SCAI Quality Improvement Toolkit

Working on QUALITY, One Cath Lab at a Time
Acknowledgements

The SCAI Cardiovascular Professional (CVP) Quality Improvement Toolkit was developed with support from Daiichi Sankyo and Lilly. The Society gratefully acknowledges this support, while taking sole responsibility for all content developed and disseminated through this effort.
Vision

“We have talked for a number of years about the need for interventionalists to “own” the QI process in the cath lab.

SCAI QIT offers a unique opportunity for SCAI members to demonstrate their commitment to improving quality of care and to reassure our patients that their expectations of receiving the highest quality of care in the cath lab are being met.

It’s time for you to get involved. It’s time for you to get to work.”

– Christopher J. White, MD, MScAI
Purpose: To provide SCAI Cardiovascular Professionals (CVPs), who are SCAI QIT champions, the foundation to promote and implement quality improvement processes.

Audience: Non-physicians involved in leading quality improvement in the area of cardiac and/or endovascular angiography and/or intervention.
Module 2
NCDR, performance measures and benchmarking
NCDR

- National Cardiovascular Data Registry

- Developed by ACC in 1997 as QI resource

- Data captured and reported by NCDR helps participants:
  - understand current performance
  - compare their performance with absolute standards (e.g., The Joint Commission standards) and other cath labs (external benchmark)
  - improve quality of cardiovascular care delivered

- Includes following registries
CathPCI Registry collects the following data:

- Patient demographics for cardiac catheterization and PCI procedures
- Provider and facility characteristics
- History/risk factors, cardiac status, treated lesions
- Intracoronary device utilization and adverse event rates
- Appropriateness use criteria (AUC) for coronary revascularization
- Compliance with ACC/AHA clinical guideline recommendations

CathPCI registry data collection form
Data are submitted securely and directly to NCDR by data manager using either web based tool or approved software vendor

Data definitions are standardized

Based on data received, NCDR provides quarterly “quality outcomes reports”

NCDR registry reports are:
- “benchmarked” - compare hospital’s performance to peers and national experience
- risk adjusted - outcomes in a cath lab that performs higher risk procedures/has sicker patients should be “adjusted” for the level of risk
- provided with both performance measures and quality metrics
Quality Metrics

• NCDR definition: Support self assessment and quality improvement at the provider, hospital, and/or health care system level

• Focus on the following-
  • Processes of care that have been shown to improve patient outcome (e.g. aspirin, statin, and P2Y12 after MI)- process metrics
  • Structure of care (e.g. PCI volume, adequacy of staffing)
  • Efficiency of care (e.g. readmission post PCI)
  • Outcomes of care (e.g. mortality after STEMI)-outcome metrics
## Defining Quality in the Cath Lab

### PCI Performance Metrics

<table>
<thead>
<tr>
<th>Metric Description</th>
<th>Source</th>
<th>Line</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCI in-hospital risk adjusted mortality (all patients)</td>
<td>NCDR CathPCI</td>
<td>1</td>
</tr>
<tr>
<td>Composite: Discharge Medications in Eligible PCI Patients</td>
<td>NCDR CathPCI</td>
<td>38</td>
</tr>
</tbody>
</table>

### PCI Process Metrics

<table>
<thead>
<tr>
<th>Metric Description</th>
<th>Source</th>
<th>Line</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proportion of elective PCI's with prior positive stress or imaging study</td>
<td>NCDR CathPCI</td>
<td>2</td>
</tr>
<tr>
<td>Median time to immediate PCI for STEMI patients (in minutes)</td>
<td>NCDR CathPCI</td>
<td>3</td>
</tr>
<tr>
<td>Proportion of STEMI patients receiving immediate PCI within 90 minutes</td>
<td>NCDR CathPCI</td>
<td>4</td>
</tr>
<tr>
<td>Median time from ED arrival at STEMI transferring facility to ED arrival at STEMI receiving facility among transferred patients (in minutes)</td>
<td>NCDR CathPCI</td>
<td>5</td>
</tr>
<tr>
<td>Median time from ED arrival at STEMI transferring facility to Immediate PCI at STEMI receiving facility among transferred patients (in minutes)</td>
<td>NCDR CathPCI</td>
<td>6</td>
</tr>
</tbody>
</table>

