The Score for Prediction of Postoperative Respiratory Complications — SPORC Revisited: A Score Development and External Validation Study

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DISCLOSURES

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Why focus on postoperative respiratory complication prediction?

**RECOMMENDED PRACTICE BY AHRQ:**

Assess risk factors:

“Determine which patients are at increased risk for postoperative respiratory failure to better prepare clinicians to anticipate adverse events postoperatively, as well as improve allocation of resources after surgery,” Agency for Healthcare Research and Quality (2015); Selected Best Practices and Suggestions for Improvement https://www.ahrq.gov/sites/default/files/wysiwyg/professionals/systems/hospital/iproki/combined/d4h_combo_ps11-postoprespfailure-bestpractices.pdf

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From SPORC to SPORC II

**AIM:**
To incorporate preoperative + intraoperative predictors

To test whether the addition of intraoperative predictors improves predictive ability.

Brueckmann B et al. (2013) Anesthesiology 118:1276-1285
Methodology

**Design:** Hospital registry study analysing data from two independent healthcare networks in Massachusetts.

- Development cohort \( n = 90,893 \)
- Validation cohort \( n = 50,389 \)

**Primary Outcome:** 3-day reintubation after primary post-procedural extubation.

Predictors considered for development:

**Pre- op (all SPORC variables):**
- ASA physical status >3
- emergency status
- “high risk” surgical service
- chronic pulmonary disease
- heart failure

**Intraoperative:**
- Mean FiO\(_2\)
- Vasopressor dose
- NMBA dose
- Fluids
- Opioid dose
- Fentanyl dose
- Packed red blood cells
- Volatile anesthetics
- **Protective ventilation patterns** (driving pressure >15mmHg)
- **Post-intubational desaturation** ≤ 90 percent within five minutes

**Procedure-related:**
- duration of surgery
- surgical complexity (Procedure Severity Index)
SPORC II

Pre-Operative Risk Factors
- Heart Failure
- Emergency Procedure
- ASA physical status ≥ 3
- Chronic Pulmonary Disease

Procedure-related Risk Factors
- Desaturation ≤ 90% SpO2 (5 min post-intubation)
- PSS Morbidity (32-48/ ≥ 49)
- Duration of Surgery (> 140 min / > 225 min)
- High FiO2
- Intraoperative Administration of Packed Red Blood Cells
- No Protective Ventilation Pattern
- High Vasopressor Dose
- Absence of Application of Volatile Anesthetics

Model Performance

DEVELOPMENT COHORT
- Hosmer-Lemeshow-Test: not significant (0.06), indicating good calibration of the model

EXTERNAL VALIDATION COHORT

Calibration plot in Development Cohort
Calibration plot in Validation Cohort
Model Comparison
SPORC vs SPORC II

Compare **AUC 0.84 (SPORC II)** at **AUC 0.76 (SPORC)** (95% CI 0.75-0.78), p-value <0.001.

**Net Reclassification index**

- **NRI: 0.25**
- In the event group 213 (30.4%) were adequately classified in higher risk categories when using the novel prediction score (SPORCII)

<table>
<thead>
<tr>
<th>Risk Categories for Postoperative Reintubation</th>
<th>&lt;1% Risk</th>
<th>1-5% Risk</th>
<th>5-10% Risk</th>
<th>&gt;10% Risk</th>
<th>Total Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>In 699 patients who were reintubated within 3 days after surgery</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>&lt;1% Risk</td>
<td>161</td>
<td>80</td>
<td>1</td>
<td></td>
<td>242</td>
</tr>
<tr>
<td>1-5% Risk</td>
<td>66</td>
<td>240</td>
<td>88</td>
<td>29</td>
<td>423</td>
</tr>
<tr>
<td>5-10% Risk</td>
<td>2</td>
<td>9</td>
<td>15</td>
<td></td>
<td>26</td>
</tr>
<tr>
<td>&gt;10%</td>
<td>3</td>
<td>5</td>
<td></td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>Total Number</td>
<td>227</td>
<td>322</td>
<td>101</td>
<td>49</td>
<td>699</td>
</tr>
</tbody>
</table>

| <1% Risk                                      | 63583    | 3987      | 45         | 1         | 67616        |
| 1-5% Risk                                     | 9609     | 11125     | 1200       | 223       | 22157        |
| 5-10% Risk                                    | 1        | 106       | 154        | 104       | 365          |
| >10%                                          | 5        | 26        | 25         | 56        | 66           |
| Total Number                                  | 73193    | 15223     | 1425       | 353       | 90194        |
Conclusion

SPORC II is an improved tool for the prediction of early postoperative reintubation.

- Utilizes preexisting comorbidity, surgery, and anesthesia-related risk factors
- Improved c-statistics performance compared with previous SPORC instrument
- Well calibrated and externally validated
- Improved net reclassification

Thank you!

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