“Critical Care Management of Cardiovascular Patients”

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Director, CVSICU and Heart Transplant
Johns Hopkins Hospital

Michigan Society of Thoracic and Cardiovascular Surgery
August 13, 2016
Disclosures

• Abbott Nutrition
QUALITY AND REPORTING
Where should you go for heart surgery?

Our new Ratings of more than 400 hospitals can help you find the right one

Consumer Reports August 2014
Consumer Reports
Adult Cardiac Surgery Database Public Reporting

Since its inception in 2010, the STS adult cardiac surgery public reporting initiative continues to grow, both in the number of voluntarily enrolled participants and the composite measures offered. STS now publicly reports outcomes for isolated coronary artery bypass grafting (CABG), isolated aortic valve replacement (AVR), and AVR+CABG surgeries. The Society plans to report outcomes for mitral valve replacement/repair and mitral valve replacement/repair + CABG composites in the future.

Isolated CABG:
Search or browse star ratings for surgery groups
Search or browse star ratings for hospitals

Isolated AVR:
Search or browse star ratings for surgery groups
Search or browse star ratings for hospitals

AVR+CABG:
Search or browse star ratings for surgery groups
Search or browse star ratings for hospitals
STS Star Ratings for Coronary Bypass Surgery

NQF Report Metrics:

1. Operative Mortality (Risk-Adjusted)
2. Major Morbidity (5 Risk-Adjusted variables)
   - RF, Reop, Stroke, Mediastinitis, Intub > 24 hrs
3. Use of Internal Mammary Artery
4. Medications
   - Pre-op. Beta Blockers
   - Discharge Beta Blockers
   - Discharge Anti-Lipids
   - Discharge Anti-Platelets
It is all about “morbidity and mortality”
### Search CABG Data by Group

<table>
<thead>
<tr>
<th>Group name</th>
<th>Year:</th>
<th>State:</th>
<th>Overall Composite Score</th>
<th>Absence of Operative Mortality</th>
<th>Absence of Major Morbidity</th>
<th>Use of Internal Mammary Artery</th>
<th>Receipt of Required Perioperative Medications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiac Vascular &amp; Thoracic Surgery, Associates, P.C.</td>
<td></td>
<td>MD</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Takoma Park, MD</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Johns Hopkins Cardiac Surgery</td>
<td></td>
<td>MD</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Baltimore, MD</td>
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<td></td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Medstar Union Memorial Open Heart</td>
<td></td>
<td>MD</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baltimore, MD</td>
<td></td>
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<tr>
<td>NIH Heart Center at Suburban Hospital</td>
<td></td>
<td>MD</td>
<td></td>
<td></td>
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</tr>
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<td>Bethesda, MD</td>
<td></td>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>
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<table>
<thead>
<tr>
<th>Name</th>
<th>Overall Composite Score</th>
<th>Absence of Operative Mortality</th>
<th>Absence of Major Morbidity</th>
<th>Use of Internal Mammary Artery</th>
<th>Receipt of Required Perioperative Medications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Genesys Heart Institute, Grand Blanc, MI</td>
<td>4 stars</td>
<td>4 stars</td>
<td>4 stars</td>
<td>4 stars</td>
<td>4 stars</td>
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<tr>
<td>Genesys Heart Institute, Physician Group, Rochester, MI</td>
<td>4 stars</td>
<td>4 stars</td>
<td>4 stars</td>
<td>4 stars</td>
<td>4 stars</td>
</tr>
<tr>
<td>Henry Ford Hospital Cardiac Surgery, Detroit, MI</td>
<td>4 stars</td>
<td>4 stars</td>
<td>4 stars</td>
<td>4 stars</td>
<td>4 stars</td>
</tr>
<tr>
<td>HFMG - Henry Ford Macomb, Clinton Township, MI</td>
<td>4 stars</td>
<td>4 stars</td>
<td>4 stars</td>
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<td>4 stars</td>
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<tr>
<td>IHA Cardiovascular and Thoracic Surgery, Ann Arbor, MI</td>
<td>4 stars</td>
<td>4 stars</td>
<td>4 stars</td>
<td>4 stars</td>
<td>4 stars</td>
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<tr>
<td>Lakeshore Cardiothoracic and Vascular Surgery, Saint Joseph, MI</td>
<td>4 stars</td>
<td>4 stars</td>
<td>4 stars</td>
<td>4 stars</td>
<td>4 stars</td>
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<tr>
<td>McLaren Cardiothoracic Vascular Surgeons, Lansing, MI</td>
<td>4 stars</td>
<td>4 stars</td>
<td>4 stars</td>
<td>4 stars</td>
<td>4 stars</td>
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<tr>
<td>McLaren-Flint, Flint, MI</td>
<td>4 stars</td>
<td>4 stars</td>
<td>4 stars</td>
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<td>4 stars</td>
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<tr>
<td>MCVI, Saginaw, MI</td>
<td>4 stars</td>
<td>4 stars</td>
<td>4 stars</td>
<td>4 stars</td>
<td>4 stars</td>
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<tr>
<td>Michigan Cardiovascular Institute, Saginaw, MI</td>
<td>4 stars</td>
<td>4 stars</td>
<td>4 stars</td>
<td>4 stars</td>
<td>4 stars</td>
</tr>
</tbody>
</table>

**Numeric Value: 99.6**
Percentage of first-time CABG patients who received at least one IMA graft.

**Numeric Value: 98.9**
Percentage of first-time CABG patients who received at least one IMA graft.
Deaths by POCA Category and Problem

Shannon FL, Fazzalari FL, Theurer PF, Bell GF, Sutcliffe KM, Prager RL
Michigan Society of Thoracic and Cardiovascular Surgeons
Full Time Intensivists: How It All Began

On-site Physician Staffing in a Community Hospital Intensive Care Unit
Impact on Test and Procedure Use and on Patient Outcome
Theodore C. M. Li, MD; Malcolm C. Phillips, MD; Linda Shaw, MPH; E. Francis Cook, ScD; Charles Natanson, MD; Lee Goldman, MD, MPH

- St Barnabas Hospital, Bronx, NY
- 1979-1981 10 bed ICU n = 1070

<table>
<thead>
<tr>
<th>ICU Care</th>
<th>Daytime</th>
<th>Nighttime</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yr. 1</td>
<td>Office based MD</td>
<td>Agency MD: board eligible</td>
</tr>
<tr>
<td>Yr. 2</td>
<td>Full time MD (IM/Cards)</td>
<td>Subspecialty Fellow</td>
</tr>
</tbody>
</table>
Benefit of On-Site Physician: Mortality Decreased (OR 0.62, p=0.01)

Li et al, JAMA 1984;252:2023
26 Observational Trials: staffing patterns and outcomes

Staffing:
- Low Intensity: no intensivist/elective consultation
- High Intensity: closed ICU/mandatory consult
Staffing Patterns Matter in the ICU: Pronovost et al JAMA 2002

