The Predictive Validity of Risk Factors for Colon SSI

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Background

- CMS mandates reporting of Colon SSI rates to NHSN.
- Young et al. (2012) concluded that the National Healthcare Safety Network (NHSN) risk-adjustment model for colon surgery does not accurately adjust for colon SSI risk.
- We sought to develop a simple colon SSI risk-adjustment model using electronically-available variables from the NHSN model and published literature.

Methods

Retrospective Cohort
- Level I trauma urban public safety-net hospital
- October 2010 through December 2012
- NHSN variables used in risk adjustment modeling:
  - Age at procedure
  - Procedure duration
  - Wound class (C, CC, CO, D)
  - American Society of Anesthesiologists (ASA) score (1-5)
  - General anesthesia (Y/N)
  - Endoscope used (Y/N)
  - Hospital size (# of beds)
  - Medical school affiliation (Y/N)
  - Other variables collected:
    - BMI
    - Gender
    - Trauma (Y/N)
    - Emergent (Y/N)

Analysis
- Assessed each variable’s univariate association with SSI
- Variables with > 10% missing data excluded
- Logistic regression model constructed including all variables having univariate p-value < 0.25
- Area under the Curve (AUC) was then compared to those for other publicly reported NHSN risk adjustment models
  - Colon
  - Hip and knee arthroplasty
  - Vaginal and abdominal hysterectomy

Results

### Risk Factors for SSI in Colon Surgery

#### Univariate Analysis

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>No SSI (N=267)</th>
<th>SSI (N=17)</th>
<th>P-value</th>
<th>OR</th>
<th>95% CI</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>NHSN Risk Factors</td>
<td></td>
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<tr>
<td>Procedure Duration, (mean min.)</td>
<td>121</td>
<td>173</td>
<td>0.07</td>
<td>1.07</td>
<td>1.01 – 1.12</td>
<td>0.02</td>
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<tr>
<td>Age at Procedure, (mean years)</td>
<td>49</td>
<td>55</td>
<td>0.23</td>
<td>1.16</td>
<td>0.85 – 1.57</td>
<td>0.36</td>
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<tr>
<td>ASA Score &gt; 2, N, (%)</td>
<td>153 (57)</td>
<td>8 (47)</td>
<td>0.41</td>
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<tr>
<td>Wound Class CO or D, N, (%)</td>
<td>74 (28)</td>
<td>6 (35)</td>
<td>0.58</td>
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<tr>
<td>General Anesthesia, N, (%)</td>
<td>180 (67)</td>
<td>13 (76)</td>
<td>0.44</td>
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<tr>
<td>Endoscope Used, N, (%)</td>
<td>0</td>
<td>0</td>
<td>-</td>
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<tr>
<td>Facility-Specific Factors</td>
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<tr>
<td>Medical School Affiliation, N, (%)</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Hospital Size (# of Beds), N</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Other Potential Risk Factors</td>
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<tr>
<td>Trauma, N, (%)</td>
<td>9 (3)</td>
<td>1 (6)</td>
<td>0.47</td>
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<tr>
<td>Emergent, N, (%)</td>
<td>38 (14)</td>
<td>2 (12)</td>
<td>1.00</td>
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<tr>
<td>BMI, mean kg/m²</td>
<td>29</td>
<td>30</td>
<td>0.70</td>
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<tr>
<td>Male, N, (%)</td>
<td>164 (61)</td>
<td>11 (65)</td>
<td>0.79</td>
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</tbody>
</table>

#### Multivariate Analysis

- After multivariate analysis, only procedure duration remained a significant predictor of SSI.
- This model performed better than NHSN risk-adjustment model for Colon surgery (AUC=0.664 vs. NHSN AUC = 0.590)
- Model was comparable to NHSN risk-adjustment models for other publicly reportable procedures:
  - Hip Arthroplasty AUC = 0.66
  - Knee Arthroplasty AUC = 0.64
  - Vaginal Hysterectomy AUC = 0.65
  - Abdominal Hysterectomy AUC = 0.66

Conclusions

- Most variables included in the NHSN risk-adjustment model for colon surgery perform poorly at predicting SSI.
- A model including only one variable was able to perform better than the NHSN risk-adjustment model – may indicate that data underlying risk-adjustment model are biased.
- Models with greater predictive validity are needed given reporting mandate for colon surgery.

Limitations

- SSI capture was performed on a small cohort of procedures at a single institution.
- SSI capture may be better at our institution given Denver Health’s structure and multiple modalities for follow-up.
- Model may not be generalizable to other patient populations or institutions.