HIMSS DAVIES AWARD

CLEVELAND CLINIC
Our mission is to provide better care of the sick, investigation into their problems, and further education of those who serve.
## LOCAL PROBLEM

<table>
<thead>
<tr>
<th></th>
<th>Paper</th>
<th>Clinical Decision Support</th>
<th>New Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk Score Framework</td>
<td>☑</td>
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<tr>
<td>Defined Interventions</td>
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<td>Manually Reportable</td>
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<td>Event Based</td>
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<td>Computable</td>
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<tr>
<td>Non-Manually Reportable</td>
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</tbody>
</table>
DESIGN PROCESS

TRADITIONAL PROCESS

Understand \rightarrow IDEA! \rightarrow Develop

NEW PROCESS

Explore \rightarrow Watch \rightarrow Empathy
Create \rightarrow Prototype \rightarrow Repeat
Iterate \rightarrow Implement
DESIGN PROCESS

ASK

OBSERVE

CREATE

Obvious       Implied       Undiscovered
IT PROJECT SELECTION PROCESS: eCSC TOOLS OF THE TRADE

- Clinical Data
  - Request Routing
  - Data Validation
  - Standardized API
  - Composite Services
  - Batching

- CSL BROKER LAYER

- CSL DATA LAYER
  - EPIC
  - ANALYTICS DB
  - IMAGING

Access Management
- Security
- Logging
- App Management
- Reporting
- Caching
- Documentation
1994 – Lucian Leape, MD, “Error in Medicine”
1999 – Institute of Medicine (IOM) Report
2014 – Cleveland Clinic Vital Scout Journey Begins…
2016 - Johns Hopkins – BMJ

**Agency for Healthcare Research and Quality (AHRQ):**
“The concept of [failure to rescue](https://www.ahrq.gov/) captures the idea that, although not every complication of medical care is preventable, health care systems should be able to rapidly identify and treat complications when they occur.”

- 80% Cardiopulmonary arrests with signs of deteriorating in preceding 24-hours
- Greater than ½ are felt to be preventable

BMJ 2016;353:i2139
LOCAL PROBLEM | % TIME SPENT AT HIGHER ACUITY – MED/SURG UNITS

Pre-Implementation (2015-2016)
LOCAL PROBLEM | AVERAGE TIME TO REASSESSMENT (Median Minutes)

Pre-Implementation (2015-2016)
LOCAL PROBLEM | WORKFLOW

- Communication
- Chain of command
- Transition to practice gap
- Preponderance of technology
- Workflow variance

Assessment ➔ Diagnosis

Evaluation ➔ Planning

Implementation ➔ Nurse A ➔ Physician ➔ PCNA ➔ Nurse B
Situational Awareness (SA)

Key Components:

• Awareness of information
• Comprehension of its meaning
• Projection of future status

Under stress, SA is adversely effected.

SA is difficult to measure: You can’t process what you’re not aware of!
LOCAL PROBLEM

CHALLENGE

Turning data into Actionable Knowledge

GOAL

Timely recognition & intervention for early signs of clinical deterioration on Medical/Surgical units
USER MEETINGS

ITERATIVE DEVELOPMENT

CONTINUOUS FEEDBACK

• Agile
• Design
• Functionality
• Adaptability
• Improvements
Increased accountability for taking and recording vital signs in the EHR in a timely manner

Increased frequency of vital sign monitoring and re-assessment for patients identified with moderate or high risk early warning system (EWS) scores

Increased communication and collaboration among caregivers regarding significance and management of subtle changes in patient condition

Improved recognition and intervention for early signs of clinical deterioration
GOVERNANCE STRATEGY & SCALING

**Vital Scout Enterprise Pilot & Core Team**
- Project Manager
- Executive Sponsorship (ACIO, ACNO)
- Clinical Lead
- Technical Clinical Solutions Center Lead
- Education Lead
- Nursing Informatics Lead
- Nursing Quality Lead
- Physician Sponsor

**8 Local Implementation Teams**
- Local Executive Sponsor (Hospital CNO)
- Clinical Lead
- Education Lead
- Nursing Informatics Lead
- Local Systems Engineer Team Lead
- Nursing Quality Lead
- Physician Sponsor
Pilot & Major Revision

- Root Cause Analysis
- Research & Literature Review
- Team Formation
- Proposal development
- Pilot metrics established
- Leadership approval
- Ongoing User Meetings/Iteration
- EPIC Build(s)
- Initial Education Planning
- Interactive Caregiver Testing Sessions
- Hospital-wide education
- Pilot!

