Show me the Evidence: Updates from the literature

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Professor and Foundation Chair of Anaesthesia
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Melbourne Medical School

Director, Melbourne Clinical and Translational Sciences (MCATS) research platform
No Conflict of Interest
Perioperative Pulmonary Hypertension

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Professor and Foundation Chair of Anaesthesia
Head of Anaesthesia, Perioperative and Pain Medicine Unit

Director of Melbourne Clinical and Translational Sciences
Perioperative Medicine
Collaboratively managing patient and operative risks before, during, and after surgery to provide patient-centred, clinically effective and cost effective care

Austin: Perioperative Medicine Collaborative
How Physicians view Anaesthetists…
How Anaesthetists view Physicians...

Avoid hypoxia and hypotension. Suggest spinal.
Anaesthesia: Critical Care Specialty

- General anaesthesia and sedation
- Airway management
- Regional and local anaesthesia
- Perioperative medicine
- Pain medicine
- Resuscitation, trauma, crisis management
- Safety and quality
What I want to know…

For co-morbidity:
What is the
– (Detailed) Nature
– Severity
– Optimal Management of the patient’s condition(s)?

How do WE finesse this individual perioperatively: pre, intra, post?
Mortality 1% to 18%
Peri-operative morbidity 14 to 42%

- respiratory failure
- heart failure
- dysrhythmias
- sepsis
- renal insufficiency
- myocardial infarction
Pulmonary Hypertension

- Pre-capillary
  - Idiopathic PAH
  - PAH associated with: connective tissue disease, HIV, congenital heart disease, haemolysis, etc.
  - Chronic thromboembolic pulmonary disease
- Post-capillary
  - Pulmonary Hypertension
  - mPAP ≥ 25 mmHg
  - Right heart failure
  - Left heart disease
  - Ventricular Interdependence
  - LV preload
  - Cardiac output
  - Right coronary perfusion

- Genetic susceptibility
  - NO
  - PGI
  - End-Tx
  - Vasoconstriction
  - Perivascular inflammation
  - Proliferation
  - Thrombus
  - RV wall stress
  - Adaptive remodelling
  - Ischaemia
  - RV dimension
  - Poor contractility
  - Right heart failure
Table 2  Haemodynamic definition of pulmonary hypertension [9, 10, 12].

<table>
<thead>
<tr>
<th>Definition</th>
<th>Characteristics (all values at rest)</th>
<th>WHO clinical groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulmonary hypertension (PH)</td>
<td>mPAP ≥ 25 mmHg</td>
<td>All</td>
</tr>
<tr>
<td>1) Pre-capillary PH</td>
<td>mPAP ≥ 25 mmHg, PAWP ≤ 15 mmHg, PVR &gt; 3 WU, CO normal/reduced/high</td>
<td>Pulmonary arterial hypertension, PH due to lung disease, CTEPH</td>
</tr>
<tr>
<td>2) Post-capillary PH</td>
<td>mPAP ≥ 25 mmHg, PAWP &gt; 15 mmHg, CO normal/reduced/high</td>
<td>PH with unclear and/or multifactorial mechanisms</td>
</tr>
<tr>
<td>2a) Isolated post-capillary PH*</td>
<td>PAWP &gt; 15 mmHg</td>
<td>PH due to left heart disease</td>
</tr>
<tr>
<td>2b) Post-capillary PH with pre-capillary component*</td>
<td>DPAP-PAWP &lt; 7 mmHg, PAWP &gt; 15 mmHg, DPAP-PAWP ≥ 7 mmHg</td>
<td>PH due to left heart disease</td>
</tr>
</tbody>
</table>
STATE-OF-THE-ART REVIEW ARTICLES

Echocardiography in Pulmonary Arterial Hypertension: from Diagnosis to Prognosis

Eduardo Bossone, MD, PhD, Antonello D’Andrea, MD, PhD, Michele D’Alto, MD, Rodolfo Citro, MD, Paola Argiento, MD, PhD, Francesco Ferrara, MD, Antonio Cittadini, MD, PhD, Melvyn Rubenfire, MD, and Robert Naeije, MD, PhD, Milan, Salerno, and Naples, Italy; Ann Arbor, Michigan; Brussels, Belgium

(J Am Soc Echocardiogr 2013;26:1-14.)

