Leadership Saves Lives
Early Identification and In-House Treatment of Patients with AMI

The Problem: As the Leadership Saves Lives guiding coalitions began to systematically evaluate the root causes of mortality for their patients with AMI, they made a realization. Although most hospitals had well-refined care processes for patients arriving in the emergency department with STEMI, they had highly poorly designed care processes for patients with NSTEMI, and for patients developing an AMI after arrival.

The Response: Coalitions began to work together to create clearly defined care processes, seeking to apply the same rigor and process improvement approaches that they had used to improve their door-to-balloon processes. We present three case examples.

Case Study 1: AMI Risk Stratification
As part of their root cause analysis, some LSL hospitals identified the need for reliable classification of the most at risk AMI patients for (1) tracking of performance improvement over time and (2) proactive and multidisciplinary follow-up. One hospital decided to compare use of the TIMI and Cadillac scores. In addition to allowing the coalition to stratify their root cause analysis by patient acuity to check for anomalies, this tool traveled with the patient, allowing care providers to understand the history and severity of their presentation and tailor their care plan accordingly.

Case Study 2: NSTEMI Process of Care
Some LSL hospitals identified delays and a high level of variability in time to treatment for patients with NSTEMI. Working from their own data and staffing constraints, and integrating national guidelines, they developed and tested an operational definition to trigger timely review of patients with NSTEMI. The resulting process, was brought to life by a physician champion armed with data and the support of the coalition.

NSTEMI Process of Care Proposal
- All NSTEMI transfers have ECGs screened by cardiology attending at time of transfer request
- Define “At Risk” NSTEMI Patients
  - Refractory angina or resting/unstable angina despite medical management
  - Crease Score > 1.40
  - New or presumed new ST depressions on ECG
  - Significantly increasing temporal troponin pattern (>20%)
  - Signs or symptoms of heart failure
  - Hemodynamic instability
  - VT or VF
- All “At Risk” NSTEMI transfers verbally presented to attending by hospitalist or cardiology fellow as part of initial evaluation
- All “At Risk” NSTEMIs have echo evaluation for LV function and WAMs as part of the initial evaluation or at least within first 3-3 hours post admission
Case Study 3: ACS Patient in Distress

LSL hospitals identified need for more reliable and timely identification and care for patients whose AMI evolved in-house. The resulting AMI Patient in Distress bundle helped to standardize care processes and also empowered front-line nurses as part of the broader care team.

In this toolkit

The toolkit includes an editable PowerPoint deck on each of the three case studies, including rationale for the approach, the resulting tool, reflections on implementation experience, and a note about the importance of tailoring this approach to your local hospital context.
AMI Risk Stratification Tool
Rationale for the approach

As part of their root cause analysis, some LSL hospitals identified the need for reliable classification of the most at risk AMI patients for proactive and multidisciplinary follow-up.

One approach was to compare use of the TIMI and Cadillac scores.
“We really focused on identifying areas that we could work on. We implemented an acuity tool for our critical care areas. Then through that process, we really identified that we weren't capturing all of our non-STEMIs. That's when I really dove into finding objective measures for our STEMIs and our non-STEMIs. I implemented the TIMI risk versus the CADILLAC scoring. I score every single one of those patients.”
**Killip Classification of AMI**

<table>
<thead>
<tr>
<th>Score</th>
<th>Class</th>
<th>Class Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I</td>
<td>No evidence of heart failure</td>
</tr>
</tbody>
</table>
| 2     | II    | Findings consistent with mild to moderate heart failure (S3 gallop, lung rales less than one-half way up the posterior lung fields or jugular venous distension)  
Chest X-Ray: □ WNL □ Cardiomegaly □ Pulmonary Vascular Congestion |
| 3     | III   | Overt pulmonary edema: □ H&P Reported Lung Sounds: □ Clear □ No JVD  
OTHER: ProBNP= |
| 6     | IV    | Cardiogenic Shock □ IABP □ Impella |

**AMI Risk: Patient Cadillac Score**

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Score</th>
<th>Patient Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline LVEF &lt;40%</td>
<td>4</td>
<td>□ Possible EP Consult</td>
</tr>
<tr>
<td>LVEDP: mmHg.</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>CATH EF=</td>
<td>ECHO EF=</td>
<td>% Date:</td>
</tr>
<tr>
<td>Renal Insufficiency: BUN</td>
<td>Creatinine</td>
<td>3</td>
</tr>
<tr>
<td>eCrCl: mL/min.</td>
<td>GFR: mL/min/1.73m²</td>
<td></td>
</tr>
<tr>
<td>Killip Class II/III</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Age &gt;65 years</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Final TiMi Flow 0-2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Three-Vessel Disease: □ LMCA □ LAD □ Circumflex □ RCA</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Anemia: Hgb Hct %, WBC=</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