**A** Hospital Mortality

<table>
<thead>
<tr>
<th>Source</th>
<th>Weight</th>
<th>Risk Ratio (95% CI)</th>
<th>Favors High Intensity</th>
<th>Favors Low Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pronovost et al</td>
<td>8.4</td>
<td>0.58 (0.43-0.79)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brown and Sullivan</td>
<td>8.6</td>
<td>0.69 (0.52-0.93)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baldock et al</td>
<td>9.7</td>
<td>0.65 (0.51-0.83)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multz et al (Retrospective)</td>
<td>9.0</td>
<td>0.81 (0.62-1.07)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multz et al (Prospective)</td>
<td>7.5</td>
<td>0.74 (0.53-1.05)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reynolds et al</td>
<td>10.7</td>
<td>0.77 (0.63-0.94)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carson et al</td>
<td>6.2</td>
<td>1.39 (0.91-2.11)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Li et al</td>
<td>11.0</td>
<td>0.93 (0.78-1.13)</td>
<td></td>
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<tr>
<td>Marthous et al</td>
<td>10.6</td>
<td>0.72 (0.59-0.89)</td>
<td></td>
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<tr>
<td>Dimick et al</td>
<td>2.5</td>
<td>0.26 (0.12-0.59)</td>
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<tr>
<td>Dimick et al</td>
<td>1.6</td>
<td>0.19 (0.07-0.55)</td>
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<tr>
<td>Rosenfeld et al</td>
<td>2.9</td>
<td>0.39 (0.19-0.81)</td>
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<tr>
<td>Blunt and Burchett</td>
<td>10.0</td>
<td>0.69 (0.54-0.87)</td>
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<tr>
<td>Hanson et al</td>
<td>1.2</td>
<td>0.67 (0.19-2.29)</td>
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<tr>
<td>Overall (95% CI)</td>
<td>0.71</td>
<td>0.62-0.82</td>
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</tbody>
</table>

**B** ICU Mortality

<table>
<thead>
<tr>
<th>Source</th>
<th>Weight</th>
<th>Risk Ratio (95% CI)</th>
<th>Favors High Intensity</th>
<th>Favors Low Intensity</th>
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</thead>
<tbody>
<tr>
<td>Brown and Sullivan</td>
<td>8.4</td>
<td>0.48 (0.32-0.72)</td>
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<tr>
<td>Baldock et al</td>
<td>10.0</td>
<td>0.69 (0.52-0.91)</td>
<td></td>
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<tr>
<td>Kuo et al</td>
<td>11.3</td>
<td>0.60 (0.49-0.73)</td>
<td></td>
<td></td>
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<tr>
<td>Al-Asadl et al</td>
<td>9.9</td>
<td>0.82 (0.61-1.10)</td>
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<tr>
<td>Ghorra et al</td>
<td>4.4</td>
<td>0.42 (0.20-0.90)</td>
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<tr>
<td>Marthous et al</td>
<td>10.1</td>
<td>0.71 (0.54-0.94)</td>
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<tr>
<td>Marini et al</td>
<td>4.7</td>
<td>0.54 (0.28-1.10)</td>
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<tr>
<td>Pollack et al</td>
<td>2.5</td>
<td>0.53 (0.17-1.64)</td>
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<tr>
<td>Reich et al</td>
<td>8.2</td>
<td>0.61 (0.41-0.92)</td>
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<tr>
<td>DiCosmo et al</td>
<td>10.0</td>
<td>0.59 (0.44-0.79)</td>
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</tr>
<tr>
<td>Rosenthal et al</td>
<td>2.3</td>
<td>0.15 (0.05-0.50)</td>
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<tr>
<td>Goh et al</td>
<td>9.3</td>
<td>0.38 (0.27-0.53)</td>
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<td></td>
</tr>
<tr>
<td>Topell</td>
<td>8.9</td>
<td>1.44 (1.00-2.07)</td>
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</tr>
<tr>
<td>Overall (95% CI)</td>
<td>0.61</td>
<td>0.50-0.75</td>
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</tbody>
</table>
FULL TIME INTENSIVIST ICU STAFFING

- Improves Mortality
- Decreases Length of Stay
- Improves Cost Efficiency

Fuchs et al
Clinical Anesthesiology 2005;19:125-135
Effect of Multi-D Rounds and ICU Mortality

Kim M et al, Arch Int Med 2010;170:369-376

Pa Hospitals n = 112 , Patients = 108,000 2004-2006

Low intensity: Intensivist optional/none
Hi intensity: Intensivist mandatory

Multi-D:
• Pharmacy,
• Resp Therapy
• Social Work
Table 2. Adverse Drug Event Rates*

<table>
<thead>
<tr>
<th></th>
<th>MICU Study Unit</th>
<th>CCU Control Unit</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Phase 1</td>
<td>Phase 2</td>
</tr>
<tr>
<td>Average daily census</td>
<td>13.9</td>
<td>12.4</td>
</tr>
<tr>
<td>Total patient-days No.</td>
<td>787</td>
<td>861</td>
</tr>
<tr>
<td>No. of patients</td>
<td>75</td>
<td>75</td>
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<tr>
<td>All adverse drug events, No.</td>
<td>35</td>
<td>10</td>
</tr>
<tr>
<td>Rate per 1000 patient-days†</td>
<td>33.0 (27-39)</td>
<td>11.6 (8-15)†</td>
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<tr>
<td>Preventable ordering adverse drug events, No.</td>
<td>11</td>
<td>3</td>
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<tr>
<td>Rate per 1000 patient-days†</td>
<td>10.4 (7-14)</td>
<td>3.5 (1-5)†</td>
</tr>
</tbody>
</table>

†Data expressed as percentage (95% confidence interval).
‡P<.001 for comparison with both phase 1 in the study unit and phase 2 in the control unit.

366 recommendations with a 95% acceptance rate.
### Cardiac Surgery Clinical Practice Guidelines: POD 0

#### Phase 1: Upon Admission to the CVSICU

- Rapid Extubation Protocol Ordered, If appropriate
- Review EKG and CXR immediately
- External & internal pacemakers addressed
- Change to single chamber pacer, if appropriate. *(AICD to be re-programmed on POD 1, If stable)*
- Apply anchor device to Central Line
- Foley cath secured? *If not please secure using the Grip-lok device*
- If Swan in place, check height, weight and computation □ Send SvO2
- OGT to LIS and check placement
- Validate current Type and Cross
- Insulin drip □ Notify provider for IV insulin bolus if any BG >160mg/dl
- Chest Tubes to 20 cm suction
- MAP goal discussed *(Reflected in orders)*
- Date/Team Information Completed *(Top left)*
- Clip PINK "Vent Alert Sign", □ BG Clock, and □ POD 0 Checklist to door

#### Phase 2a: Assessment / Management: Nursing *(within 2 Hours post-admission)*

- Correlate manual BP to A-line
- VAP bundle *(HOB 30°, Mouth Care q4hr., CHG q12hr.)*
- Stockings and SCD's in place
- Notify Attending if Chest tube output > 150cc/hr. x 2hr. □ Send Heme 8 / coags
- Family contacted □ Phone #’s in chart
- ASA 325mg via NG tube NOW if no signs of bleeding
- Carrier DSW *(Goal rate 20 cc per hr.)*

#### Phase 2b: Assessment / Management: Provider *(within 24 Hours post-admission)*

- Vent changes, review initial ABG, aim for alkalemia until weaning
- Appropriate POD 1 labs ordered
- Verify MRSA/MSSA PCR status □ Verify Isolation status
- Continue mupirocin dosing *(If applicable)*

#### Nursing: Daily Goals/Plan of Care

<table>
<thead>
<tr>
<th>Neuro / Pain</th>
<th>Infectious Disease</th>
<th>GI/Nutrition/Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain Control:</td>
<td>Antibiotics:</td>
<td>Antibiotic stop dates:</td>
</tr>
<tr>
<td>Fentanyl: <em>(Intermittent/Continuous)</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Propofol:</td>
<td></td>
<td>GI/Nutrition:</td>
</tr>
<tr>
<td>Other:</td>
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</table>

