ePOD
(early Predictor Of Deterioration)

January 25, 2016
AAMI Foundation

• **Vision:** To drive the safe adoption and use of healthcare technology

• Visit our website [National Coalition for Alarm Management Safety](#)
  • **NEW** [Clinical Alarm Management Compendium](#)

• Get involved and consider making a donation to this important national effort!

• Contact Sarah Lombardi at [slombardi@aami.org](mailto:slombardi@aami.org)
Thank You to Our Industry Partners

This Patient Safety Seminar is offered at no charge thanks to funding from our National Coalition for Alarm Management Safety industry partners. The AAMI Foundation and its co-convening organizations appreciate their generosity. The AAMI Foundation is managing all costs for the series. The seminar does not contain commercial content.
LinkedIn Questions

Join our group

Please post questions about alarms on the 
AAMI Foundation’s LinkedIn page

OR

Type questions into “Question” box on the webinar dashboard.

OR

Email slombardi@aami.org
Speaker Introductions

• Kathy J. Simpson, BSN, RN – Director, Medical Emergency Team, Intermountain Medical Center

• Kathryn G. Kuttler, PhD - Director of Clinical, Quality and Research Medical Informatics, Homer Warner Center, Intermountain Healthcare

• R. Scott Evans, MS, PhD - Medical Informatics Director, Intermountain Healthcare; Professor of Biomedical Informatics, University of Utah
Disclosures

• Kathy Simpson: None
• Kathryn Kuttler: None
• Scott Evans: None
Initial Collaborators/Developers

- Scott Evans, PhD
- Kathryn Kuttler, PhD
- Kathy Simpson, RN
- Terry Clemmer, MD
- Stephen Howe, BS
- Kyle Johnson, BA
- Peter Crossno, MD
- Roger Keddington, APRN
- William Tettelbach, MD
- Misty Schreiner, RN
- Alden Tanner, RN
- Chelbi Wilde, RN
- Jeff Moore
- James Lloyd
ePOD Objectives

• Why we need help with early recognition
  • IHI Mortality Diagnostic
• How failure/delays in “rescue” of acute care patients affects their outcomes
• Why hospitals, as rapid response systems, need two limbs to be effective:
  • Afferent (recognition)
  • Efferent (response/treatment)
• ePOD algorithm and methods
• ePOD evaluation and conclusion
IHI Mortality Diagnostic

“People die unnecessarily every single day in our hospitals. The goal is to respond to a “spark” before it becomes a forest fire.”

2005 Institute for Healthcare Improvement

<table>
<thead>
<tr>
<th></th>
<th>ICU Admission</th>
<th>No ICU Admission</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Comfort Care</strong></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>86/3175</td>
<td>402/3175</td>
</tr>
<tr>
<td></td>
<td>3%</td>
<td>13%</td>
</tr>
<tr>
<td></td>
<td>(0-14%)</td>
<td>(0-40%)</td>
</tr>
<tr>
<td><strong>Non Comfort Care</strong></td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>1161/3175</td>
<td>1526/3175</td>
</tr>
<tr>
<td></td>
<td>37%</td>
<td>48%</td>
</tr>
<tr>
<td></td>
<td>(10-72%)</td>
<td>(18-76%)</td>
</tr>
</tbody>
</table>

Aggregate Results for 64 US Hospitals

AAMI FOUNDATION
Box four should further be analyzed by asking if there were any...

- Failures in planning
  - Includes assessments, treatments, goals
- Failure to communicate
  - Patient-to-staff, staff-to-staff, staff-to-physician, etc.
- Failure to recognize a deteriorating patient

These three problems often lead to **Failure to Rescue** *(IHI 2005)*
Failure/Delays in Rescue
what we know…

- Risk of death from in-hospital cardiac arrest is 50-90%

- “Unexpected” cardiac arrests usually preceded by 6-8 hours of instability (deterioration time)

- Patients who are attended to within 30-60 minutes of physiologic deterioration have significantly lower mortality rates

References:
- Crit Care Med 2008;36:634–6,
- Chest 1990; 98: 1388-92
Delays in Rescue  
Mike Young et al

Identified simple clinical predictors of rapid deterioration in patients on acute care units who may have benefited from prompt ICU admission

*JGIM 2003:18:77-83*
Delays in Rescue (cont.)