Echocardiography often reports systolic rather than mean PAP

Dx: SPAP > 36 mmHg (Rule of thumb MPAP about 2/3 SPAP)
Perioperative Mortality in Patients with Pulmonary Hypertension Undergoing Major Joint Replacement

Stavros G. Memtsoudis, MD, PhD,* Yan Ma, PhD,† Ya Lin Chiu, MS,‡ J. Matthias Walz, MD,‡ Robert Voswinckel, MD,§ and Madhu Mazumdar, PhD‡

Anaesthesiology 2013

Retrospective Observational Database study
US insurance database
671,000 TKA; 2184 (0.3%) PHPT
360,000 for THA; 1359 (0.4%),

PHPT: Clinical Modification [ICD-9-CM]) codes
Mortality by PHTN Type and Procedure Type

- THA: Primary PHTN (p=0.0026) vs. Other PHTN
- TKA: Primary PHTN (p=0.001)

Mortality Incidence (%)
## Demographics of matched sample

<table>
<thead>
<tr>
<th></th>
<th>Total hip arthroplasty</th>
<th>Total knee arthroplasty</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No PHTN</td>
<td>PHTN</td>
</tr>
<tr>
<td>No.</td>
<td>3735</td>
<td>1245</td>
</tr>
</tbody>
</table>

## Multivariate regression analysis

<table>
<thead>
<tr>
<th>Variable</th>
<th>Total knee arthroplasty (AUC = 0.66), odds ratio (95% CI)</th>
<th>Total hip arthroplasty (AUC = 0.81), odds ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHTN (reference: no PHTN)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHTN</td>
<td>5.05 (3.14–8.13)*</td>
<td>3.36 (2.27–4.97)*</td>
</tr>
<tr>
<td>Age group (y) (reference: 45–64 y)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;44</td>
<td>0.52 (0.19–1.39)</td>
<td>0.63 (0.35–1.13)</td>
</tr>
<tr>
<td>65–74</td>
<td>2.06 (1.67–2.55)*</td>
<td>2.05 (1.60–2.63)*</td>
</tr>
<tr>
<td>&gt;75</td>
<td>5.01 (4.11–6.09)*</td>
<td>6.34 (5.10–7.89)*</td>
</tr>
<tr>
<td>Gender (reference: female)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>1.92 (1.68–2.19)*</td>
<td>1.53 (1.34–1.73)*</td>
</tr>
<tr>
<td>Deyo comorbidity index</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increase 1 unit</td>
<td>1.14 (1.06–1.22)†</td>
<td>1.27 (1.20–1.34)*</td>
</tr>
</tbody>
</table>
Mortality by PHTN Status and Procedure Type

![Graph showing mortality comparison between PHTN and no PHTN for THA and TKA procedures.](image_url)

- THA:
  - No PHTN (full sample): Lower mortality
  - No PHTN (matched sample): Lower mortality
  - PHTN (full sample): Higher mortality
  - PHTN (matched sample): Higher mortality

- TKA:
  - No PHTN (full sample): Lower mortality
  - No PHTN (matched sample): Lower mortality
  - PHTN (full sample): Higher mortality
  - PHTN (matched sample): Higher mortality

Significance levels:
- *p < 0.0001*
- **p < 0.0001**

Note: *test between no PHTN and PHTN in full sample
**test between no PHTN and PHTN in matched sample
Something to tighten sphincters…

Review Article

Pulmonary hypertension and its management in patients undergoing non-cardiac surgery

S. A. Pilkington, D. Taboada and G. Martinez

…successful management requires a multidisciplinary team approach and thorough pre-operative risk assessment. Correct diagnosis, optimisation of the patient’s functional status and haemodynamics and management of co-morbidities are vital. The presence of an experienced anaesthetist and surgeon in a specialist centre is advocated.
160,000 participants, mainly VA men
Diagnosis, evaluation, and management of acute kidney injury: a KDIGO summary (Part 1)

