

Educating and Training Your Staff: Circling Back to Your Policies and Procedures

April 29, 2014

Healthcare Technology Safety Institute

- HTSI

- Brings together multidisciplinary stakeholders to identify patient safety issues
- Sets priorities and works together to solve them

- Visit our website to learn more about the program

- Get involved and consider making a donation to this important national effort!
- www.aami.org/htsi
 - Or....call Marilyn Neder Flack, Executive Director, AAMI Foundation at 703-647-2770
 - Sarah Fanta Lombardi, Senior Project Manager, HTSI at 703-253-8297

Co-Conveners




Thank You to Our Sponsors



This webinar series is offered at no charge thanks to commercial grants from the companies shown here. HTSI and its co-convening organizations appreciate their generosity. AAMI and HTSI are managing all costs for the series. None of the co-convening organizations participated in seeking, discussing, or otherwise facilitating the commercial grants. The companies had no role in content development, and the webinars do not contain commercial content. Webinar presenters were selected based on topic expertise without regard to industry affiliation by a multi-disciplinary HTSI volunteer planning committee.

LinkedIn - Questions

Join our group ™

Please post questions about alarms on HTSI's
LinkedIn page:

<http://www.linkedin.com/groups/Healthcare-Technology-Safety-Institute-HTSI-4284508>

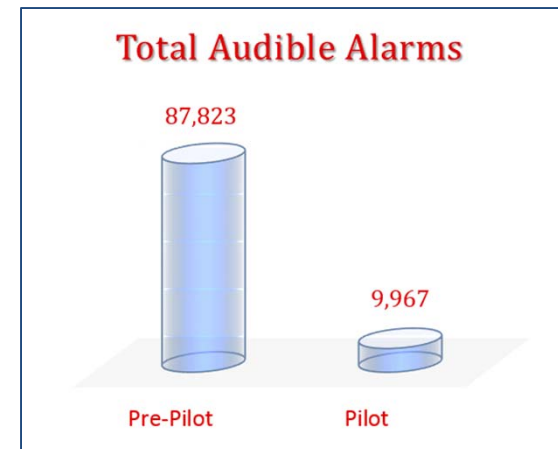
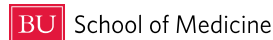
Speaker Introductions

- **James Piepenbrink, BSBME**, Director of Clinical Engineering, Boston Medical Center
- **Jaspreet Mankoo, BS**, Clinical Engineering Intern, VA Boston Healthcare System, UConn Clinical Engineering MS Program
- **Ekta Srinivasa, RN**, Clinical Resource Nurse, VA Boston Healthcare System
- **Russell S. Coggins, RN, MSN**, Clinical Nurse Advisor for Critical Care, Office of Nursing Services (Field Based), and Nurse Manager, Surgical ICU, Charles George VAMC
- **Maria Cvach, DNP, RN, CCRN**, Assistant Director of Nursing, Clinical Standards, The Johns Hopkins Hospital
- **Marjorie Funk, PhD, RN, FAHA, FAAN**, Professor, Yale University School of Nursing (Moderator)