### PCI Outcome Metrics

<table>
<thead>
<tr>
<th>Metric Description</th>
<th>Source</th>
<th>Line</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proportion of PCI patients with emergency CABG</td>
<td>NCDR CathPCI</td>
<td>12</td>
</tr>
<tr>
<td>Proportion of PCI procedures with post-procedure stroke</td>
<td>NCDR CathPCI</td>
<td>16</td>
</tr>
<tr>
<td>Composite: Proportion of PCI patients with death, emergency CABG stroke or repeat target lesion revascularization</td>
<td>NCDR CathPCI</td>
<td>17</td>
</tr>
<tr>
<td>PCI in-hospital risk adjusted mortality (patients with STEMI)</td>
<td>NCDR CathPCI</td>
<td>18</td>
</tr>
<tr>
<td>PCI in-hospital risk adjusted mortality (STEMI patients excluded)</td>
<td>NCDR CathPCI</td>
<td>19</td>
</tr>
<tr>
<td>Proportion of PCI procedures with transfusion of whole blood or RBC's post PCI</td>
<td>NCDR CathPCI</td>
<td>25</td>
</tr>
<tr>
<td>PCI in-hospital risk adjusted rate of bleeding events (all patients)</td>
<td>NCDR CathPCI</td>
<td>37</td>
</tr>
<tr>
<td>PCI in hospital risk adjusted acute kidney injury (all patients)</td>
<td>NCDR CathPCI</td>
<td>39</td>
</tr>
</tbody>
</table>

### PCI Appropriate Use Criteria (AUC)

<table>
<thead>
<tr>
<th>Metric Description</th>
<th>Source</th>
<th>Line</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proportion of PCI procedures not classifiable for AUC reporting</td>
<td>NCDR CathPCI</td>
<td>30</td>
</tr>
<tr>
<td>Proportion of evaluated PCI procedures that were appropriate (WITHOUT Acute Coronary Syndrome)</td>
<td>NCDR CathPCI</td>
<td>34</td>
</tr>
<tr>
<td>Proportion of evaluated PCI procedures that were of uncertain appropriateness (WITHOUT Acute Coronary Syndrome)</td>
<td>NCDR CathPCI</td>
<td>35</td>
</tr>
<tr>
<td>Proportion of evaluated PCI procedures that were inappropriate, (WITHOUT Acute Coronary Syndrome)</td>
<td>NCDR CathPCI</td>
<td>36</td>
</tr>
</tbody>
</table>

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Examples of PCI quality metrics
Performance Measures

- NCDR definition: Refers to a subset of quality metrics which are suitable for public reporting and external comparisons (e.g., NQF-endorsed)

- Valid, reliable, practical to measure, meaningful to patients and society

- Risk-adjusted or Risk Standardized

- Amenable to modification

- ACC/AHA has published clinical performance measures for STEMI/NSTEMI ([2008 performance measures](#))
Examples of performance measures

- PCI Risk-Adjusted Mortality (RAM)
- PCI Risk Adjusted Bleeding (RAB)
- 30-Day Risk-Standardized readmission rate following PCI
- 30 Day Risk Adjusted Mortality post PCI for patients with STEMI or with cardiogenic shock
- 30 Day Risk Adjusted Mortality post PCI for patients without STEMI or without cardiogenic shock
- Therapy with aspirin, P2Y12 inhibitor, and statin at discharge following percutaneous coronary intervention (PCI) in eligible patients
Benchmarking

- Refers to comparison of outcomes across sites/providers

- Steps involved
  - Data entry by hospital registry site manager with input from physician champion who understands data definitions and intent of registry
  - Data collection by registries (NCDR, MassDAC)
  - Risk-adjustment
  - Measurement of outcome using standardized definitions
  - Reporting of results to sites/providers
## Comparison of quality metrics with benchmarks

<table>
<thead>
<tr>
<th>PCI process metrics</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASA at discharge for all PCI patients (no contraindication to ASA)</td>
<td>≥ 99%</td>
</tr>
<tr>
<td>Additional antiplatelet drug for stent patients at discharge (no contraindications noted)</td>
<td>≥ 99%</td>
</tr>
<tr>
<td>Lipid lowering agent at discharge in patients with dyslipidemia (no contraindications to statin use)</td>
<td>≥ 90%</td>
</tr>
<tr>
<td>Measurement of case appropriateness in a minimum of 75% of all cases performed. (The case appropriateness metrics will be reported in future versions of the NCDR)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PCI outcome metrics</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Vascular access injury requiring surgery or major bleeding**</td>
<td>&lt; 2.0%</td>
</tr>
<tr>
<td>Emergency CABG</td>
<td>&lt; 1.0%</td>
</tr>
<tr>
<td>Transfusion of whole blood or RBCs post PCI*</td>
<td>&lt; 5.0%</td>
</tr>
<tr>
<td>Post-procedure stroke</td>
<td>&lt; 1.0%</td>
</tr>
<tr>
<td>In-hospital risk-adjusted mortality (excluding STEMI)</td>
<td>&lt;1.0</td>
</tr>
<tr>
<td>In-hospital risk-adjusted mortality for all patients</td>
<td>&lt; 2.0%</td>
</tr>
</tbody>
</table>