- 91 consecutive non-cardiac inpatients
- Determined the time each patient first met a physiologic criterion (deterioration time)
- Categorized patients into “rapid” transfers (≤ 4 hrs) and “slow” transfers (> 4 hrs)
- At the time the first physiologic criterion was met on the acute care unit, groups were similar in terms of demographics, diagnosis, severity of illness and APACHE II scores
By the time they were admitted to the ICU, slow-transfer patients were far sicker than the rapid-transfer patients:

- Significantly higher APACHE II scores (21.7 vs 16.2)
- Four-fold higher risk of hospital mortality (41% vs 11%)
- 60% higher total hospital costs ($34k vs $21k)
Delays in Rescue affects ability to function independently at discharge

- Slow Transfer:
  - Dependent at discharge: 33%
  - Died in-hospital: 11%

- Rapid Transfer:
  - Dependent at discharge: 41%
  - Died in-hospital: 16%
Addressing Failure to Rescue
Recognition and Treatment

To be effective, **hospitals**, as rapid response systems, must have two limbs:

- Afferent (recognition) **ePOD**
- Efferent (medical response/treatment) **RRT**
Addressing Failure to Rescue (cont.)

Recognition

The success of a Healthcare System’s ability to prevent acute care codes and keep their patient’s safe is directly tied to any given bedside clinician’s:

• experience
• clinical judgment
• work environment
• ability to recognize deterioration
Addressing Failure to Rescue (cont.)

Recognition

• Because **we know** that half of patients who die on acute care units do so unexpectedly; many of them after prolonged deterioration

• Support bedside clinicians with a clinical algorithm that helps them recognize their patient’s deterioration sooner…

  **ePOD early Predictor Of Deterioration**
ePOD

• Applies to acute care patients ≥ 13 years
• Exclusions: ED, ICU, OR/PACU, L&D, hospice/comfort care patients
• Six patient parameters analyzed and assigned a “score” each time new vitals are entered in the computer (EMR)
  • SBP, HR, RR, temp, change in oxygen requirements and neurological data
• When cumulative score is ≥ 4, an alert is sent via text to a designated clinician on the unit (charge nurse), who further assess the patient with the bedside nurse
  • Emails or pages can be sent to other recipients as well (e.g. manager, educator, nursing supervisor, LIP)
<table>
<thead>
<tr>
<th></th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>SBP</td>
<td>≤ 50</td>
<td>51 - 70</td>
<td>71 - 81</td>
<td>82 - 90</td>
<td>91 - 199</td>
<td>≥ 200</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HR</td>
<td>≤ 34</td>
<td>35 - 40</td>
<td>41 - 51</td>
<td>52 - 114</td>
<td>115 - 124</td>
<td>125 - 129</td>
<td>130 - 200</td>
<td>≥ 201</td>
<td></td>
</tr>
<tr>
<td>Temp</td>
<td>≤ 38.0</td>
<td>38.1 - 38.9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RR</td>
<td>≤ 7</td>
<td>8 - 9</td>
<td>10 - 23</td>
<td>24 - 25</td>
<td>26 - 29</td>
<td></td>
<td>≥ 30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>O2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>O2 increase by ≥ 3 LPM</td>
<td>Change from NC to mask</td>
<td></td>
</tr>
<tr>
<td>Neuro AVPU:</td>
<td>Unresponsive</td>
<td>Responds to Pain</td>
<td>Responds to Voice</td>
<td>Alert</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NAMDU</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Moderate sedation</td>
<td>Deep sedation</td>
<td>unconscious</td>
</tr>
</tbody>
</table>
EMR Graphs

• When the ePOD score reaches $\geq 4$, an alert is sent to bedside clinician who takes appropriate action:
  • Clinical interventions
  • May notify LIP/MD
  • Problem charting