John A Kellum* and Norbert Lameire², for the KDIGO AKI Guideline Work Group³
Kidney Disease: Improving Global Outcomes (KDIGO)

AKI definitions

<table>
<thead>
<tr>
<th>Stage</th>
<th>Serum creatinine</th>
<th>Urine output</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.5 to 1.9 times baseline or ≥0.3 mg/dl (≥26.5 µmol/l) increase</td>
<td>&lt;0.5 ml/kg/hour for 6 to 12 hours</td>
</tr>
<tr>
<td>2</td>
<td>2.0 to 2.9 times baseline</td>
<td>&lt;0.5 ml/kg/hour for ≥12 hours</td>
</tr>
<tr>
<td>3</td>
<td>3.0 times baseline or increase in serum creatinine to ≥4.0 mg/dl (≥353.6 µmol/l) or initiation of renal replacement therapy or in patients &lt;18 years a decrease in eGFR to &lt;35 ml/minute per 1.73 m²</td>
<td>&lt;0.3 ml/kg/hour for ≥24 hours or anuria for ≥12 hours</td>
</tr>
</tbody>
</table>
AKI across types of surgery

<table>
<thead>
<tr>
<th>AKI Incidence</th>
<th>Cardiac</th>
<th>ENT</th>
<th>General</th>
<th>Ortho</th>
<th>Thoracic</th>
<th>Urology</th>
<th>Vascular</th>
</tr>
</thead>
<tbody>
<tr>
<td>AKI with RRT</td>
<td>0.4%</td>
<td>0.1%</td>
<td>0.3%</td>
<td>0.1%</td>
<td>0.2%</td>
<td>0.1%</td>
<td>0.4%</td>
</tr>
<tr>
<td>Stage 3 AKI No RRT</td>
<td>0.7%</td>
<td>0.1%</td>
<td>1.2%</td>
<td>0.7%</td>
<td>0.8%</td>
<td>0.4%</td>
<td>0.9%</td>
</tr>
<tr>
<td>Stage 2 AKI</td>
<td>2.3%</td>
<td>0.3%</td>
<td>2.2%</td>
<td>1.6%</td>
<td>1.9%</td>
<td>0.8%</td>
<td>1.4%</td>
</tr>
<tr>
<td>Stage 1 AKI</td>
<td>15.2%</td>
<td>3.6%</td>
<td>9.4%</td>
<td>7.8%</td>
<td>9.2%</td>
<td>7.3%</td>
<td>6.6%</td>
</tr>
<tr>
<td>No AKI</td>
<td>81.3%</td>
<td>95.9%</td>
<td>86.8%</td>
<td>89.8%</td>
<td>88.0%</td>
<td>91.4%</td>
<td>90.8%</td>
</tr>
<tr>
<td></td>
<td>KDIGO Stage 1</td>
<td>KDIGO Stage 2</td>
<td>KDIGO Stage 3 no RRT</td>
<td>RRT Requirement&lt;sup&gt;a&lt;/sup&gt;</td>
<td>With AKI</td>
<td>Without AKI</td>
<td></td>
</tr>
<tr>
<td>--------------------------</td>
<td>---------------</td>
<td>---------------</td>
<td>----------------------</td>
<td>-----------------------------</td>
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<td></td>
</tr>
<tr>
<td>No. of participants</td>
<td>14,477</td>
<td>2,780</td>
<td>1,348</td>
<td>420</td>
<td>19,025</td>
<td>142,160</td>
<td></td>
</tr>
<tr>
<td>Hospital length of stay, d</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospital readmission, %&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Within 30 d</td>