Overview of Education Efforts at Boston Medical Center

James Piepenbrink, BSBME
Director of Clinical Engineering
Boston Medical Center

Educational Efforts at Boston Medical Center

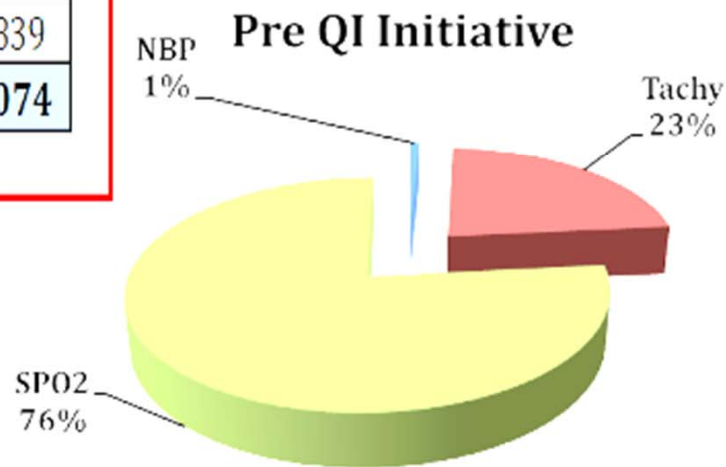


All Alarms

	Newton (6 Units) Total	Menino (4 Units) Total
Pre 1	288,479	244,273
Pre 2	266,532	231,436
	555,011	475,709
Post 1	94,280	105,235
Post 2	76,516	137,839
	170,796	243,074



Period	Campus	NBP	Tachy	SPO2
Pre	Menino	2,110	59,888	202,423
Pre	Newton	834	73,730	22,903
	Total	2,944	133,618	225,326
Post	Menino	1,571	14,427	168,207
Post	Newton	394	18,365	19,360
	Total	1,965	32,792	187,567



Educational Efforts at Boston Medical Center

Competency

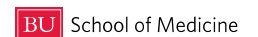
- Ensure staff competency through telemetry exam
- Provide simulation for managing use of system

Transparency

- Governance is essential for momentum
- Training affects all users [RNs as well as MDs]

Knowledge Transfer

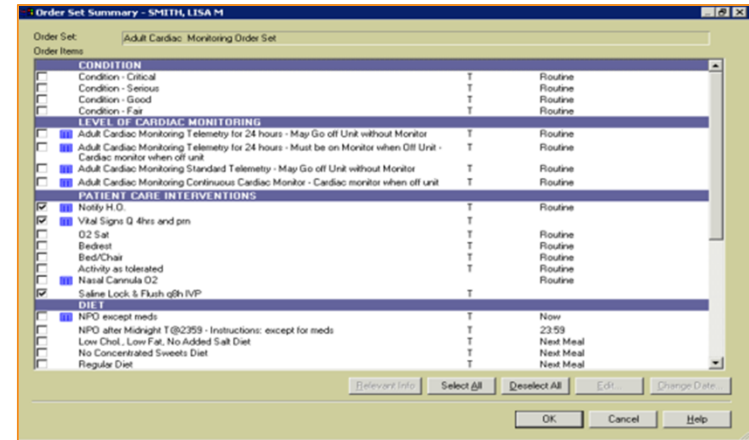
- Use data to help frame advances
- Leverage expert users as well as quality tools
- Share information in the moment



Develop Tools to Support Initiatives



Leverage quality tools to define issues and uncover gaps/risks

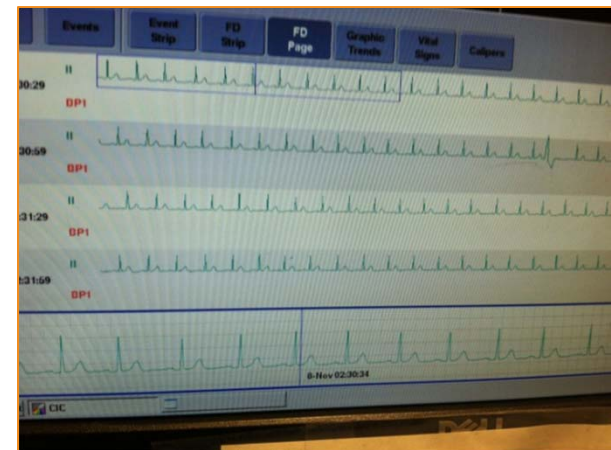


Create order sets that make sense and help improve communication between caregivers