<table>
<thead>
<tr>
<th>CV</th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>MAP Goal:</td>
<td>GI/Nutrition/Volume:</td>
<td>GI/Nutrition:</td>
</tr>
<tr>
<td>CVP/PAD Goal:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Presor/Vaan Plan:</td>
<td>Diuresis Goal:</td>
<td></td>
</tr>
<tr>
<td>*(Afib) Amio Treatment Plan:</td>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Resp</th>
<th>Study Patient: Yes* No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early Extubation: □ Y □ N</td>
<td>*If yes, what study:</td>
</tr>
</tbody>
</table>

*Updated by Miranda 05.10.2018*
Daily Goals: Impact on ICU Care

Provider Understanding of Daily Goals

- Residents
- Nurses

Average ICU Length of Stay (days)

- Implement goals sheet

654 New Admissions: 7 Million Additional Revenue

Pronovost JCC 2003;18:71-75
## Cardiac Surgery Clinical Practice Guidelines: POD 0

### Phase 1: Upon Admission to the CVSICU

- **Check when addressed**
  - Rapid Exubation Protocol Ordered, *if appropriate*
  - Review EKG and CXR immediately
  - External & internal pacemakers addressed
  - Change to single chamber pacer, *if appropriate.* *(AICD to be re-programmed on POD 1, if stable)*
  - Apply anchor device to Central Line
  - Foley cath secured? *If not please secure using the Grip-loc device*
  - If Swan in place, check height, weight and computation *Send SvO2*
  - OGT to LIS and check placement
  - Validate current Type and Cross
  - Insulin drip *Notify provider for IV insulin bolus if any BG >160mg/dl*
  - Chest Tubes to 20 cm suction
  - MAP goal discussed *(Reflected in orders)*
  - Date/Team Information Completed *(Top left)*
  - Clip PINK "Vent Alert Sign", *BG Clock, and POD 0 Checklist to door*

### Phase 2a: Assessment / Management: Nursing *(within 2 Hours post-admission)*

- **Check when addressed**
  - Correlate manual BP to A-line
  - VAP bundle *(HOB 30°, Mouth Care q4hr., CHG q12hr.)*
  - Stockings and SCD’s in place
  - Notify Attending If Chest tube output > 150cc/hr. x 2hr. *Send Heme 8 / coags*
  - Family contacted *Phone #’s in chart*
  - ASA 325mg via NG tube NOW if no signs of bleeding
  - Carrier DSW *(Goal rate 20 cc per hr.)*

### Phase 2b: Assessment / Management: Provider *(within 21 Hours post-admission)*

- **Check when addressed**
  - Vent changes, review initial ABG, aim for alkalemia until weaning
  - Appropriate POD 1 labs ordered
  - Verify MRSA/MSSA PCR status *Verify Isolation status*
  - Continue mupirocin dosing, *If applicable*

### Nursing: Daily Goals/Plan of Care

<table>
<thead>
<tr>
<th>Neuro / Pain</th>
<th>Infectious Disease</th>
<th>GI / Nutrition / Volume</th>
<th>Heme</th>
<th>Resp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain Control: Fentanyl <em>(Intermittent/Continuous)</em></td>
<td>Antibiotics:</td>
<td>Anticoag:</td>
<td>Study Patient: Yes* No</td>
<td>Early Exubation: Y N</td>
</tr>
<tr>
<td>Protop: Other:</td>
<td>Antibiotic stop dates:</td>
<td></td>
<td>Study:</td>
<td>*If yes, what study: ____________________</td>
</tr>
<tr>
<td>CV</td>
<td>Glucose Goal:</td>
<td>Diuretics Goal:</td>
<td></td>
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### Table 1. Elements of the Surgical Safety Checklist. *

<table>
<thead>
<tr>
<th>Sign in</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before induction of anesthesia, members of the team (at least the nurse and an anesthesia professional) orally confirm that:</td>
</tr>
<tr>
<td>* The patient has verified his or her identity, the surgical site and procedure, and consent</td>
</tr>
<tr>
<td>* The surgical site is marked or site marking is not applicable</td>
</tr>
<tr>
<td>* The pulse oximeter is on the patient and functioning</td>
</tr>
<tr>
<td>* All members of the team are aware of whether the patient has a known allergy</td>
</tr>
<tr>
<td>* If there is a risk of blood loss of at least 500 ml (or 7 ml/kg of body weight, in children), appropriate access and fluids are available</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time out</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before skin incision, the entire team (nurses, surgeons, anesthesia professionals, and any others participating in the care of the patient) orally:</td>
</tr>
<tr>
<td>* Confirms that all team members have been introduced by name and role</td>
</tr>
<tr>
<td>* Confirms the patient’s identity, surgical site, and procedure</td>
</tr>
<tr>
<td>* Reviews the anticipated critical events</td>
</tr>
<tr>
<td>Surgeon reviews critical and unexpected steps, operative duration, and anticipated blood loss</td>
</tr>
<tr>
<td>Anesthesia staff review concerns specific to the patient</td>
</tr>
<tr>
<td>Nursing staff review confirmation of sterility, equipment availability, and other concerns</td>
</tr>
<tr>
<td>* Confirms that prophylactic antibiotics have been administered ≤60 min before incision is made or that antibiotics are not indicated</td>
</tr>
<tr>
<td>* Confirms that all essential imaging results for the correct patient are displayed in the operating room</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sign out</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before the patient leaves the operating room:</td>
</tr>
<tr>
<td>* Nurse reviews items aloud with the team</td>
</tr>
<tr>
<td>* Name of the procedure as recorded</td>
</tr>
<tr>
<td>* That the needle, sponge, and instrument counts are complete (or not applicable)</td>
</tr>
<tr>
<td>* That the specimen (if any) is correctly labeled, including with the patient’s name</td>
</tr>
<tr>
<td>* Whether there are any issues with equipment to be addressed</td>
</tr>
<tr>
<td>* The surgeon, nurse, and anesthesia professional review aloud the key concerns for the recovery and care of the patient</td>
</tr>
</tbody>
</table>

* The checklist is based on the first edition of the WHO Guidelines for Safe Surgery. For the complete checklist, see the Supplementary Appendix.
Selected Process Measures before and after Checklist Implementation, According to Site

<table>
<thead>
<tr>
<th>Site No.</th>
<th>No. of Patients Enrolled</th>
<th>Objective Airway Evaluation Performed (N = 7688)</th>
<th>Pulse Oximeter Used (N = 7688)</th>
<th>Two Peripheral or One Central IV Catheter Present at Incision When EBL ≥500 ml (N = 953)</th>
<th>Prophylactic Antibiotics Given Appropriately (N = 6802)</th>
<th>Oral Confirmation of Patient’s Identity and Operative Site (N = 7688)</th>
<th>Sponge Count Completed (N = 7572)</th>
<th>All Six Safety Indicators Performed (N = 7688)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before</td>
<td>After</td>
<td>Before</td>
<td>After</td>
<td>Before</td>
<td>After</td>
<td>Before</td>
<td>After</td>
<td>Before</td>
</tr>
<tr>
<td>1</td>
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<td>100.0</td>
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<td>61.3</td>
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<tr>
<td>3</td>
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<td>486</td>
<td>74.7</td>
<td>66.3</td>
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<td>100.0</td>
<td>83.8</td>
<td>82.5</td>
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<td>95.8</td>
<td>100.0</td>
<td>100.0</td>
<td>66.7</td>
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<tr>
<td>5</td>
<td>370</td>
<td>330</td>
<td>6.2</td>
<td>0.0</td>
<td>68.9</td>
<td>91.2</td>
<td>7.6</td>
<td>2.7</td>
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<tr>
<td>6</td>
<td>496</td>
<td>476</td>
<td>46.2</td>
<td>56.3</td>
<td>76.4</td>
<td>83.0</td>
<td>49.2</td>
<td>57.9</td>
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<tr>
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<td>585</td>
<td>97.5</td>
<td>99.7</td>
<td>99.4</td>
<td>100.0</td>
<td>32.0</td>
<td>100.0</td>
</tr>
<tr>
<td>8</td>
<td>444</td>
<td>524</td>
<td>6.3</td>
<td>94.0</td>
<td>99.3</td>
<td>99.5</td>
<td>68.8</td>
<td>57.1</td>
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<tr>
<td>Total</td>
<td>3733</td>
<td>3955</td>
<td>64.0</td>
<td>77.2</td>
<td>93.6</td>
<td>96.8</td>
<td>58.1</td>
<td>63.2</td>
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</tbody>
</table>