<td>20 (19-20)</td>
<td>26 (24-27)</td>
<td>28 (26-31)</td>
<td>28 (23-34)</td>
<td>21 (21-22)</td>
<td>13 (13-13)</td>
<td></td>
</tr>
<tr>
<td>Within 90 d</td>
<td>30 (29-31)</td>
<td>37 (35-39)</td>
<td>40 (37-43)</td>
<td>43 (37-49)</td>
<td>32 (31-32)</td>
<td>22 (22-22)</td>
<td></td>
</tr>
<tr>
<td>Within 6 mo</td>
<td>38 (37-39)</td>
<td>45 (43-47)</td>
<td>49 (45-52)</td>
<td>55 (49-62)</td>
<td>40 (39-40)</td>
<td>29 (29-30)</td>
<td></td>
</tr>
<tr>
<td>Within 1 y</td>
<td>48 (47-49)</td>
<td>55 (53-58)</td>
<td>57 (54-60)</td>
<td>69 (63-75)</td>
<td>50 (49-51)</td>
<td>39 (39-39)</td>
<td></td>
</tr>
<tr>
<td>Mortality, %&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In-hospital</td>
<td>4.6 (4.1-5.0)</td>
<td>15 (14-17)</td>
<td>24 (22-27)</td>
<td>35 (31-40)</td>
<td>8.2 (8.0-8.4)</td>
<td>1.1 (1.0-1.2)</td>
<td></td>
</tr>
<tr>
<td>Within 30 d</td>
<td>6.7 (6.3-7.2)</td>
<td>19 (18-21)</td>
<td>30 (28-33)</td>
<td>40 (36-45)</td>
<td>11 (11-11)</td>
<td>2.2 (2.1-2.3)</td>
<td></td>
</tr>
<tr>
<td>Within 90 d</td>
<td>9.0 (8.5-9.4)</td>
<td>22 (21-24)</td>
<td>33 (31-36)</td>
<td>45 (40-50)</td>
<td>13 (13-14)</td>
<td>3.6 (3.5-3.7)</td>
<td></td>
</tr>
<tr>
<td>Within 6 mo</td>
<td>11 (11-12)</td>
<td>25 (23-26)</td>
<td>36 (33-39)</td>
<td>49 (44-53)</td>
<td>16 (15-16)</td>
<td>5.4 (5.2-5.5)</td>
<td></td>
</tr>
<tr>
<td>Within 1 y</td>
<td>14 (14-15)</td>
<td>28 (26-30)</td>
<td>39 (36-42)</td>
<td>54 (49-59)</td>
<td>19 (18-20)</td>
<td>8.0 (7.9-8.2)</td>
<td></td>
</tr>
<tr>
<td>ESRD, %&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Within 30 d</td>
<td>0.072 (0.039-0.134)</td>
<td>0.36 (0.19-0.69)</td>
<td>0.95 (0.52-1.71)</td>
<td>8.0 (5.7-11.3)</td>
<td>0.33 (0.26-0.43)</td>
<td>0.0036 (0.0015-0.0086)</td>
<td></td>
</tr>
<tr>
<td>Within 90 d</td>
<td>0.19 (0.13-0.29)</td>
<td>0.64 (0.38-1.06)</td>
<td>1.1 (0.6-1.9)</td>
<td>10 (8-14)</td>
<td>0.50 (0.41-0.62)</td>
<td>0.012 (0.008-0.020)</td>
<td></td>
</tr>
<tr>
<td>Within 6 mo</td>
<td>0.35 (0.26-0.47)</td>
<td>0.74 (0.46-1.19)</td>
<td>1.7 (1.0-2.7)</td>
<td>12 (8-16)</td>
<td>0.68 (0.57-0.82)</td>
<td>0.026 (0.018-0.036)</td>
<td></td>
</tr>
<tr>
<td>Within 1 y</td>
<td>0.58 (0.46-0.73)</td>
<td>1.1 (0.7-1.7)</td>
<td>2.1 (1.3-3.2)</td>
<td>12 (8-16)</td>
<td>0.94 (0.80-1.10)</td>
<td>0.053 (0.042-0.068)</td>
<td></td>
</tr>
</tbody>
</table>
### Adjusted odds ratios