### Diagnostic Cath Process Metrics

| Incidence of non-obstructive disease in elective patients, diagnostic only labs    | < 30%        |
| Incidence of non-obstructive disease in elective patients at all other labs †     | < 40%        |

### Diagnostic Cath Outcome Metrics

| Vascular access injury requiring surgery or major bleeding**                       | < 1.0%        |
Interpreting CathPCI Registry Reports

Interpreting Box and Whisker Plots

Distribution of Hospital Performance

10th percentile
90% of the hospitals achieved “better” scores than the 10th percentile.

25th Percentile or 1st Quartile
75% of the hospitals achieved “better” scores than the 25th percentile.

50th Percentile or 2nd Quartile
Middle of the distribution: Half of the hospitals data is above and half are below the median.

75th Percentile or 3rd Quartile
25% of the hospitals achieved “better” scores than the 75th percentile.

90th Percentile
10% of the hospitals achieved “better” scores than the 90th percentile.

Your Hospital Position
Your ‘Hospital Position’ in relation to all other hospitals’ data.
## Executive Summary

**CathPCI Registry® compared to Rolling Four Quarters (R4Q) for All Hospitals ending 2010Q3**

### Section I: PCI Performance Measures

Endorsed by the National Quality Forum and appropriate for public reporting

<table>
<thead>
<tr>
<th>PCI Performance Measures</th>
<th>10th percentile</th>
<th>Distribution of Data</th>
<th>90th percentile</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCI in-hospital risk adjusted mortality (all patients)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My Hospital</td>
<td>Vol Group R4Q</td>
<td>All Hosp</td>
<td>90th Pctl</td>
</tr>
<tr>
<td>1.76</td>
<td>1.40</td>
<td>0.73</td>
<td></td>
</tr>
</tbody>
</table>

Your hospital's PCI in-hospital risk adjusted mortality rate for all patients adjusted using the NCDR® risk adjustment model. [Detail Line:1979]

<table>
<thead>
<tr>
<th>PCI Outcome Metrics</th>
<th>10th percentile</th>
<th>Distribution of Data</th>
<th>90th percentile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vascular access site injury requiring treatment or major bleeding</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My Hospital</td>
<td>Vol Group R4Q</td>
<td>All Hosp</td>
<td>90th Pctl</td>
</tr>
<tr>
<td>1.2%</td>
<td>1.4%</td>
<td>1.4%</td>
<td>0.0%</td>
</tr>
</tbody>
</table>

Your hospital's proportion of patients (excluding CABG or other surgery during same admission) with major access site related injury requiring treatment or major bleeding. [Detail Line:1818]
Comparison to a benchmark will give you a sense of whether your typical results are similar to the comparison population.

Outlier values are opportunities to learn! They might represent:

- Actual “bad” performance
- Unusual cases
- Misinterpretation of physician documentation or NCDR coding definition by CVP data abstractor
- Incomplete data entry due to missing data or inability to find entered data

Can improve quality by …

- Moving outliers closer to the median
- Shifting the curve by improving performance on every case by a little bit
- Reviewing unusual behavior, e.g., performing elective PCI on a lesion with 40-70% diameter stenosis without ischemia on non-invasive testing (and with FFR >0.8 if pressure wire performed)
Look at Data by Subgroups

- Compare “apples to apples”

- Divide your data into subgroups:
  - PCIs
    - Planned PCIs without diagnostic angiography vs. Ad hoc PCIs
    - STEMI vs. all others
  - Diagnostic coronary angiography
    - Diagnostic coronary angiography only
    - Diagnostic coronary angiography with ad hoc PCI
    - Coronary angiography with adjunctive procedures (e.g., lower extremity angiography, RHC)
  - Special procedures without coronary angiography
    - RHC, IABP insertion, temporary RV pacing
    - Valvuloplasty
In-Hospital Risk Adjusted Mortality

- Ideally adjust expected risk of death for each patient based on his/her severity of illness

- CathPCI Post-PCI Risk Adjusted Mortality (RAM)
  - 50th percentile or median: 1.83%
  - 10th percentile: 3.17%
  - 25th percentile: 2.47%
  - 75th percentile: 1.37%
  - 90th percentile: 1.01%

- Lower RAM is better!