P value: <0.001

Prophylactic antibiotics were considered to be indicated for all cases in which an incision was made through an uncontaminated field and appropriately administered when given within 60 minutes before an incision was made. Sponge counts were considered to be indicated in all cases in which an incision was made. P values are shown for the comparison of the total values before and after checklist implementation, calculated by means of the chi-square test. EBL denotes estimated blood loss, and IV intravenous.
Outcomes before and after Checklist Implementation, According to Site

<table>
<thead>
<tr>
<th>Site No.</th>
<th>No. of Patients Enrolled</th>
<th>Surgical-Site Infection</th>
<th>Unplanned Return to the Operating Room</th>
<th>Pneumonia</th>
<th>Death</th>
<th>Any Complication</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before</td>
<td>After</td>
<td>Before</td>
<td>After</td>
<td>Before</td>
<td>After</td>
</tr>
<tr>
<td>1</td>
<td>524</td>
<td>598</td>
<td>4.0</td>
<td>2.0</td>
<td>4.6</td>
<td>1.8</td>
</tr>
<tr>
<td>2</td>
<td>357</td>
<td>351</td>
<td>2.0</td>
<td>1.7</td>
<td>0.6</td>
<td>1.1</td>
</tr>
<tr>
<td>3</td>
<td>497</td>
<td>486</td>
<td>5.8</td>
<td>4.3</td>
<td>4.6</td>
<td>2.7</td>
</tr>
<tr>
<td>4</td>
<td>520</td>
<td>545</td>
<td>3.1</td>
<td>2.6</td>
<td>2.5</td>
<td>2.2</td>
</tr>
<tr>
<td>5</td>
<td>370</td>
<td>330</td>
<td>20.5</td>
<td>3.6</td>
<td>1.4</td>
<td>1.8</td>
</tr>
<tr>
<td>6</td>
<td>496</td>
<td>476</td>
<td>4.0</td>
<td>4.0</td>
<td>3.0</td>
<td>3.2</td>
</tr>
<tr>
<td>7</td>
<td>525</td>
<td>585</td>
<td>9.5</td>
<td>5.8</td>
<td>1.3</td>
<td>0.2</td>
</tr>
<tr>
<td>8</td>
<td>444</td>
<td>584</td>
<td>4.1</td>
<td>2.4</td>
<td>0.5</td>
<td>1.2</td>
</tr>
<tr>
<td>Total</td>
<td>3733</td>
<td>3955</td>
<td>6.2</td>
<td>3.4</td>
<td>2.4</td>
<td>1.8</td>
</tr>
</tbody>
</table>

* The most common complications occurring during the first 30 days of hospitalization after the operation are listed. Bold type indicates values that were significantly different (at P<0.05) before and after checklist implementation, on the basis of P values calculated by means of the chi-square test or Fisher’s exact test. P values are shown for the comparison of the total value after checklist implementation as compared with the total value before implementation.

Cardiac Surgery Intraoperative Timeout Checklist

- Patient Name
- Operation
- Allergies?
- Introduction of Team
- Patient position (supine, L/R thoracotomy) and marking and incision?
- Planned cannulation (site and cannulae needed)?
- Valve or graft prosthesis and sizers?
- Sutures?
- Other special equipment (RF device, cryoprobe, etc)?
- Blood availability
- If redo or high risk sternal re-entry, redo pads and plan for emergent CPB?
- Room temperature setting?
- Wall monitors programmed appropriately?
- Antibiotics given (Vancomycin if MRSA+)?
- Beta blockers given (CABG only)? IF NOT, DOCUMENT WHY
- Pulmonary artery catheter?
- Temporary dual chamber pacemaker in room?
- ICD deactivated (if applicable)?
- Sterile magnet if patient has pacemaker?
- Lowest NP temperature on bypass?
- Transfusion trigger on CPB (notify surgeon of all transfusions)?
- Whole blood removed before CPB?
- Suction working?
- Plan to notify family?
- Disposition after OR?
- Is all hair/jewelry covered and eye protection on?

---

Nurse  Anesthesiologist  Surgeon  (date)
Cardiac Surgery Intraoperative Timeout Checklist

**Checklist Prior to Leaving OR for CVS|ICU**

- Patient Hemodynamically Stable
- Chest Tube Output Acceptable
- CVS|ICU Notified and Ready to Accept Patient
- Last Potassium > 3.2
- Last pH > 7.35
- Pacer Connected and in DDD Mode
- Oxygen in Tank
- Breathing Mask Accompanying Patient
- Adequate Fluid for Resuscitation
- Emergency/Resuscitation Meds
- Specimen and documents checked with surgeon
- Debrief
- Resident Review
- STS Surgeon worksheet
- STS risk form in packet
- Op note dictated?
- Claves placed on all infusion ports?

**If leaving OR with open chest:**

- Use Kerlix gauze only
- Is this documented in CLINDOC?
- IRFO green sticker on dressing?
- Documented on IRFO logbook?

__________________________________________  ____________________________________________  ____________________________________________
Nurse  Anesthesiologist  Surgeon  (date)
Resident OR to ICU Handoff

- **Pre-op Diagnosis:** Include EF, STS risk score
- **Post-op Diagnosis:**
- **Procedure:** (Include: elective, urg, emerg, salvage)
- **Surgeon:**
- **X Clamp time:**
- **Bypass time:**
- **Off Pump:** Filling pressures, Inotropes, Cardiac Output
- **Chest Tubes:** MT’s L Pleural R Pleural
- **Cardioversion:**
- **Wires:** Atrial Ventricular
- **Blood Products:**
  - PRBCs FFP Plts Cryo
- **TEE Echo**
- **Points of note** (e.g. questionable grafts, goal BP/pH, bleeding, pacing, call resident/surgeon parameters, etc.)
### OR to ICU Handoff - Checklist

- **Out of OR Time:**

- **Patient arm band intact?** ☐ Y  ☐ N

- **Pacemaker connected?**  ☐ Y  ☐ N

- **Is dual chamber pacer needed?**  ☐ Y  ☐ N  *If not, change to Single Chamber Pacer*

- **Are Medication Infusions Standard Concentrations?**  ☐ Y  ☐ N

- **Anecef and Amicar Drips stopped?**  ☐ Y  ☐ N

- **Central line dressings occlusive?**  ☐ Y  ☐ N

- **Are lines in order?**  ☐ Y  ☐ N

- **IV pump for GTTS - Verify patient weight and “infusion mode”**  ☐ Y  ☐ N

- **Was IV insulin protocol (OR goal: 130-160) utilized in the OR?**  ☐ Y  ☐ N  *Last Intraop BS:*