Vital Scout Version 2.0

- Metrics Evaluation
- Version 2.0 build & testing
- Intervention algorithm revised
- Education revised
- Quality Metrics Developed
- 2nd Hospital Live
- Playbook Developed/Finalized (6-week go-live cycle)
- Vital Scout Screensaver Developed
- Additional Hospitals Go Live
- Rolling metric report-out

... Version 3.0?
SUSTAINABLE QUALITY IMPROVEMENT

Supplemental Oxygen Impact
N=41 2nd quarter codes/RRTs at Medina Hospital
VSA (Pilot) score within 8 hours of event

- Current VSA not sensitive to supplemental oxygen use
- Weighing for supplemental oxygen use may increase opportunity to intervene earlier to prevent deterioration
**DNR-CC – Comfort Care Only (designated by color purple)**

*Nursing Staff can *always* escalate to higher level (i.e. from green to red)*
VITAL SCOUT

VITAL SIGN (Flowsheet) Discrete Value (Flowsheet)

<table>
<thead>
<tr>
<th>Vital Sign (Flowsheet)</th>
<th>Discrete Value (Flowsheet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart Rate</td>
<td>93</td>
</tr>
<tr>
<td>Respiratory Rate</td>
<td>22*</td>
</tr>
<tr>
<td>Blood Pressure</td>
<td>147/69*</td>
</tr>
<tr>
<td>SpO2</td>
<td>88*</td>
</tr>
<tr>
<td>Oxygen Supplementation</td>
<td>NC*</td>
</tr>
<tr>
<td>Vital Scout Score</td>
<td>5</td>
</tr>
<tr>
<td>(Calculates “On File” Trigger)</td>
<td></td>
</tr>
</tbody>
</table>

IMPLEMENTATION | WORKFLOW DEVELOPMENT

HL7 Message/ Device Integration

Mobile App Entry (Web Services)

Manual EMR Flowsheet Entry

VITAL SCOUT
Iris Mobile Application

VITAL SCOUT
* HIPAA de-identified information outside of Epic (location only) with the screen saver facilitates rapid recognition of patient changes; full workflow remains within EMR

© 2017 Epic Systems Corporation. Used with permission.
Shared Report: Getting Caregivers on the same page
Discrete, form-based documentation tools surface information in appropriate workflow for nurses, providers and allied health professionals.

They enhance transparency around notifications – appearing on the shared report.
<table>
<thead>
<tr>
<th>Feature</th>
<th>Paper</th>
<th>Clinical Decision Support</th>
<th>Pilot &amp; Vital Scout</th>
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<tr>
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<td>Non-Manually Reportable</td>
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<tr>
<td>Situational Awareness</td>
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<tr>
<td>Interactive Visualization</td>
<td></td>
<td></td>
<td>✔</td>
</tr>
<tr>
<td>Population Health Management</td>
<td></td>
<td></td>
<td>✔</td>
</tr>
<tr>
<td>Defined Escalation</td>
<td></td>
<td></td>
<td>✔</td>
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<tr>
<td>Accountability</td>
<td></td>
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</table>
% Events Occurring within 24 Hours Admission

% events occurring within 24 hours of admission – Pilot Facility

Pilot go-live Feb, 2015

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<th></th>
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<th></th>
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</thead>
<tbody>
<tr>
<td>% events</td>
<td>45%</td>
<td>50%</td>
<td>57%</td>
<td>41%</td>
<td>37%</td>
<td>23%</td>
<td>27%</td>
<td>35%</td>
<td>24%</td>
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</tbody>
</table>
VALUE | % TIME SPENT AT HIGHER ACUITY – MED/SURG UNITS

Pre-Implementation (2015-2016)

Post-Implementation (2016-2017)
VALUE | MEAN TIME TO REASSESSMENT

120 Minute Set Target
### Reassessment Times in YELLOW Patients

<table>
<thead>
<tr>
<th>Minutes</th>
<th>Base</th>
<th></th>
<th>Vital Scout</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Freq</td>
<td>%</td>
<td>Freq</td>
<td>%</td>
</tr>
<tr>
<td>0 - 60</td>
<td>23</td>
<td>6%</td>
<td>29</td>
<td>8%</td>
</tr>
<tr>
<td>60 - 120</td>
<td>55</td>
<td>14%</td>
<td>256</td>
<td>71%</td>
</tr>
<tr>
<td>120 - 180</td>
<td>188</td>
<td>49%</td>
<td>68</td>
<td>19%</td>
</tr>
<tr>
<td>&gt; 180</td>
<td>120</td>
<td>31%</td>
<td>9</td>
<td>2%</td>
</tr>
</tbody>
</table>

- At Baseline **20%** of yellow/at risk patients were reassessed within 2 hours.
- After the GoLive date, **79%** of yellow/at risk patients were reassessed within 2 hours as of **5/2017**
105,182 Net Green Hours Gained...

“... What we will do with these green hours?”
VALUE | IMPACT ON IT CULTURE

IT Leadership

Clinical Leadership

Developers

Systems Analysts

Life Cycle

Field Services

Nurses

Physicians

Clinical Analysts

Education

Cleveland Clinic

VITAL SCOUT | 32
VALUE | IMPACT BY THE NUMBERS

1,729 - Patient Beds under surveillance by Vital Scout

3,261 – Nursing Caregivers Trained - Education Program

2,928 – Nursing Continuing Education Credits Awarded (8/2017)

2,500 – Vital Scout Screensavers Running 24/7/365... refreshing every 2 minutes

11.5 MILLION - API Service Calls per Month to keep the data accurate and real-time!

21 – Help Desk Incidents since 2015
**Costs**

- Vital Scout Development Cost: $671,000
- Training Cost: $86,000
- **Total Program Investment Estimate To-Date**: $757,100