<table>
<thead>
<tr>
<th>Case type</th>
<th>Median in-hospital RAM</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCI</td>
<td>1.83%</td>
</tr>
<tr>
<td>Overall</td>
<td>6.37%</td>
</tr>
<tr>
<td>STEMI patients</td>
<td>0.94%</td>
</tr>
<tr>
<td>Patients without STEMI</td>
<td></td>
</tr>
</tbody>
</table>

National Outcomes Report (999997) compared to Rolling Four Quarters (R4Q) for US Hospitals ending 2015Q3
Thresholds for Concern

- Observed unadjusted event rate > the 10th percentile of event rate in the CathPCI Registry

- Post-PCI observed in-hospital all-cause mortality thresholds for concern:
  - All PCIs > 3.17%
  - PCIs for STEMIs > 11.65%
  - PCIs for patients without STEMI > 1.95%

National Outcomes Report (999997) compared to Rolling Four Quarters (R4Q) for US Hospitals ending 2015Q3
**Vascular Complications**

- **CathPCI Registry Definition: Bleeding event**
  - Hematomas, retroperitoneal bleed, access site occlusion, peripheral embolization, dissection, pseudoaneurysm, AV fistula
  - Requiring treatment, developing within 72 hours of the procedure
  - Must be associated with a hemoglobin drop of >3 g/dL; transfusion of whole or packed red blood cells, or a procedural intervention/surgery

- **Current Benchmark rates:**
  - Diagnostic cath
    - Median: 0.06%
    - 10th percentile: 0.57%
    - 25th percentile: 0.28%
    - 90th percentile: 0.0%
    - 75th percentile: 0.0%

National Outcomes Report (999997) compared to Rolling Four Quarters (R4Q) for US Hospitals ending 2015Q3
Acute kidney injury (AKI) post-PCI

- **Cath PCI AKI definition**
  - Stage 1 is defined as an absolute increase of \( \geq 0.3 \text{ mg/dL} \) or a relative increase of 50\% in serum creatinine (Cr)
  - Stage 2 is defined as an increase in serum Cr to more than 200\% to 300\% (>2-to 3-fold) from baseline
  - Stage 3 is defined as increase in serum Cr to more than 300\% (>3-fold) from baseline (or serum Cr of more than or equal to 4.0 mg/dl with an acute increase of at least 0.5 mg/dl)

- **Current benchmark rates for post-PCI risk-adjusted AKI**
  - 50th percentile or median: 6.26\%  
  - 10th percentile: 9.86\%  
  - 25th percentile: 8.13\%  
  - 75th percentile: 4.70\%  
  - 90th percentile: 3.17\%

National Outcomes Report (999997) compared to Rolling Four Quarters (R4Q) for US Hospitals ending 2015Q3
Fluoroscopy Time (minutes)

- A crude measure of radiation exposure
  - Does not include exposure from “cine”
  - Does not account for higher radiation dose per minute necessary for larger patients
  - Does not account for collimation and protective filters

- Benchmarks from CathPCI Registry
  - PCI single lesion, without CABG-10 minutes (median)

<table>
<thead>
<tr>
<th>Cases</th>
<th>Mean</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagnostic cath (with &amp; without PCI)</td>
<td>9.3</td>
<td>6.2</td>
</tr>
<tr>
<td>Without prior CABG</td>
<td></td>
<td></td>
</tr>
<tr>
<td>With prior CABG</td>
<td>10.7</td>
<td></td>
</tr>
<tr>
<td>PCI</td>
<td>14.9</td>
<td>11.8</td>
</tr>
<tr>
<td>Without prior CABG: 1 lesion</td>
<td>10.0</td>
<td></td>
</tr>
<tr>
<td>Without prior CABG: &gt;1 lesion</td>
<td>15.3</td>
<td></td>
</tr>
<tr>
<td>With prior CABG: 1 lesion</td>
<td>14.0</td>
<td></td>
</tr>
<tr>
<td>With prior CABG: &gt;1 lesion</td>
<td>19.5</td>
<td></td>
</tr>
</tbody>
</table>