- **Admitting temperature:**  ☐ Y  ☐ N  *if <35°, is fluid warmer used?*

- **Was Beta Blocker Given? (For Isolated CABG Only)**  ☐ Y  ☐ N

- **If patient on iNO, discussed plan to switch to inhaled epoprostenol within 4 hours**  ☐ Y  ☐ N

- **Pink Donut in place?**  ☐ Y  ☐ N

- **Is patient in a study?**  ☐ Y*  ☐ N  *If yes, what study?*

- **Does patient need coagulation labs?**  ☐ Y  ☐ N

- **Clavicles placed on all infusion ports?**  ☐ Y  ☐ N

- **Anesthesia Infusions Zeroed & Discontinued in EPIC?**  ☐ Y  ☐ N

**If Vascular Surgery Patient:**

- **Obtain Vascular MD on Call:**

- **Obtained neuro checks at time of handoff**  ☐ Y  ☐ N

- **Check LP drain set-up (if applicable)**  ☐ Y  ☐ N
**Cardiac Surgery Clinical Practice Guidelines: POD>0**

### Assessments:

**Daily Weights**

- VAP bundle (HOB 30°, Mouth Care q4hr, CIRS q12hr, Wound Screen)
- Sedation vacation at least q24 hours
- If intubated, pink donut-shaped ring to back of head
- If patient on INO, discussed plan to switch to inhaled epoprostenol
- Pacemaker settings addressed (Threshold & Sensitivity)
- Change to single chamber pacers, if appropriate (AICD to be re-programmed)
- Central lines/Arterial lines: Necessary?
- Dressings Loose?
- Scrub the Cave
- Alcohol swabs at head of bed
- Date dressing
- If Central Line > 14 days old, team should consider new site
- Verify MRSA/MSSA: pro-op PCR / Need for mupirocin
- Foley secured in place?
- Document need for Foley cath. If no need, D&C Foley cath by MN POD #2
- Sequential compression devices, sub q heparin
- PT/PTT needs assessed: Consult issued, if applicable
- Nutrition: If on TPN, make % deficit from prior day
- Chart TPN Goals deficit over past 24 hrs-% and ccs: Chart Prostate dose on flow
- If on Vel牝l, is neutrophil upright inflow

### Diagnostics:

- Appropriate testing ordered
- If POD > 2, CIK Needed?
- If valve repair, myectomy, or VSARR, order echo on transfer to Z10

### Medications Addressed:

- Med Reconciliation with Pre-op Meds
- PO
  - Aflib Prophylaxis
- Statin
  - Diuretic
- ASA
  - stool softeners
- DVT Prophylaxis
  - AEX
- Beta Blocker
  - Sleeping aid?

### Miscellaneous:

- PT Fall Risk (Low/Moderate/High) used: Fall risk alert card matches
- Family contacted: Contact info verified
- Document pressure ulcers prophylaxis, need for specialty bed
- SSI, CLABSI: Fall prev. doc. plan, pt/Family ed. provided and documented
- Restraint order in POE, if applicable
- Social work/Pastoral needs addressed: Consult issued, if applicable
- Supportive care needs addressed: Consult issued, if applicable

### Nursing Daily Goals - Plan of Care

#### Skin:
- Wound care consult?
- Active Issues:
  - Sedation Vacation?
  - Pain Control:
    - Activity Plan:
    - PT/PTT Needs:
      - Ventilator/BiPAP changes:
  - Pulm:
    - Pulm Toilet Plan:
      - CT Removal
    - CV:
      - MAP/MBP Goal:
        - Pressure:
          - (Aphi) Amlo? Tx Plan:
  - G/U:
    - Nutrition & Glucose Control:
      - T:
        - TS:
          - Goal Rate:
  - Diuretics/LAX:
  - ENDO:
    - BC Target window:
      - From:
        - To:
          - *Call Provider if BG > 180

#### ID:
- Anx Level/Test Culture/Culture:
- Antibiotic Step Dates:
- DVT Lines?
  - DVT Prophylaxis: HEP QD or AFX mg/TEO = BB doses
  - Anticoagulation & protocol

### Procedures:

- Procedures Today:
  - Sedation / Analgesia Plan:
  - Study:
    - Study Patient:
      - Yes
    - If yes, what study:
  - Patient ready for transfer?
    - No
    - *Issues delaying transfer:
POD 0 Checklist Compliance

- % POD0 Complete
- % Signed
- Goal
Cardiac Surgery Clinical Practice Guidelines: POD 0

**Phase 1: Upon Admission to the CVICU**

- Check when addressed:
  - Rapid Extubation Protocol Ordered, if appropriate
  - Review EKG and CXR Immediately
  - External & internal pacemakers addressed
  - Change to single chamber pacer, if appropriate. (AICD to be re-programmed on POD 1, if stable)
  - Apply anchor device to Central Line
  - Foley cath secured? *If not, please secure using the Grip-loc device
  - If Swan in place, check height, weight and computation □ Send SvO2
  - OGT to LIS and check placement
  - Validate current Type and Cross
  - Insulin drip □ Notify provider for IV insulin bolus if any BG >160mg/dl
  - Chest Tubes to 20 cm suction
  - MAP goal discussed (Reflected in orders)
  - Date/Team Information Completed (Top left)
  - Clip PINK "Vent Alert Sign", □ BG Clock, and □ POD 0 Checklist to door
  - If on Veleti, is nebulizer upright / inflow arm
  - Is patient a candidate for late transfer today? □ Y □ N

**Phase 2a: Assessment / Management: Nursing** (within 2 Hours post-admission)

- Check when addressed:
  - Correlate manual BP to A-line □ Family contacted □ Phone #’s in chart
  - VAP bundle (HOB 30°, Mouth Care q4hr., CHG q12hr.) □ ASA 325mg via NG tube NOW if no signs of bleeding
  - Stockings and SCD’s in place □ Carrier D5W (Goal rate 20 cc per hr.)
  - Notify Attending if Chest tube output > 150cc/hr. x 2hr. □ Send Heme 8 / coags

**Phase 2b: Assessment / Management: Provider** (within 2 Hours post-admission)

- Check when addressed:
  - Vent changes, review initial ABG, aim for alkalemia until weaning
  - Appropriate POD 1 labs ordered
  - Verify MRSA/MSSA PCR status □ Verify isolation status
  - Continue mupirocin dosing, if applicable

Provider Signature: ___________________________ Nurse Signature: ___________________________
# Cardiac Surgery Clinical Practice Guidelines: POD 0

## Phase 1: Upon Admission to the CVSICU

<table>
<thead>
<tr>
<th>Comment</th>
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<tr>
<td>- Rapid Extubation Protocol Ordered, <em>if appropriate</em></td>
</tr>
<tr>
<td>- Review EKG and CXR Immediately</td>
</tr>
<tr>
<td>- External &amp; internal pacemakers addressed</td>
</tr>
<tr>
<td>- Change to single chamber pacer, <em>if appropriate</em>. <em>(AICD to be re-programmed on POD 1, if stable)</em></td>
</tr>
<tr>
<td>- Apply anchor device to Central Line</td>
</tr>
<tr>
<td>- Foley cath secured? <em>If not, please secure using the Grip-lok device</em></td>
</tr>
<tr>
<td>- If Swan in place, check height, weight and computation, <em>Send SvO2</em></td>
</tr>
<tr>
<td>- OGT to LIS and check placement</td>
</tr>
<tr>
<td>- Validate current Type and Cross</td>
</tr>
<tr>
<td>- Insulin drip, <em>Notify provider for IV insulin bolus if any BG &gt;160mg/dl</em></td>
</tr>
<tr>
<td>- Chest Tubes to 20 cm suction</td>
</tr>
<tr>
<td>- Correlate manual BP to A-line</td>
</tr>
<tr>
<td>- MAP goal discussed <em>(Reflected in orders)</em></td>
</tr>
<tr>
<td>- Date/Team Information Completed <em>(Top left)</em></td>
</tr>
<tr>
<td>- Clip PINK &quot;Vent Alert Sign&quot;, <em>BG Clock, and POD 0 Checklist to door</em></td>
</tr>
<tr>
<td>- If on Veletri, is nebulizer upright / inflow arm</td>
</tr>
<tr>
<td>- Is patient a candidate for late transfer today? <em>Y N</em></td>
</tr>
<tr>
<td>- Vent changes, review initial ABG, aim for alkalemia until weaning</td>
</tr>
<tr>
<td>- Appropriate POD 1 labs ordered</td>
</tr>
<tr>
<td>- Verify MRSA/MSSA PCR status, <em>Verify Isolation status</em></td>
</tr>
<tr>
<td>- Continue mupirocin dosing, <em>if applicable</em></td>
</tr>
<tr>
<td>- Stockings and SCD's in place</td>
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</table>