**Total AMI Cadillac Risk Score:**

<table>
<thead>
<tr>
<th>AMI Cadillac Risk Score</th>
<th>30-Day Mortality</th>
<th>One-year Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Risk (score 0-2)</td>
<td>0.1-0.2%</td>
<td>0.8-0.9%</td>
</tr>
<tr>
<td>Moderate Risk (score 3-5)</td>
<td>1.3-1.9%</td>
<td>4.0-4.5%</td>
</tr>
<tr>
<td>High Risk (score ≥6)</td>
<td>6.6-8.1%</td>
<td>12.4-13.2%</td>
</tr>
</tbody>
</table>

**TRI TIMI Risk Index to Predict Short-Term Mortality Post-AMI**

<table>
<thead>
<tr>
<th>TRI Index</th>
<th>Risk Group</th>
<th>Risk of Death: 24-Hour</th>
<th>Risk of Death: In-Hospital</th>
<th>Risk of Death: 30-Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤12.5</td>
<td>1</td>
<td>0.2</td>
<td>0.6</td>
<td>0.8</td>
</tr>
<tr>
<td>&gt;12.5 to 17.5</td>
<td>2</td>
<td>0.4</td>
<td>1.5</td>
<td>1.9</td>
</tr>
<tr>
<td>&gt;17.5 to 22.5</td>
<td>3</td>
<td>1.0</td>
<td>3.1</td>
<td>3.3</td>
</tr>
<tr>
<td>&gt;22.5 to 30</td>
<td>4</td>
<td>2.4</td>
<td>6.5</td>
<td>7.3</td>
</tr>
<tr>
<td>&gt;30</td>
<td>5</td>
<td>6.9</td>
<td>15.8</td>
<td>17.4</td>
</tr>
</tbody>
</table>

**TRI Formula:** 
\[
(\text{Heart Rate}) \times \left\{ \frac{\text{age}}{10} \right\}^{2} \div \text{Systolic Blood Pressure(NIBP)}
\]

**ER/EMS= CARDIAC CATH=**

**LACE Score:**

□ CIN RISK: Evidenced by: Decreased EF % and ANEMIA
□ NEPHRECTOMY
LSL: AMI Risk Scores

TIMI Risk Score verses Cadillac Score
May 2015 – May 2016

TIMI RISK INDEX

- Group 1-Low: 166 (40.98%)
- Group 2-Low: 55 (21.74%)
- Group 3-Mod: 65 (16.00%)
- Group 4-Mod: 86 (20.99%)
- Group 5-High: 33

Cadillac AMI Mortality Risk Predictor

- Low: 163 (40.25%)
- Moderate: 157 (38.8%)
- High: 85 (20.99%)

P = 405
“This completed form with this gets faxed to cardiology consultants’ scheduling team for AMI as well as their nurse director, and their nurse leader, as well as the two nurse practitioners that run AMI clinic, as well as our pharmacy, our CV patient educators. They have an idea of how critical this patient was in the cath lab setting or the pre-cath lab setting. Then it also goes to the case management and all of the discharge charge nurses on the unit. It gets disbursed to a large population.”
Disclaimer

This Risk Stratification Form was generously shared by Baptist Health Care as part of their participation in LSL. It is intended to serve as a starting point for conversations about how to improve in-house care processes, and should not be interpreted as an ACC-endorsed clinical guideline.

We encourage your hospital team to adapt this approach to your own needs and local context.

Thank you to the entire LSL Guiding Coalition at Baptist Hospital for their commitment to improving outcomes for patients with AMI.
NSTEMI Process of Care Protocol
Rationale for the approach

Through root cause analysis, some LSL hospitals identified opportunity for more reliable and consistent identification NSTEMI patients.

One solution was to create an NSTEMI process of care protocol.
“We have a STEMI meeting every week where we go over every STEMI. But we don’t have a process for doing that with NSTEMI mainly because it’s a different animal. A STEMI has a bunch of timelines. It’s a process. It’s a front loaded process in terms of decisions, in terms of metrics, in terms of treatment. NSTEMI is not like that. That’s the bulk actually of AMI. It’s about 65/70 percent. They come in. They get diagnosed somewhere. They usually are stabilized, and they get transferred to us. They get evaluated by us, and then they sit around for 24 to 48 hours depending upon what we find out about them…It’s a different animal.”

“Then we got a bunch of data, and I started noticing the difference between STEMI’s and NSTEMI’s. I started noticing that with STEMI’s there was never any waiting. STEMI’s were dying after revascularized them. You’ve done everything you could. But the NSTEMI’s are coming in - somebody thought they were stable, and then they deter which makes you think you’ve got really more of an opportunity with them.”