National Outcomes Report (999997) compared to Rolling Four Quarters (R4Q) for US Hospitals ending 2015Q3
Other Quality Metrics: CathPCI Registry Data

- Stents per PCI admission: mean 1.45

- No obstructive CAD (proportion of elective coronary angiograms without a major coronary artery with a stenosis ≥ 50%. (excludes patients with prior CABG, cardiac transplant donor, pre-op evaluation for non-cardiac surgery, need for valve surgery or ICDs)

  - Median: 42.56%
  - 10th percentile: 55.17%
  - 25th percentile: 48.67%
  - 75th percentile: 36.51%
  - 90th percentile: 30.36%

- If > 50% of your diagnostic coronary angiograms do not have flow-limiting CAD, the non-invasive testing algorithm used to select patients for angiography should be re-evaluated

National Outcomes Report (999997) compared to Rolling Four Quarters (R4Q) for US Hospitals ending 2015Q3
Appropriateness use criteria (AUC)

- AUC rate PCI as appropriate care (A), of may be appropriate care (U) or rarely appropriate care (I)

- Takes into account
  - Canadian Cardiovascular Society (CCS) Angina class
  - Extent of ischemia on stress test (high, moderate, low risk)
  - Adequacy of medical treatment prior to PCI
  - Scenario (acute coronary syndrome, stable angina)
  - Complexity of CAD

- NCDR determines PCI AUC class based on data entry into on-line CathPCI registry form

- Therefore complete, clear and accurate documentation by staff aids in data abstraction and is key to improving your lab’s AUC scores

- Ideally information on angina class, stress test results and medical therapy should be obtained before hand from scheduling documents/ referring physician’s office note

- AUC are also valuable to interventionalist for decision making, specially if performing PCI following diagnostic angiogram performed by non-interventionalist

- **SCAI QIT webinar on 2012 revascularization AUC**

- **SCAI AUC app**
### Patients WITH Acute Coronary Syndrome: Proportion of evaluated PCI procedures that were appropriate

<table>
<thead>
<tr>
<th></th>
<th>My Hospital</th>
<th>US Hospitals 50th Pctl</th>
<th>US Hospitals 90th Pctl</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proportion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2015Q3</td>
<td>98.96%</td>
<td>98.96%</td>
<td>100.00%</td>
</tr>
</tbody>
</table>

Proportion of PCI procedures that were evaluated as "Appropriate", among patients with ACS, meaning coronary revascularization is generally acceptable and is a reasonable approach for the indication and is likely to improve the patients’ health outcomes or survival. [Detail Line:1581]

### Patients WITH Acute Coronary Syndrome: Proportion of evaluated PCI procedures that were inappropriate

<table>
<thead>
<tr>
<th></th>
<th>My Hospital</th>
<th>US Hospitals 50th Pctl</th>
<th>US Hospitals 90th Pctl</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proportion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2015Q3</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
</tr>
</tbody>
</table>

Proportion of PCI procedures that were evaluated as "Inappropriate", among patients with ACS, meaning coronary revascularization is not generally acceptable and is not a reasonable approach for the indication and is unlikely to improve the patients’ health outcomes or survival. [Detail Line:1583]

### Patients WITHOUT Acute Coronary Syndrome: Proportion of evaluated PCI procedures that were appropriate

<table>
<thead>
<tr>
<th></th>
<th>My Hospital</th>
<th>US Hospitals 50th Pctl</th>
<th>US Hospitals 90th Pctl</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proportion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2015Q3</td>
<td>52.03%</td>
<td>52.03%</td>
<td>80.10%</td>
</tr>
</tbody>
</table>

Proportion of PCI procedures that were evaluated as "Appropriate", among patients without ACS, meaning coronary revascularization is generally acceptable and is a reasonable approach for the indication and is likely to improve the patients’ health outcomes or survival. [Detail Line:1585]
Resources & Support

- SCAI QI Committee Assistance: Info@scai.org

- SCAI QIT Updates: http://www.scai.org/QIT/default.aspx

- SCAI QIT Tip of the Month: http://www.scai.org/QITTtip/default.aspx
Acknowledgments

- SCAI President: James C. Blankenship, MD

- SCAI QI Committee Chair/Vice-Chair: Sunil V. Rao, MD and Kalon K. Ho, MD

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