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## Phase 2: Assessment / Management: Nursing *(within 2 Hours post-admission)*

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<tr>
<th>Comment</th>
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<tbody>
<tr>
<td>* Check when addressed</td>
</tr>
<tr>
<td>- VAP bundle <em>(HOB 30°, Mouth Care q4hr, CHG q12hr.)</em></td>
</tr>
<tr>
<td>- ASA 325mg <em>via NG tube NOW if no signs of bleeding</em></td>
</tr>
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<table>
<thead>
<tr>
<th>Signatures</th>
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<tbody>
<tr>
<td>Provider Signature:</td>
</tr>
<tr>
<td>Nurse Signature:</td>
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</table>
ICU TEAMWORK MATTERS
Cardiac Surgery Quality Assurance Performance Improvement Committee (2009 – 2012)

- First and Third Friday of Every Month
- Representatives From:
  - Attendings
  - Fellows
  - AP’s: both CVSICU and CVPCU
  - Respiratory Therapy
  - Physical Therapy
  - Pharmacy
  - Nursing: both CVSICU and CVPCU
  - Administration
  - Quality Improvement
INFLUENCE OF THE COMPREHENSIVE UNIT–BASED SAFETY PROGRAM IN ICUS: EVIDENCE FROM THE KEYSTONE ICU PROJECT

Hsu Y, Marsteller J
Am J Med Qual 2016;31:349-357
CUSP: Comprehensive Unit Based Safety Program

- CUSP Members:
- Team Leader
- Physician Champion
- Executive Champion
- Nurse Manager
- Infection Prevention Representative
- Resp Therapy, Environmental, Invited Stakeholders
CUSED

- Monthly Meetings
- Monthly Safety Rounds
- Identify system defects
- Develop safety and monitoring tools
- Educate the staff
- Present outcomes
Influence of CUSP on ICU Culture

Hsu Y, Marsteller J
American Journal of Medical Quality 2016;31:349–357
The strongest predictor of clinical excellence: caregivers feel comfortable speaking up if they perceive a problem with patient care.
The Effect of a Comprehensive Unit Based Safety Program on CLABSI

Miller K et al, 2016 Am J Infection Control
The Impact of ICU Structure and Processes on Outcomes

- Full Time Intensivists
- Multidisciplinary Teams
- Organization of Rounds
- Checklists
- Teamwork
- Performance Improvement and Metrics
Post-Op SSI and PNA Rate in Open Heart Surgery Patients

(n = 2253)
### Primary Outcome
**Postoperative Overall Infection (n=127)**
with/without Vent time adjusted

<table>
<thead>
<tr>
<th>Intraop + Postop Transfusion</th>
<th>Without Vent Time</th>
<th>p-value</th>
<th>With Vent Time</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>RBC (unit)</td>
<td>1.1 (1.0-1.2)</td>
<td>0.04</td>
<td>1.0 (0.9-1.1)</td>
<td>0.76</td>
</tr>
<tr>
<td>FFP</td>
<td>1.3 (0.8-2.2)</td>
<td>0.26</td>
<td>1.1 (0.6-1.8)</td>
<td>0.81</td>
</tr>
<tr>
<td>Platelet</td>
<td>0.8 (0.5-1.3)</td>
<td>0.34</td>
<td>0.8 (0.5-1.4)</td>
<td>0.48</td>
</tr>
<tr>
<td>Cryo</td>
<td>1.2 (0.6-2.5)</td>
<td>0.60</td>
<td>1.2 (0.4-3.2)</td>
<td>0.78</td>
</tr>
<tr>
<td>Preop WBC</td>
<td>1.1 (1.0-1.1)</td>
<td>&lt;0.001</td>
<td>1.05 (1.0-1.1)</td>
<td>0.001</td>
</tr>
<tr>
<td>Preop COPD</td>
<td>3.3 (2.2-5.0)</td>
<td>&lt;0.001</td>
<td>2.6 (1.6-4.3)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Preop Cr&gt;1.5mg/dL</td>
<td>1.7 (1.0-2.7)</td>
<td>0.04</td>
<td>1.34 (0.8-2.2)</td>
<td>0.26</td>
</tr>
</tbody>
</table>

Adjusted variables were blood products, previous cardiac surgery, preoperative WBC value, heart failure within 2 weeks prior to surgery, preoperative COPD, preoperative serum creatinine, CPB time, and surgery type vs. isolated CABG, and postoperative ventilation time. Only values < 0.05 are shown, except for transfusions.
Early Extubation Performance at the Johns Hopkins Hospital - 2008

% Patients Extubated <6hrs (CABG Only)

- JHH 2008
- STS Like 2008
- STS National 2008
Pre vs. Post Implementation of New MV Weaning Protocol

% Patients Extubated <6hrs (CABG Only)

STS National Average 2009 37%
STS Like Institutions 2009 32%

n= 1174

JHH Period 2 (10/1/2009-8/31/2011)
n= 637 *

* p<0.01 compared to JHH Period 1
A Bow Around Your Finger

Initial Vent Time 1/23/12

Start: NOON
4hr post 4 PM
**6hr post 6 PM
Results Following Additional Protocol Changes

% Patients Extubated <6hrs (CABG Only)

JHH Period 3 (9/1/2011-6/30/2012): n=236

STS National Average 2011 40%
STS Like Institutions 2011 42%

* p<0.01 compared to JHH Period 1
† p<0.01 compared to JHH Period 2

Extubation < 6 Hours Current Performance: 2014

% Patients Extubated <6hrs (CABG Only)

* p<0.01 compared to JHH Period 1
† p<0.01 compared to JHH Period 2
<table>
<thead>
<tr>
<th>Event</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Out of OR Time (T)</td>
<td>15:20</td>
</tr>
<tr>
<td>Reversal (T+2Hr)</td>
<td>17:20</td>
</tr>
<tr>
<td>1st SBT (T+4hr)</td>
<td>19:20</td>
</tr>
<tr>
<td>Extubated (T+5hr)</td>
<td>20:20</td>
</tr>
</tbody>
</table>
CVSICU Reasons For Extubation >6h

- Hemodynamic Instability: 4%
- Hypoxia: 3%
- CVA or delirium: 5%
- Bleeding: 20%
- Metabolic Acidosis: 28%
- Open chest / ECMO: 17%
- Other: 23%
Isolated CAB Morbidity