• An icon in the EMR can be accessed to display 24 hours’ worth of vital sign data in graphical form, assisting the clinician in identifying trends and deterioration
ePOD Alert: 4  Triggered at: 05/13/2015 12:25
SBP: 83, 05/13/2015 12:25, points: 3
HR: 118, 05/13/2015 12:25, points: 1
BP: 22, 05/13/2015 12:25, points: 0
Temp: 36.8, 05/13/2015 12:25, points: 0
O2: 0, points: 0
LOC: , points: 0

**ePOD Score**

**Systolic BP (mm Hg)**

**Heart Rate (bpm)**

**Respiratory Rate (bpm)**

**Temperature (°C)**
ePOD alerting methods

- Pager
- Cell Phone
- email
- Vocera – Audio & Text alert
- Spectralink
Vocera/pager/cell alerts

Mar 12, 7:33 AM

(ePOD Alert) Room: T1307
Patient: 123456789
Advanced Directive found. POLST found.
SBP: 57
HR: 128

• Date and time is that of the page/text, not alert
• Only displays values with points
• Vocera only says/texts “ePOD alert” and room #
Room: T111    Patient: 098765432  Name: XTEST, SAM H
Age: 79Y  Gender: M  Admit Diagnosis: PYELONEPHRITIS
Height: 160 cm       Weight: 72 kg       BSA: 1.83 sqm   BMI: 24.9
Advance Directive found: 02/07/15 00:31

ePOD Alert
ePOD (early Predictor Of Deterioration): 7 Triggered at: 02/09/15 15:51

SBP: 51, 02/09/2015 15:39, Points: 3
HR: 119, 02/09/2015 14:10, Points: 0
RR: 14, 02/09/2015 14:05, Points: 0
Temp: 0, --/--/---- --:--, Points: 0
O2 LPM: --/--/---- --:--, Points: 0
LOC (unresponsive): 02/09/2015 15:51, Points: 4
ePOD Study

After a two year prospective study of ePOD, we found:

• Positive predictive value between 91-98%
• Significant increase in appropriate MET calls (60 vs 29, p = 0.0004)
• MD notified 44-90% of the time after receiving an alert
• Interventions occurred 52-72% of the time
• Significantly fewer patients died [84 (2.6%) vs 125 (3.7%), p = 0.022] (MET deterioration time affected)
Thank you for attending!

Slides & Recording Available on the National Alarm Coalition website.
Free Alarm Resources

• **National Alarm Coalition Compendium** *NEW*
• **Safety Innovations Series**
  • White Papers
  • Patient Safety Seminar Recordings
• **Alarms Management Patient Safety Seminars**
  • Seminar Recordings
  • Seminar Slides
  • Key Points Checklists
Questions?

Please visit the AAMI Foundation’s LinkedIn page to post a question

Or you can email your question to: slombardi@aami.org.
Thank You to Our Industry Partners

This Patient Safety Seminar is offered at no charge thanks to funding from our National Coalition for Alarm Management Safety industry partners. The AAMI Foundation and its co-convening organizations appreciate their generosity. The AAMI Foundation is managing all costs for the series. The seminar does not contain commercial content.

<table>
<thead>
<tr>
<th>Platinum</th>
<th>Gold</th>
<th>Silver</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medtronic &amp; COVIDIEN</td>
<td>Baxter</td>
<td>BBRAUN Sharing Expertise</td>
</tr>
<tr>
<td>Extension HealthCare</td>
<td>CareFusion</td>
<td>EarlySense</td>
</tr>
<tr>
<td>GE Healthcare</td>
<td>Cerner</td>
<td>Masimo</td>
</tr>
<tr>
<td>PHILIPS</td>
<td>Dräger</td>
<td>Sotera Wireless</td>
</tr>
<tr>
<td></td>
<td>mindray</td>
<td>Spacelabs Healthcare</td>
</tr>
</tbody>
</table>
Consider Making a Donation to the AAMI Foundation Today!

Making Healthcare Technology Safer, Together

Click here to donate online

Thank you for your support!