<table>
<thead>
<tr>
<th>Outcome</th>
<th>No AKI</th>
<th>KDIGO 3 (no RRT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital readmission within 30 d</td>
<td>88%</td>
<td>1%</td>
</tr>
<tr>
<td>In-hospital mortality</td>
<td>13%</td>
<td>28%</td>
</tr>
<tr>
<td>90-d mortality</td>
<td>1.1%</td>
<td>24%</td>
</tr>
<tr>
<td>1-y mortality</td>
<td>3.6%</td>
<td>33%</td>
</tr>
<tr>
<td>1-y ESRD</td>
<td>8%</td>
<td>39%</td>
</tr>
<tr>
<td>1-y ESRD</td>
<td>0.05%</td>
<td>2.1%</td>
</tr>
</tbody>
</table>
eGFR
Calculated from CKD-EPI: Creatinine, age, gender (NOT weight)
Gold standard: clearance of exogenous filtration markers
\[
GFR = 141 \times \min (S_{cr} / \kappa, 1)^{\alpha} \times \max (S_{cr} / \kappa, 1)^{-1.209} \times 0.993^{\text{Age}} \times 1.018 \text{ [if female]}
\]

Published in final edited form as:

**A New Equation to Estimate Glomerular Filtration Rate**

Andrew S. Levey, MD\(^1\), Lesley A. Stevens, MD, MS, FRCP(C)\(^1\), Christopher H. Schmid, PhD\(^1\), Yaping (Lucy) Zhang, MS\(^1\), Alejandro F. Castro III, MPH\(^2\), Harold I. Feldman, MD, MSCE\(^3\), John W. Kusek, PhD\(^4\), Paul Eggers, PhD\(^4\), Frederick Van Lente, PhD\(^5\), Tom Greene, PhD\(^6\), and Josef Coresh, MD, PhD, MHS\(^2\) for the Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI)\(^7\)
<table>
<thead>
<tr>
<th>Factor</th>
<th>RR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age /10 y older</td>
<td>1.10</td>
<td>(1.09 to 1.12)</td>
</tr>
<tr>
<td>Male</td>
<td>1.69</td>
<td>(1.51 to 1.85)</td>
</tr>
<tr>
<td>eGFR / 10 ml/min &lt; 60</td>
<td>1.25</td>
<td>(1.21 to 1.28)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>eGFR 40 = RR: 2.0 cf eGFR 75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td>1.16</td>
<td>(1.12 to 1.19)</td>
</tr>
<tr>
<td>CCF</td>
<td>1.21</td>
<td>(1.17 to 1.26)</td>
</tr>
<tr>
<td>Liver disease</td>
<td>1.71</td>
<td>(1.56 to 1.87)</td>
</tr>
<tr>
<td>Laparoscopic surgery</td>
<td>0.72</td>
<td>(0.68 to 0.77)</td>
</tr>
</tbody>
</table>
High eGFR
-Lower baseline Cr more likely to have 50% increase through lab errors or fluctuations in volume status
-low muscle mass = greater perioperative risk (frailty)
POM points

Risk assessment

Prevention

Detection / Intervention

Secondary Prevention
Restrictive *versus* Liberal Transfusion Strategy in the Perioperative and Acute Care Setting. A Context-specific Systematic Review and Meta-analysis of Randomized Controlled Trials

Anesthesiology 2016

Frédérique Hovaguimian, M.D., M.Clin.Res.Meth.,

MEDLINE, EMBASE, CENTRAL, and grey literature sources to November 2015 for RCTs comparing restrictive *versus* liberal transfusion strategies applied more than 24 h in adult surgical or critically ill patients
Outcomes and Groups

Composite events: myocardial infarction, arrhythmia, unstable angina, stroke, acute kidney injury, mesenteric ischemia, peripheral ischemia, and 30-day mortality

Patient Context Groups
1. patients with cardiovascular disease undergoing cardiac or vascular procedures (surgery or catheterization)
2. elderly patients undergoing orthopaedic surgery
3. mixed surgical/medical patient population admitted to an acute care facility (emergency or intensive care unit)
Composite risk
- 30-day mortality
- AMI
- Arrhythmia,
- Unstable angina
- Stroke
- AKI
- Mesenteric ischemia
- Peripheral ischemia
What We Already Know about This Topic

- Although many studies and some systematic reviews have examined the role of transfusion strategies in patient morbidity and mortality, these have not included the role for context-specific (patient characteristics and clinical setting) conditions.