- Any Morbidity: blue (2013 n=390), red (2014 n=348), green (2015 n=469), purple (Q1-2016 n=110)
- Reoperation Only: blue (2013 n=390), red (2014 n=348), green (2015 n=469), purple (Q1-2016 n=110)
- Renal Failure Only: blue (2013 n=390), red (2014 n=348), green (2015 n=469), purple (Q1-2016 n=110)
- DSWI/Mediastinitis Only: blue (2013 n=390), red (2014 n=348), green (2015 n=469), purple (Q1-2016 n=110)
- Prolonged Vent Only: blue (2013 n=390), red (2014 n=348), green (2015 n=469), purple (Q1-2016 n=110)
- CVA Only: blue (2013 n=390), red (2014 n=348), green (2015 n=469), purple (Q1-2016 n=110)
- Multiple Morbidities: blue (2013 n=390), red (2014 n=348), green (2015 n=469), purple (Q1-2016 n=110)
Failed to Prescribe All Eligible Medications for Isolated CAB

If you don’t know your performance, you are not doing as well as you think you are.
Intervention – PCR testing

• Preoperative PCR testing for MRSA
  – Nasal swab by PAs on preop visit

• If positive:
  – Intranasal mupirocin bid
  – Chlorhexidine baths

• Both for 5 days (or as many days as possible preop; full course completed in ICU if necessary)
Overall SSI in CABG Patients

Pre-Intervention (n=1357)
- Non-MRSA: 4.2%
- MRSA: 0.5%

Intervention (n=1990)
- Non-MRSA: 3.7%
- MRSA: 0.05%

<table>
<thead>
<tr>
<th></th>
<th>Un-adjusted</th>
<th>Adjusted</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR</td>
<td>95% CI</td>
</tr>
<tr>
<td>Intervention Era</td>
<td>0.64</td>
<td>0.44</td>
</tr>
</tbody>
</table>
MRSA ICU Admissions

Pre-Intervention (n=2826) | Intervention (n=4038)
--- | ---
MRSA-Positive on ICU Admission | 2.6% | 1.4%

<table>
<thead>
<tr>
<th></th>
<th>Univariate</th>
<th>Multivariate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR</td>
<td>95% CI</td>
</tr>
<tr>
<td>Intervention Era</td>
<td>0.5</td>
<td>0.37</td>
</tr>
</tbody>
</table>
### MRSA ICU Admissions

#### Pre-Intervention (n=2826) vs Intervention (n=4038)

<table>
<thead>
<tr>
<th></th>
<th>Percentage of ICU Admissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Intervention</td>
<td>2.6%</td>
</tr>
<tr>
<td>Intervention</td>
<td>1.4%</td>
</tr>
</tbody>
</table>

**MRSA-Positive on ICU Admission**

#### Univariate vs Multivariate

<table>
<thead>
<tr>
<th></th>
<th>Univariate</th>
<th>Multivariate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR</td>
<td>95% CI</td>
</tr>
<tr>
<td>Intervention Era</td>
<td>0.5</td>
<td>0.37</td>
</tr>
</tbody>
</table>

**Note:** The data indicates a significant decrease in MRSA-Positive ICU admissions after the intervention era, with a p-value of less than 0.001 in both univariate and multivariate analyses.
MRSA ICU Transmission

Adjusted Poisson Regression: MRSA transmissions

<table>
<thead>
<tr>
<th></th>
<th>aIRR</th>
<th>95% CI</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention era</td>
<td>0.29</td>
<td>0.13</td>
<td>0.65</td>
</tr>
</tbody>
</table>

Pre-Intervention (14,733 pt days) vs. Intervention (21,467 pt days) Incidence Rate per 1000 pt days
Staph Screening Miss Categories
July 2016

- Transfer: 1
- True Miss: 2
- >45 Days: 2
- Discontinued: 3

September 12, 2016
Group, but not Individual, Accountability

CVSICU Hand Hygiene Compliance by Year
Weekly Transfusions with Corresponding Hgb for All Procedures

All Surgeons Combined

Hgb (gm/dL)

Period 1

Period 2

Week
Weekly Transfusions with Corresponding Hgb for All Procedures

For a Single Surgeon

Period 1
Period 2
Period 3

Hgb (gms/dL)

Week
Weekly Transfusions with Corresponding Hgb for All Procedures

All Surgeons Combined
Percent of Transfusions at Increasing Hgb Thresholds
All Surgeons Combined

*Denotes significantly different than period 1
** Denotes significantly different than period 2

- % above Hgb of 8 gm/dL
- % above Hgb of 9 gm/dL
- % above Hgb of 10 gm/dL
Monthly Cardiac Surgery Dashboard

• Vent Times
• Reasons for ext > 6 hrs
• iNO vs Veletri hrs
• Hyper/Hypo glycemia
• Checklist Compliance
• Staph screening (with reasons for misses)
• Blood Utilization

• CVSICU arrival:
  • K+
  • Temp
  • Base Deficit
• Daily Weights
• Transfers > 6 pm
• Bouncebacks (Total, < 24 hrs) with Reasons

And Weekly Mortality and Morbidity
The Johns Hopkins Cardiac Surgery
Code of Conduct and Professional Behavior

A. I will treat everyone with respect and trust and acknowledge diversity by:
   1. Greeting patients and staff in a courteous manner.
   2. Taking responsibility for offering constructive criticism, when necessary, in a respectful and non-threatening manner.
   3. Praising publicly, criticizing privately.
   4. Acknowledging concerns, taking them seriously and investigating.
   5. Respecting different cultures, backgrounds, religions, gender and sexual orientation of peers, other co-workers, patients, and families.
   6. Allowing people to express both opinions and feelings and to ask questions.

B. I will promote an image of professionalism and support co-workers by:
   1. Fostering a culture that does not seek to assign blame but that learns and then moves on from errors—a culture characterized by “forgive and remember.”
   2. Being open to, respectful of and involved in developing new ideas and processes and by reserving judgment until the development process is complete.
   3. Teaching constantly and being accountable for participation in educational programs and in-service training.
   4. Accepting responsibility and providing leadership in support of the adoption of new procedures designed to address service problems.

C. I will demonstrate professionalism, effective communication skills and display openness by:
   1. Never using profanity.
   2. Recognizing when help is needed and then asking for it in a timely manner.
   3. Being willing to listen and understand other perspectives.
   4. Approaching colleagues positively, always giving them the benefit of the doubt.
   5. Taking responsibility for communicating to colleagues any changes in patient care.
   6. Being non-defensive and non-judgmental in dealing with peers, other co-workers, patients, and families.

______________________________  ______________________
Signature                                      Date
Critical Care of the Cardiovascular Patient:
The essentials for high quality

1. Full time intensivists
2. Structured Multi-D rounds (Pharmacy?)
3. Nurse readbacks
4. Checklists
5. Culture of safety/teamwork (CUSP)
6. Performance improvement requires:
   • Multidisciplinary input
   • Agreed upon targets
   • Review of outcomes
   • Continual reassessment
6. Individual accountability matters
Isolated CABG
Post Op Morbidities

*2014: Jan 1 – Jun 30
• Universal public reporting is inevitable

• ICU care plays a major role in patient outcomes
Surgeon-Reported Conflicts with Intensivists About Postoperative Goals of Care

- Vascular, Neurologic, and Cardiothoracic Surgeons
  - Mail Questionnaire
  - 56% response rate, n = 2100
Rates of Surgeon Reported Conflicts