Training cart provides best method to train users as well as demonstrate changes

Use in-the-moment training to provide support to staff as they manage changes



Sharing Data and Expanding Knowledge on the Road to Alarms Management

Jaspreet Mankoo, BS
Clinical Engineering Intern

Ekta Srinivasa, RN
Clinical Resource Nurse

VA Boston Healthcare System

From Noise Reduction to Alarms Management

- National Patient Safety Goal helped spawn the VA BHS Alarms Taskforce
- Multi-Disciplinary Team:
 - Nurse Managers
 - Front-Line Nurses
 - Clinical Engineering
 - Patient Safety
 - Hospital Administration
 - Medical Device Vendors
- Overall goal is to minimize alarm fatigue by:
 - Prioritizing medical device alarms risk
 - Optimizing medical device settings
 - Developing new training methods



Alarms Management System



Leadership



Infrastructure



Practices



Technology

Database of Alarms

Staff Training, Education, and Involvement

Risk Management through Alarms Database

- NPSG.06.01.01: Identify the most important alarm signals to manage based upon:
 - Clinical input
 - Risks associated with alarm
 - Contribution to alarm fatigue

Current Database	Future Database
<ul style="list-style-type: none">• Inventory of medical devices with alarms• General priority levels• No indication of device configurability• Harder to differentiate risk	<ul style="list-style-type: none">• Building off of Shashi Avandhani's model• Inventory of alarms organized by device type• Quantitative risk assessment for prioritization• Clear identification of configurable alarms• Links to alarm settings for configurable alarms

Old vs. New Alarms Database

Equipment	Priority Level	Unit	Common Reasons for Alarms
BIPAP	High-Risk Area/High-Risk Clinical Condition	ICUs/Floors	Leak, patient removed the mask, improper fit
Cardiac Monitors	High-Risk Area/High-Risk Clinical Condition	MICU, CCU, PCU, SICU, OR, Cath/EP Lab/TEE Proc Areas	High-priority alarms: V-tach, V-fib, asystole, apnea, desaturation Medium-priority alarms: PVC, Irregular heart rate (i.e. bradycardia, tachycardia), pulse ox, heart rate & BP alarms

Old vs. New Alarms Database

Clinical Alarms	Risk (if not addressed): 3: Highest (Death) 2: High (Injury) 1: Low (Little to no injury)	Clinical Oversight Level Required: 3: High (Continuous) 2: Moderate (Intermittent) 1: Low (Little to no oversight)	Use Frequency: 3: High (Continuous) 2: Moderate (Intermittent) 1: Low (Little to no time)	Alarm Criticality Score Will auto-populate (Risk + Oversight Level + Frequency)	Are the alarms configurable?	Co Pur
Bed Associated Alarms						
Bedside Exit				0		
Micro solo bed alarm				0		
Poesy Chair				0		
FMS Supported Alarms						
Restroom Assistance				0		
Gas alarm: Wall				0		
Gas alarm: Portable				0		
Negative Pressure Room				0		
Code Blue Alarms				0		
Wander alert/ code alert				0		
Life Support						
External Pacer: Transvenous				0		
Defibrillator				0		
Operating Room						
Electrosurgical Unit				0		
Heart-Lung Machine				0		
Anesthesia Machine				0		
Tourniquets Machines				0		
Cerebral Oximeters				0		
Physiological Monitoring						
O2 monitor				0		
Oxygen Concentrator				0		
Bedside Physiological Monitors	3	2	3	8	Yes	
Telemetry System	3	2	2	7	Yes	
Vital Sign Monitor (SPO2, BP, Temp)				0		
Portable Patient Monitor (not defib)				0		
Pumps						
IV Pumps/ Controllers				0		
PCA pumps				0		
IABP - Intra-aortic balloon pump				0		
Compression Pump (leg pump)				0		