What This Article Tells Us That Is New

- In a review of 31 trials grouped into 5 context-specific strata, restrictive transfusion strategies increased the risk of mortality and composite morbidity in patients undergoing cardiac/vascular procedures and in elderly orthopedic patients.
Thoughtfully individualise...

**Patient Blood Management**

**1st Pillar**
- Optimize hematopoiesis

**2nd Pillar**
- Minimize blood loss & bleeding

**3rd Pillar**
- Harness & optimize physiological tolerance of anemia

**Multidisciplinary team approach**
The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3)

Mervyn Singer, MD, FRCP; Clifford S. Deutschman, MD, MS; Christopher Warren Seymour, MD, MSc; Manu Shankar-Hari, MSc, MD, FFICM; Djillali Annane, MD, PhD; Michael Bauer, MD; Rinaldo Bellomo, MD; Gordon R. Bernard, MD; Jean-Daniel Chiche, MD, PhD; Craig M. Coopersmith, MD; Richard S. Hotchkiss, MD; Mitchell M. Levy, MD; John C. Marshall, MD; Greg S. Martin, MD, MSc; Steven M. Opal, MD; Gordon D. Rubenfeld, MD, MS; Tom van der Poll, MD, PhD; Jean-Louis Vincent, MD, PhD; Derek C. Angus, MD, MPH

Box 1. SIRS (Systemic Inflammatory Response Syndrome)

Two or more of:
- Temperature >38°C or <36°C
- Heart rate >90/min
- Respiratory rate >20/min or PaCO₂ <32 mm Hg (4.3 kPa)
- White blood cell count >12 000/mm³ or <4000/mm³
- or >10% immature bands

• New definition of sepsis
  “Life-threatening organ dysfunction caused by dysregulated host response to infection”

• Emphasises
  – primacy of non-homeostatic host response
  – potential lethality considerably in excess of straightforward infection
  – need for urgent recognition
Sepsis = Suspected Infection AND SOFA 2+

SOFA CHANGE of 2+ > 10% in hospital mortality, but lab dependent (0 to 24)