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>At times, conflicts may arise among different parties involved in the care of a patient who has a poor postsurgical outcome. How frequently, if ever, do you experience conflict with each of these groups about the goals of care for your postoperative patients?</td>
<td>Sometimes/always</td>
</tr>
<tr>
<td>Critical care physicians</td>
<td>43</td>
</tr>
<tr>
<td>Nursing staff</td>
<td>43</td>
</tr>
<tr>
<td>Primary care physicians</td>
<td>23</td>
</tr>
<tr>
<td>Ethics consultants</td>
<td>16</td>
</tr>
<tr>
<td>Family members of the patient</td>
<td>60</td>
</tr>
<tr>
<td>Surgical colleagues</td>
<td>18</td>
</tr>
</tbody>
</table>
Heterogeneity of Specialties in Cardiac Intensive Care Units

$\sqrt{\text{\textsuperscript{\textdegree}}} = \text{CT trained}$
Unadjusted ICU Length of Stay

- **ICU Stay (hrs) mean ± SD**
  - 0 - 6 hrs: 44.6 ± p < 0.01
  - 6 - 9 hrs: 53.7 ± p = 0.05
  - 9 - 12 hrs: 55.6
  - 12 - 18 hrs: 75
  - 18 - 24 hrs: 88.9
  - > 24 hrs: 194.3

**Intubation Duration**

- **p** values indicate statistical significance.
Unadjusted Hospital Length of Stay

<table>
<thead>
<tr>
<th>Intubation Duration</th>
<th>Hospital Stay (days) median (IQR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 6 hrs</td>
<td>6</td>
</tr>
<tr>
<td>6 - 9 hrs</td>
<td>7</td>
</tr>
<tr>
<td>9 - 12 hrs</td>
<td>7</td>
</tr>
<tr>
<td>12 - 18 hrs</td>
<td>8</td>
</tr>
<tr>
<td>18 - 24 hrs</td>
<td>8.5</td>
</tr>
<tr>
<td>&gt; 24 hrs</td>
<td>13</td>
</tr>
</tbody>
</table>
Multidisciplinary Teams:
Physician, Nurse, and ≥ 1 more Health Care Professional

- Avoids adverse drug events
  - Pharmacists on team decreased ADE 66%
- Decreases length of stay
  - Team care shortened ICU LOS by 4.2 days
- Saves money
  - Team care saved $7500 in hospital cost per patient
- Saves lives
  - Team care lowered hospital mortality by 16%
% of Patients with Infection by RBC Units Transfused

Total Number of RBC units Transfused

*significantly different (p<0.05) compared to no RBC exposure
Relationship between Infection and Ventilation Time

Ventilation Time vs. Infection (%)

- Overall Infection
- Pneumonia
- Sepsis
- SSI

Length of Mechanical Ventilation (hrs)

0-12 12-24 24-48 48+

<table>
<thead>
<tr>
<th></th>
<th>Overall Infection</th>
<th>Pneumonia</th>
<th>Sepsis</th>
<th>SSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-12</td>
<td>1.7</td>
<td>0.1</td>
<td>0.4</td>
<td>0.0</td>
</tr>
<tr>
<td>12-24</td>
<td>4.3</td>
<td>0.2</td>
<td>0.5</td>
<td>0.0</td>
</tr>
<tr>
<td>24-48</td>
<td>4.6</td>
<td>0.7</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>48+</td>
<td>24.1 *</td>
<td>20.9 *</td>
<td>3.5 *</td>
<td>2.3 *</td>
</tr>
</tbody>
</table>

Note: 48% of all infections occurred in patients with 48+ hours ventilation
*significantly different (p<0.05) compared to vent time <12 hrs group
Isolated CABG
Post Op Morbidities

2013 and 2014

*2014: Jan 1 – Jun 30
The Tenets of CUSP

- Step 1: Safety Attitude Questionnaire (SAQ)
- Step 2: Educate re: Science of Improving
- Step 3: Identify Defects (events that should not recur)
- Step 4: Executive Partnership to “Bridge the Gap”
- Step 5: Choose a Defect each Month that poses a hazard
- Step 6: Reassess
Table 3. SAQ Scale Scores by CUSP Use Status and Time.

<table>
<thead>
<tr>
<th>SAQ scale scores</th>
<th>Non-CUSP ICUs</th>
<th>CUSP ICUs</th>
<th>Adjusted Difference-In-Difference Measure</th>
<th>SE</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline (n = 19)</td>
<td>Time 2 (n = 14)</td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>Teamwork climate</td>
<td>46.5</td>
<td>20.9</td>
<td>47.1</td>
<td>13.6</td>
<td>.923</td>
</tr>
<tr>
<td>Safety climate</td>
<td>47.4</td>
<td>21.2</td>
<td>48.1</td>
<td>16.5</td>
<td>.924</td>
</tr>
<tr>
<td>Job satisfaction</td>
<td>55.6</td>
<td>16.4</td>
<td>52.7</td>
<td>18.4</td>
<td>.635</td>
</tr>
<tr>
<td>Stress recognition</td>
<td>39.3</td>
<td>11.1</td>
<td>41.0</td>
<td>11.7</td>
<td>.673</td>
</tr>
<tr>
<td>Perceptions of management</td>
<td>26.9</td>
<td>16.3</td>
<td>30.5</td>
<td>17.9</td>
<td>.559</td>
</tr>
<tr>
<td>Working conditions</td>
<td>33.5</td>
<td>18.8</td>
<td>31.1</td>
<td>9.0</td>
<td>.662</td>
</tr>
</tbody>
</table>
% Patients with BD < -4 and K < 3.3 by Month

- Jul'15: 2%
- Aug'15: 1%
- Sep'15: 0%
- Oct'15: 1%
- Nov'15: 2%
- Dec'15: 0%
- Jan'16: 0%
- Feb'16: 6%
- Mar'16: 0%
- Apr'16: 1%
- May'16: 2%
- Jun'16: 0%
Quality Improvement

- Insight regarding what metric to target
- A sense of comfort to embark upon new initiatives
- Involves ability to create consensus
Weekly Transfusions with Corresponding Hgb for CABG Patients

All Surgeons Combined

Week

Period 1
Period 2
Period 3

Hgb (gm/dL)
Percent of Transfusions at Increasing Hgb Thresholds
All Surgeons Combined

*Denotes significantly different than period 1
** Denotes significantly different than period 2

<table>
<thead>
<tr>
<th>Period</th>
<th>% above Hgb of 8 gm/dL</th>
<th>% above Hgb of 9 gm/dL</th>
<th>% above Hgb of 10 gm/dL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period 1</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Period 2</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>Period 3</td>
<td>*</td>
<td>*</td>
<td>**</td>
</tr>
</tbody>
</table>
Conclusion

- Though recognizing that this is as yet untested, the perspective that comes with cardiothoracic surgical training and practice best addresses the above issues which face every cardiothoracic surgical team and ICU.

As a result, thoracic surgeons:
- Should be the directors of the CTICU, and
- Should play an integral part in the delivery of day to day ICU care.
Procedures for which the STS database has a predictive model

(Based on roughly 2.7 million patients)

Procedure groups for which models exist:
- Isolated CABG (CAB)
- Isolated Aortic Valve Replacement (AVRepl)
- Aortic Valve Replacement and CABG (AVRepl+CAB)
- Isolated Mitral Valve Replacement (MVRepl)
- Mitral Valve Replacement and CABG (MVRepl+CAB)
- Isolated Mitral Valve Repair (MVRepr)
- Mitral Valve Repair and CABG (MVRepr+CAB)

Model endpoints:
- Operative Mortality
- Stroke
- Renal Failure
- Prolonged Ventilation
- Deep Sternal Wound Infection
- Reoperation
- Mortality/Morbidity combined endpoint (any of the 6 previous endpoints)
- Prolonged length of stay (length of stay >14 days)
- Short length of stay (length of stay < 6 days)