Respiratory Failure Causing Readmission to the ICU

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Deputy Director, Center for Health Incentives and Behavioral Economics (CHIBE)
Respiratory Failure as a Factor Associated with Readmission to the ICU

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Readmission to the ICU: not a measure of ICU quality, with or without respiratory failure
Disclosures

Grant support
NIH (NHLBI, NIA, NCI)
Robert Wood Johnson Foundation
American Heart Association
Greenwall Foundation
Otto Haas Charitable Trust
Gordon and Betty Moore Foundation

In-kind research support
• Cerner
• CVS Health
• Ascension Health
• Kaiser Permanente

Paid consultancy
ABIM Foundation’s Choosing Wising

program
Patients readmitted to ICU have much worse outcomes than those who are not.

Readmission rate as an ICU quality marker

- **1995**: SCCM Quality Indicators Committee ranks ICU readmission within 48 hours as top indicator of ICU quality


- **1999**: Cooper et al. cast skepticism

  - No association between ICU readmission rates and case-mix-adjusted in-hospital mortality rates among 28 hospitals

    *Cooper GS et al. Are readmissions to the intensive care unit a useful measure of hospital performance? Medical Care 1999, 37:399-408.*

- **2012**: ESICM endorses 48-hour readmission as quality measure (1 of 4 outcome measures)

48-hour readmissions as a quality marker

“A high early re-admission rate suggests poor ICU discharge decision making. It can be caused by discharges occurring before the patient is ready for ward-based care, incorrect use of ward care and deficient hand-over to staff taking over the care and responsibility of the patient.”

Readmitted patients more commonly have respiratory failure at initial ICU admission

<table>
<thead>
<tr>
<th>Medical readmission = Yes</th>
<th>Readmission = No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Congestive heart failure</td>
<td>6.3%</td>
</tr>
<tr>
<td>Other respiratory disease</td>
<td>5.3%</td>
</tr>
<tr>
<td>Bacterial pneumonia</td>
<td>5.3%</td>
</tr>
<tr>
<td>GI bleeding, upper</td>
<td>4.0%</td>
</tr>
<tr>
<td>Chronic obstructive pulmonary disease (emphysema/bronchitis)</td>
<td>3.5%</td>
</tr>
<tr>
<td>Rhythm disturbance</td>
<td>3.0%</td>
</tr>
<tr>
<td>Multiple trauma (excluding head trauma)</td>
<td>2.8%</td>
</tr>
<tr>
<td>Intracerebral hemorrhage</td>
<td>2.8%</td>
</tr>
</tbody>
</table>
Respiratory failure #1 cause of ICU readmission

### Table 3. Index Admission and Readmission Diagnoses

<table>
<thead>
<tr>
<th>Index admission Diagnosis</th>
<th>Never Readmitted</th>
<th>48-h Readmissions</th>
<th>120-h Readmissions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Respiratory arrest or failure</td>
<td>20.5</td>
<td>Respiratory arrest or failure</td>
<td>23.5</td>
</tr>
<tr>
<td>Cardiac arrest or failure</td>
<td>16.1</td>
<td>Cardiac arrest or failure</td>
<td>15.2</td>
</tr>
<tr>
<td>Sepsis</td>
<td>6.7</td>
<td>Sepsis</td>
<td>9.6</td>
</tr>
</tbody>
</table>

- 48-h Readmissions:
  - Respiratory arrest or failure: 69.3%
  - Cardiac arrest or failure: 56.6%
  - Sepsis: 5.1%
  - Surgical emergency: 0.8%
  - Postoperative observation: 2.3%
  - Hemorrhage: 3.8%
  - Neuro/neurosurgery: 4.1%
  - Metabolic: 1.3%
  - Other: 0.7%

- 120-h Readmissions:
  - Respiratory arrest or failure: 23.1%
  - Cardiac arrest or failure: 52.4%
  - Sepsis: 6.7%
  - Surgical emergency: 1.2%
  - Postoperative observation: 4.2%
  - Hemorrhage: 3.7%
  - Neuro/neurosurgery: 4.5%
  - Metabolic: 1.7%
  - Other: 0.6%

Brown SES, et al. AJRCCM 2012
The Epidemiology of Intensive Care Unit Readmissions in the United States

Sydney E. S. Brown¹, Sarah J. Ratcliffe¹, Jeremy M. Kahn², and Scott D. Halpem¹, ³, ⁴

50% of ICU readmissions within 2 days
- Metrics of severity of illness at ICU admission displayed greater associations with ICU readmission at longer readmission intervals

- Inflection point between 2.5 – 3 days
Readmissions and ICU-based life support

- 214,697 patients admitted to 157 ICUs in Project IMPACT from 2001-2008
Importance of ICU discharge practices

- 214,697 patients admitted to 157 ICUs in Project IMPACT from 2001-2008
Night-time discharges: a risk for readmission?