**Return on Investment**

- Decrease in Cardiac Arrests post implementation of Vital Scout

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of cardiac arrests</th>
<th>Cardiac arrests per 1,000 med/surg patient days</th>
<th>% decrease in cardiac arrests since 2014</th>
<th>Cost for post arrest care based on 50% survival rate at cost of $27,500</th>
<th>Cost savings since 2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014 (pre-implementation)</td>
<td>18</td>
<td>0.73</td>
<td></td>
<td>$247,500</td>
<td>$247,500</td>
</tr>
<tr>
<td>2015 (post-implementation)</td>
<td>14</td>
<td>0.53</td>
<td>28%</td>
<td>$195,500</td>
<td>$52,000</td>
</tr>
<tr>
<td>2016</td>
<td>12</td>
<td>0.46</td>
<td>37%</td>
<td>$165,000</td>
<td>$82,500</td>
</tr>
<tr>
<td>2017 (January-June)</td>
<td>5</td>
<td>0.37</td>
<td>51%</td>
<td>$68,750</td>
<td>$55,000</td>
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</tbody>
</table>

**Total cost savings**: $189,500
<table>
<thead>
<tr>
<th>Hospital #1 LOS and Case Mix Index</th>
<th>2015</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Med/Surg admissions</td>
<td>5,625</td>
<td>5,493</td>
</tr>
<tr>
<td>Med/Surg ALOS</td>
<td>4.19</td>
<td>4.20</td>
</tr>
<tr>
<td>CMI</td>
<td>1.37</td>
<td>1.41</td>
</tr>
<tr>
<td>Case Mix adjusted LOS</td>
<td>2.82</td>
<td>2.79</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LOS savings in days</th>
<th>LOS savings in dollars (est)</th>
</tr>
</thead>
<tbody>
<tr>
<td>164.79</td>
<td>$69,376.59</td>
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</table>

<table>
<thead>
<tr>
<th>Hospital #2 LOS and Case Mix Index</th>
<th>2015</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Med/Surg admissions</td>
<td>18,064</td>
<td>17,572</td>
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<tr>
<td>Med/Surg ALOS</td>
<td>4.98</td>
<td>4.92</td>
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<tr>
<td>CMI</td>
<td>1.48</td>
<td>1.53</td>
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<tr>
<td>Case Mix adjusted LOS</td>
<td>3.5</td>
<td>3.39</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>LOS savings in days</th>
<th>LOS savings in dollars (est)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,933.00</td>
<td>$813,793.00</td>
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</tbody>
</table>
### VALUE | NURSE & PROVIDER SATISFACTION (PILOT)

#### Earlier Interventions for signs of deterioration
(N=85)  
- Adequate Training: 8% No, 91% Yes
- More Frequent VS reassessment: 6% No, 94% Yes
- Adequate Training: 6% No, 94% Yes

#### Better Management of Patient Acuity with VSA?

- 69% Yes
- 5% No
- 26% Same

#### VSA impact on Interdisciplinary Collaboration (N=78)

- 72% More
- 26% Same
- 2% Less
Predominating Themes:
- Awareness
- Investigation
- Prioritization
- Communication & collaboration
- Accountability
- Proactive response
- Impact on outcomes

Figure 1. Conceptual Model Describing the Impact of an Enhanced Early Warning System (EWS) on Nursing Practice, Organizational Culture, and Patient Outcomes
• Organizational leadership support
• Education focus on using technologies to support nursing process
• Change Management Strategy applied to each hospital rollout
  • Playbook to guide implementation
  • Partnership between Enterprise and Hospital Team
• Diverse development team
• Share the patient story with the IT developers
• Iterative approach
VALUE | LESSONS LEARNED

- EMPATHY
- VESTED INTEREST
- RESILIENCE
- PERSERVERANCE
<table>
<thead>
<tr>
<th>POD/Time</th>
<th>POD 2 1600</th>
<th>POD 2 2300</th>
<th>POD 3 0708</th>
<th>POD 3 1541</th>
<th>POD 4 0005</th>
<th>POD 4 0809</th>
<th>POD 4 0839</th>
<th>POD 4 1600</th>
<th>POD 4 2350</th>
<th>POD 5 0758</th>
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<tbody>
<tr>
<td>Pulse</td>
<td>94</td>
<td>95</td>
<td>102</td>
<td>116</td>
<td>117</td>
<td>104</td>
<td>115</td>
<td>76</td>
<td>121</td>
<td>106</td>
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<tr>
<td>Resp</td>
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<td>20</td>
<td>20</td>
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<tr>
<td>BP</td>
<td>152/74</td>
<td>137/72</td>
<td>130/72</td>
<td>102/72</td>
<td>88/58</td>
<td>99/57</td>
<td>73/51</td>
<td>100/64</td>
<td>112/61</td>
<td>99/61</td>
</tr>
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<td>SpO2</td>
<td>97</td>
<td>100</td>
<td>97</td>
<td>97</td>
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<td>95</td>
<td>97</td>
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