Table 1. Sequential [Sepsis-Related] Organ Failure Assessment Score

<table>
<thead>
<tr>
<th>System</th>
<th>Score</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Respiration</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PaO2/FiO2, mm Hg (kPa)</td>
<td></td>
<td>≥400  (53.3)</td>
<td>&lt;400 (53.3)</td>
<td>&lt;300 (40)</td>
<td>&lt;200 (26.7) with respiratory support</td>
<td>&lt;100 (13.3) with respiratory support</td>
</tr>
<tr>
<td>Coagulation</td>
<td></td>
<td></td>
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<tr>
<td>Platelets, ×10^3/µL</td>
<td></td>
<td>≥150</td>
<td>&lt;150</td>
<td>&lt;100</td>
<td>&lt;50</td>
<td>&lt;20</td>
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<tr>
<td>Liver</td>
<td></td>
<td></td>
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<tr>
<td>Bilirubin, mg/dL (µmol/L)</td>
<td></td>
<td>&lt;1.2 (20)</td>
<td>1.2-1.9 (20-32)</td>
<td>2.0-5.9 (33-101)</td>
<td>6.0-11.9 (102-204)</td>
<td>&gt;12.0 (204)</td>
</tr>
<tr>
<td>Cardiovascular</td>
<td></td>
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<tr>
<td>MAP ≥70 mm Hg</td>
<td></td>
<td>MAP &lt;70 mm Hg</td>
<td>Dopamine &lt;5 or dobutamine (any dose)^b</td>
<td>Dopamine 5.1-15 or epinephrine ≤0.1 or norepinephrine ≤0.1^b</td>
<td>Dopamine &gt;15 or epinephrine &gt;0.1 or norepinephrine &gt;0.1^b</td>
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<tr>
<td>Central nervous system</td>
<td></td>
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</tr>
<tr>
<td>Glasgow Coma Scale score</td>
<td></td>
<td>15</td>
<td>13-14</td>
<td>10-12</td>
<td>6-9</td>
<td>&lt;6</td>
</tr>
<tr>
<td>Renal</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Creatinine, mg/dL (µmol/L)</td>
<td></td>
<td>&lt;1.2 (110)</td>
<td>1.2-1.9 (110-170)</td>
<td>2.0-3.4 (171-299)</td>
<td>3.5-4.9 (300-440)</td>
<td>&gt;5.0 (440)</td>
</tr>
<tr>
<td>Urine output, mL/d</td>
<td></td>
<td>&lt;500</td>
<td>&lt;200</td>
<td></td>
<td></td>
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<tr>
<td>Current Guidelines and Terminology</td>
<td>Sepsis</td>
<td>Septic Shock</td>
<td></td>
<td></td>
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<td>----------------------------------</td>
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</tbody>
</table>
| 1991 and 2001 consensus terminology<sup>9,10</sup> | Severe sepsis  
Sepsis-induced hypoperfusion | Septic shock<sup>13</sup> |
| 2015 Definition | Sepsis is life-threatening organ dysfunction caused by a dysregulated host response to infection | Septic shock is a subset of sepsis in which underlying circulatory and cellular/metabolic abnormalities are profound enough to substantially increase mortality |
| 2015 Clinical criteria | Suspected or documented infection and an acute increase of ≥2 SOFA points (a proxy for organ dysfunction) | Sepsis<sup>a</sup> and vasopressor therapy needed to elevate MAP ≥65 mm Hg and lactate >2 mmol/L (18 mg/dL) despite adequate fluid resuscitation<sup>13</sup> |
Quick SOFA (qSOFA) suspected infection AND 2+
  – Altered mental state
  – SBP ≤ 100mmHg
  – Respiratory rate ≥ 22/min

• (outside ICU): AUROC 0.81 for in-hospital mortality
• **OUTSIDE ICU** qSOFA AUROC > SOFA and SIRS
  Promptly Identifies patients likely to have
  – prolonged ICU stay
  – die in the hospital (10%)
• Bedside, NOT lab
Quick SOFA (qSOFA)

2+ qSOFA in the wards identifies

- High risk ward patients: Critical Care / LOMT
- Also prompts considering possible infection in patients not previously recognized as infected

REASON (2010)

- Systemic inflammation: 7% incidence, Mortality 15%
  Adjusted OR 30-day mortality: 2.5

- ICU perspective: Infection +/- sepsis
- POM: Inflammation +/- infection
AKI is a major problem – 10% major surgery
Important long term problems

Consider Liberal Transfusion thresholds:
- Patients with CVS disease
- Elderly Orthopaedic

Quick SOFA important (teachable) tool
Outcome and Costs

The diagram illustrates the relationship between cost and effectiveness in decision-making. It is divided into four quadrants:

- **Top Right Quadrant**: Higher costs, improved outcome. This is the most preferable scenario.
- **Bottom Left Quadrant**: Lower costs, worse outcome. This is the least preferable scenario.
- **Top Left Quadrant**: Higher costs, worse outcome. This is dominated and not considered.
- **Bottom Right Quadrant**: Lower costs, improved outcome. This is dominant.

The diagram helps in understanding the trade-offs between cost and effectiveness, aiding in making informed decisions.
Reality is more subtle

Policy Implication of CEA Results

DOMINATED
⇒ No!

TRADE-OFFS

ΔCost

Threshold WTP

Cost - Saving
⇒ Yes!

ΔEffect
We play a TEAM SPORT...

Ongoing Collaboration in Clinical Care, Research, Teaching, and Engagement...
Some NZ athletes…
Allied Health Professionals

Nurses

Physiotherapists

Pharmacists
New (STEEEP) Partners

Biostatistics

Health Economics

Health Informatics
Patients…
Thank you!