-- members of the Guiding Coalition
NSTEMI Process of Care Proposal

- All NSTEMI transfers have ECGs screened by cardiology attending at time of transfer request

- Define “At Risk” NSTEMI Patients
  - Refractory angina or resting/low threshold angina despite medical management
  - Grace Score >140
  - New or presumed new ST depressions on ECG
  - Significantly increasing temporal troponin pattern (>20%)
  - Signs or symptoms of heart failure
  - Hemodynamic instability
  - VT or VF

- All “At Risk” NSTEMI transfers verbally presented to attending by hospitalist or cardiology fellow as part of initial evaluation

- All “At Risk” NSTEMIs have echo evaluation for LV function and WMAs as part of the initial evaluation or at least within first 2-3 hours post admission
Implementation Experience

- Initial presentation at Cardiology Grand Rounds

- Reformulation from “all NSTEMI patients” to only “at risk” NSTEMI patients (using ACC Guidelines)

- Significant resistance from cardiology attending staff, particularly Echo attendings

- Decision by section chief for partial implementation
  - All pre transfer ECGs reviewed by cardiology fellow
  - All NSTEMI admissions reviewed by cardiology fellow with strong recommendation to present to high risk patients to attending
  - Early Echo not considered to have adequate evidence base to justify added resource expenditure

“We got a lot of pushback from people who were not happy with the protocol, because it added an additional burden at night, on the person who was doing service all week. We took that feedback, came back to the coalition, did a bunch of literature review. Now they’ve agreed that the high risk patients which are defined by a set of criteria, those are the patients that’ll be reviewed fellow to attending, regardless of the time of day.”
Disclaimer

This NSTEMI Process of Care was generously shared by Dartmouth-Hitchcock Medical Center as part of their participation in LSL. It is intended to serve as a starting point for conversations about how to improve in-house care processes, and should not be interpreted as an ACC-endorsed clinical guideline.

We encourage your hospital team to adapt this approach to your own needs and local context.

Thank you to the entire LSL Guiding Coalition at Dartmouth-Hitchcock Medical Center for their commitment to improving outcomes for patients with AMI.
ACS Patient in Distress Protocol
Rationale for the tool

Through root cause analysis, some LSL hospitals identified opportunity for improvement in reliable and timely identification and care for patients whose AMI evolved in-house.

One solution was to create an AMI Patient in Distress bundle. This bundle helped standardize and streamline care, and also empowered front-line nurses as part of the broader care team.

The template on the following slide was used during early piloting, and then built into EPIC for better automation.
**ACs Patient in Distress Bundled Checklist**

### Patient Identification
- Unique ID

### Bundle Inclusion Criteria
- Chest pain or discomfort (retro-sternal, jaw, neck, arm, back)
- Chest pressure or tightness, altered color, sweating, lightheadedness
- "Heartburn" (epigastric pain or persistent nausea)
- Known anginal equivalent or patient report of anginal equivalent (or other symptoms suspicious for ischemia)
- New or sudden change in HR (greater than 100 or less than 50 or symptomatic arrhythmia)
- Syncopal episode or severe weakness (pre-syncope associated with SBP less than 90)
- SOB/dyspnea with no obvious non-cardiac cause with decreasing PO2 with increasing FiO2

### Bundle Start Time ("Time Zero")
- Time
- Date

### Bundle Non Adherence?
- Advanced directive for comfort care
- CT patient/CT team declined
- Patient non-report of symptoms
- Patient declined therapy
- Other (please explain):

### Within 10 minutes
- ECG Complete
  - Date
  - Time
- Time provider in room
- Labs if ordered
  - Start Time
  - Start Date
- Oxygen Administration for SpO2 less than 92%
  - O2 applied
  - O2 delivery method

### With Provider Order
- **STEMI**
  - Nitroglycerin SL
  - Nitroglycerin IV
  - Aspirin administration
  - ticagrelor
  - STEMI Alert called by cardiology fellow
  - Patient transferred to cath lab
- **Not a STEMI**
  - Nitroglycerin SL
  - Nitroglycerin IV
  - Aspirin
  - ticagrelor
  - Cath lab alert called by cardiology fellow
  - patient placed on cath lab schedule as appropriate

### Patient Demographics and Physiologic Information
- Height
- Age
- Weight
- Gender
- Troponins 1st
- Troponins 2nd
- Troponins 3rd
- HR
- Rhythm
- SpO2
- RR
- BP
- MAP
- MAP
Implementation experience

“We have [our incoming STEMIs] nailed down, but this is for people who might not even have a STEMI, and they're deteriorating. How long does it take to get the attending or a fellow involved? There's a culture among trainees that "Oh, I can handle this, so I'm not going to call anybody [at night]." Attendings would come in in the morning, look at EKGs and be like, "Oh my god. Why isn't this patient in the cath lab?"

“The nurse specialist, clinical nurse specialist, and the nurse manager, they became very involved with LSL. We did swim lanes, asking, “Nurse notices something, so what does the nurse do? What does the doctor do? How does the doctor know? What does the health safety nurse do? At what point do the cath lab and the attending get notified?”

“They worked with the guiding coalition to figure out what pre-populated orders they wanted in that protocol, and they went and they trained all of their LNAs, all of their support staff and their RNs to be able to do their own 12 lead EKG, because one of the criteria was an EKG within ten minutes of any onset of symptoms. They've been reporting out on their findings for the pilot and it's really been quite positive - to the point where last week's meeting was really about how do we go about rolling out the ACS patient in distress protocol to the rest of the house.”
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