Brown SES, Ratcliffe SJ, Halpern SD. Medical Care 2013
Most readmissions in afternoon regardless of discharge time

Sinusoidal pattern and significance of nighttime discharge risk vanish when defining ICU readmission by calendar days

<table>
<thead>
<tr>
<th>Discharge time</th>
<th>6 AM–12 PM</th>
<th>12 PM–6 PM</th>
<th>6 PM–12 AM</th>
<th>12 AM–6 AM</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 AM–12 PM</td>
<td>149 (18.4)</td>
<td>319 (39.5)</td>
<td>227 (28.1)</td>
<td>113 (14.0)</td>
<td>808</td>
</tr>
<tr>
<td>12 PM–6 PM</td>
<td>970 (18.2)</td>
<td>1931 (36.2)</td>
<td>1458 (27.3)</td>
<td>974 (18.3)</td>
<td>5333</td>
</tr>
<tr>
<td>6 PM–12 AM</td>
<td>409 (17.6)</td>
<td>870 (37.4)</td>
<td>584 (25.1)</td>
<td>461 (19.8)</td>
<td>2324</td>
</tr>
<tr>
<td>12 AM–6 AM</td>
<td>98 (16.5)</td>
<td>226 (38.1)</td>
<td>151 (25.5)</td>
<td>118 (19.9)</td>
<td>593</td>
</tr>
<tr>
<td>Overall</td>
<td>1626 (16.5)</td>
<td>3346 (36.9)</td>
<td>2420 (26.7)</td>
<td>1666 (18.4)</td>
<td>9058</td>
</tr>
<tr>
<td>Probability of death</td>
<td>446 (27.4)</td>
<td>735 (22.0)</td>
<td>406 (19.3)</td>
<td>406 (24.4)</td>
<td>2053 (22.7)</td>
</tr>
</tbody>
</table>

Brown SES, Ratcliffe SJ, Halpern SD. Medical Care 2013
200,730 patients discharged alive from 157 U.S. ICUs, 2001-2008
Strain at ICU discharge influences flow, not ultimate outcomes

Table 4. Expected Outcomes Based on Percentiles of ICU Capacity Strain*

<table>
<thead>
<tr>
<th>Capacity Strain</th>
<th>ICU LOS, h</th>
<th>Post-ICU Hospital LOS, h</th>
<th>Probability of 72-h ICU Readmission, %</th>
<th>Probability of Subsequent Death, %</th>
<th>Probability of Being Discharged Home, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>5%</td>
<td>55.1</td>
<td>100.3</td>
<td>2.9</td>
<td>4.0</td>
<td>66.0</td>
</tr>
<tr>
<td>10%</td>
<td>54.4</td>
<td>100.1</td>
<td>3.0</td>
<td>4.1</td>
<td>65.7</td>
</tr>
<tr>
<td>25%</td>
<td>53.4</td>
<td>99.5</td>
<td>3.2</td>
<td>4.1</td>
<td>66.0</td>
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<tr>
<td>50%</td>
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<td>99.4</td>
<td>3.3</td>
<td>4.1</td>
<td>66.6</td>
</tr>
<tr>
<td>75%</td>
<td>50.7</td>
<td>98.8</td>
<td>3.5</td>
<td>4.0</td>
<td>65.6</td>
</tr>
<tr>
<td>90%</td>
<td>49.4</td>
<td>98.5</td>
<td>3.8</td>
<td>4.0</td>
<td>65.6</td>
</tr>
<tr>
<td>95%</td>
<td>48.8</td>
<td>98.3</td>
<td>3.9</td>
<td>4.0</td>
<td>65.5</td>
</tr>
</tbody>
</table>

ICU = intensive care unit; LOS = length of stay.
* All expected values and probabilities derived from the fully adjusted model by entering values for capacity strain at given percentiles of their respective distributions.

- Extreme increases in all 3 strain measures yielded 6.3 hour reduction in ICU LOS and 1% increase in ICU readmissions among discharged patients (both p < 0.02)
- No differences in subsequent mortality or probability of being discharged home
ICUs staffing residents --------
ICUs not staffing residents

1) Significant decline or increase over that time period *
2) Significant change in trajectory from previous time period at that knot X
3) Significant difference in trajectory displayed between ICUs with and without residents
4) Significant difference in change in trajectory between ICUs with and without residents at that inflection point
ICUs staffing residents

ICUs not staffing residents

1) Significant decline or increase over that time period
2) Significant change in trajectory from previous time period at that knot
3) Significant difference in trajectory displayed between ICUs with and without residents
4) Significant difference in change in trajectory between ICUs with and without residents at that inflection point
Correspondence to mortality rates?

3857 hospitals in CMS Hospital Compare

Patients with primary diagnosis of congestive heart failure

Figure 1. Comparison of Risk-Adjusted Hospital Readmission Rates and Mortality Rates 30 Days after an Index Admission for Heart Failure.

The dashed lines indicate the upper and lower limits of the 95% confidence intervals, and the solid line indicates linear regression. Data are from the Centers for Medicare and Medicaid Services Hospital Compare public reporting database.¹
ICUs staffing residents

ICUs not staffing residents

1) Significant decline or increase over that time period
2) Significant change in trajectory from previous time period at that knot
3) Significant difference in trajectory displayed between ICUs with and without residents
4) Significant difference in change in trajectory between ICUs with and without residents at that inflection point
Hospital and Patient Characteristics Associated With Death After Surgery

A Study of Adverse Occurrence and Failure to Rescue

JEFFREY H. SILBER, MD, PhD,* † SANKEY V. WILLIAMS, MD, † ‡
HENRY KRAKAUER, MD, PhD,§ AND J. SANFORD SCHWARTZ, MD † ‡

MEDICAL CARE

Should we evaluate “failure to rescue” patients readmitted to ICU?
Conclusions

1. Respiratory failure is the single biggest reason for ICU readmission.

2. If we want to examine ICU readmission as a marker of ICU quality, define it as within 2 calendar days.

3. Of the many factors that may cause ICU readmission, there is no available evidence that the quality of ICU care is one of them (some suggestion of protective effect).

4. “Failure to rescue readmitted patients” is a conceptually better ICU quality measure, but need to account for deaths following preference-concordant withholding/withdrawal of life support.
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