Reducing the demand for ICU beds
PWH ICU

- Sole adult ICU
- Cardiothoracic, neurosurgical, burns, trauma, general surgical and medical
- 22 beds
- 1400 bed hospital
- Local population 750,000
“Reducing” demand

• Triage
  – ~25% of emergency referrals

• Reduce elective surgical admissions
Triage

Kaplan-Meier survival estimates

Probability of survival

Time after ICU consultation (days)

Futile

Triage

Well
Elective surgical admissions

- 30% of admissions
- Typically stay ≤1 day
- Bed assigned at 0700
- Frequently discharged on evening of surgery
- ~15% of cases postponed due to lack of ICU beds
  - “Backup case”
Upper GI surgery

![Graphs showing 30-day mortality rates for oesophagectomy and gastrectomy across different annual hospital volumes.](image)

Hepatic resection

- Fast track hepatectomy
- High volume centre
- Standardized plan
  - Multimodal analgesia
  - Epidural (except for laparoscopic resections)
  - To general ward post op day 0 (except advanced resections)
  - Hilar cholangiocarcinoma excluded

Hepatic resection

- Laparoscopic n=13
- Minor open n=55
- Major open n=32

- 30 day mortality 0%
Hepatectomy @PWH

N=75
1 unplanned ICU admission (for surgical emphysema, LOS 42h)
30 day mortality 0%
Hepatectomy @PWH

- Admitted
- Not admitted

N=71
ICU LOS 21±13h
30 day mortality 0%
Cardiac fast-track

- Uncomplicated CABG
- GA planned to allow rapid recovery of consciousness
- Post operative admission to fast-track unit
  - Monitored
  - Limited non-cardiorespiratory organ support
  - Rapid turnover
St Mary’s fast-track failure score

• repeat operations
• extracardiac arteriopathy
• preoperative IABP
• raised serum creatinine,
• complex surgery
• impaired LV function ± recent acute coronary syndrome
External validation

- Retrospective analysis of prospectively collected data
- 1645 patients undergoing open cardiac surgery
- Fast track failure = ICU stay > 48h
- AUC ROC 0.79
- Re-calibrated

Using the score

- Who needs an ICU bed?
- Unplanned admission vs unnecessary admission

Adaptive support ventilation

- PC/PS

- Predetermined target minute ventilation = 100 ml/kg/min

- Optimal respiratory rate determined from Otis equation
  - Aim to minimize work of breathing
Not weaned within 8 h

Valvular surgery

Time to separation from ventilator (min)

- ASV
- Physician
Intubation >8h

Manual changes

N=52
Future

- Suppose we can quantify the risk of an elective surgical patient requiring an ICU intervention
- Request for 3 post-op beds
- Each patient has a 20% risk of requiring an ICU intervention (bed)
### Cumulative probability

<table>
<thead>
<tr>
<th>No. of beds</th>
<th>Probability</th>
<th>Cumulative probability</th>
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<tr>
<td>1</td>
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<td>0.498</td>
</tr>
<tr>
<td>2</td>
<td>0.096</td>
<td>0.097</td>
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<tr>
<td>3</td>
<td>0.008</td>
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</tbody>
</table>

By allocating 2 beds instead of 3, bed-days saved per year is 361
Conclusion

• Reducing elective surgical admissions may be help relieve ICU admission strain
• Need to be able predict requirement for an ICU intervention
• More useful in big units