation dataset, 0.73 by internal validation (optimism-corrected), and good calibration (goodness of fit $\chi^2$=8.179, P=0.416) (Figure 1). A simplified respiratory risk score was subsequently derived and validated with nearly equivalent discrimination (c=0.73) (Table 1). Patients with relatively low risk (RRS 0-1, n=478), intermediate (RRS 2-4, n= 588) and high risk (RRS 5-8, n= 36) had respiratory complication rates of 2.7%, 10.0%, and 44.4%, respectively.

**Conclusions:**

This study characterizes PRF events after complex abdominal wall reconstruction and describes a validated predictive model and clinical risk assessment tool. Respiratory complications on average added 11 hospital days and were associated with morbid obesity, lower functional and nutritional status, and higher ASA scores. When high risk patients undergo longer operations the risk of major respiratory morbidity is profound. Data derived from this large cohort study can be used to risk-stratify patients, enhance peri-operative decision-making, and potentially allow for targeted, evidence-based interventions.

Table3. Results of logistic regression analysis and simplified respiratory risk score (RRS) coefficients.

| | Logistic Coefficient | Standard Error | Adjusted OR | 95% Wald CI | Respiratory Risk Score |
|---|---|---|---|---|---|
| Class III Obesity | 0.642 | 0.252 | 1.90 | 1.16 -3.12 | 1 |
| Dependent Functional Status | 1.213 | 0.412 | 3.37 | 1.50-7.54 | 2 |
| COPD | 1.078 | 0.321 | 2.94 | 1.57-5.51 | 2 |
| Malnutrition | 0.649 | 0.297 | 1.91 | 1.07-3.42 | 1 |
| ASA > 3 | 1.189 | 0.311 | 3.28 | 1.78-6.04 | 2 |

CI, Confidence Interval; COPD, chronic obstructive pulmonary disease; ASA, American Society of Anesthesiologists
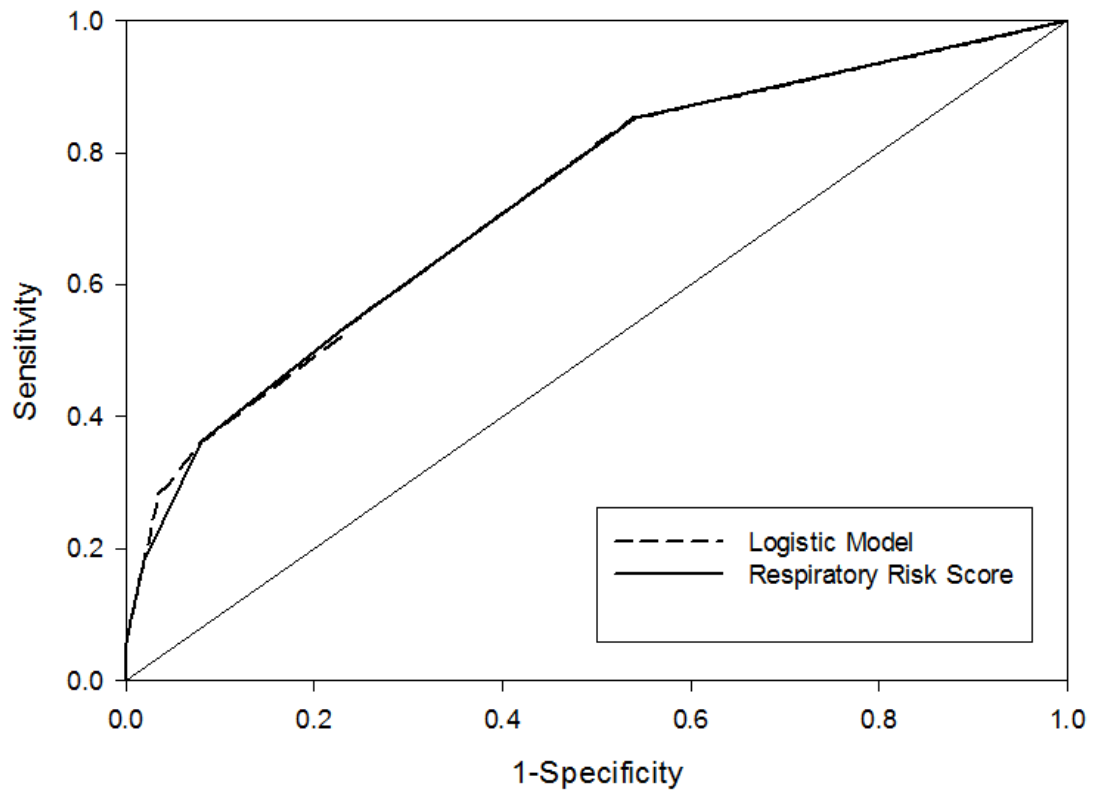
Figure 1. Plot of the receiver-operator curves for both the logistic regression model and the respiratory risk score (RSS).