Old vs. New Alarms Database

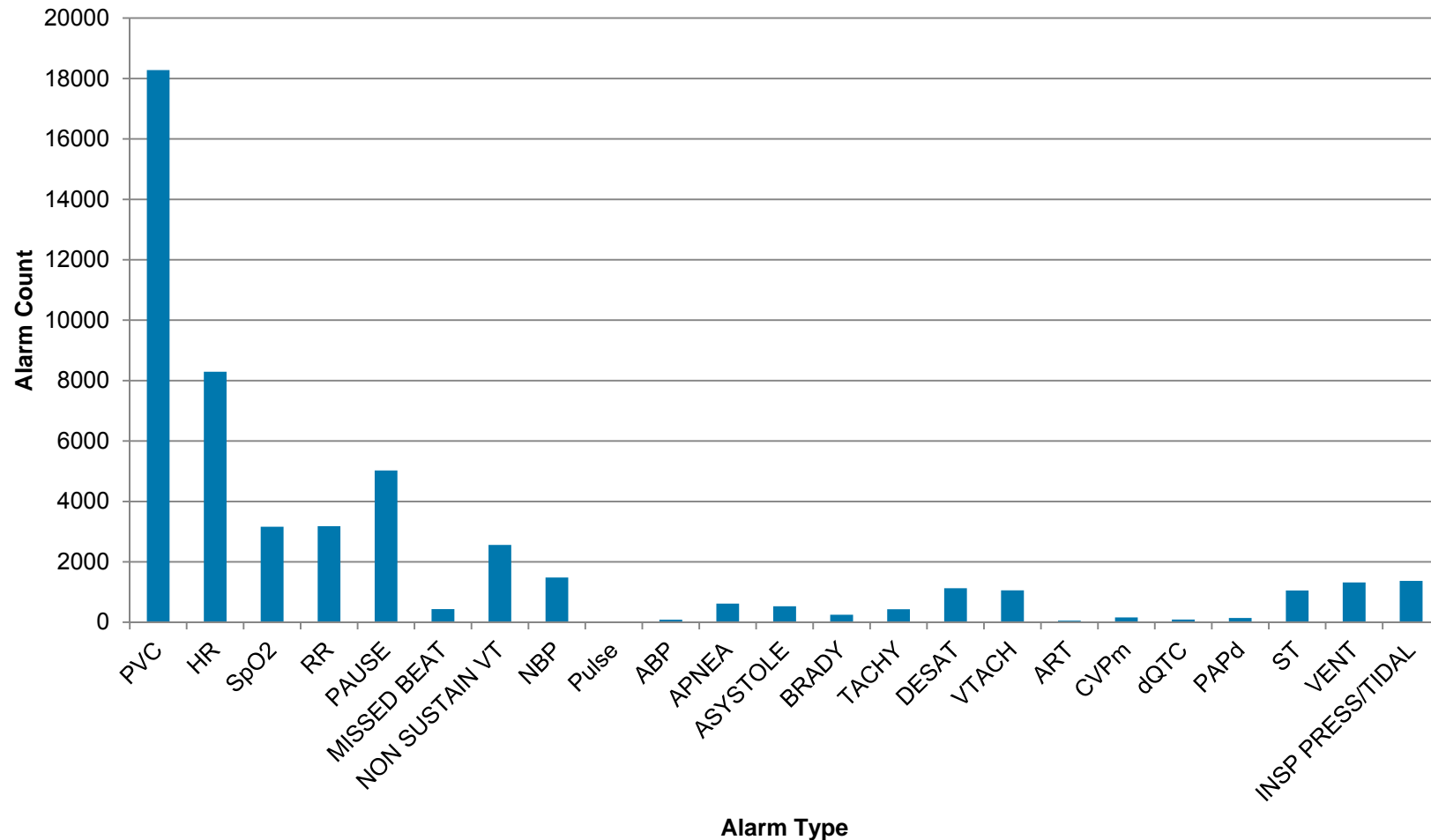
Area/Alarm Limit Setting	AG Tele	A1 Tele	A2 Tele	2South Tele	2 North Tele	3North Tele
HR-Low Alarm Limit	< 40 bpm	< 40 bpm	< 40 bpm	< 40 bpm	< 40 bpm	< 40 bpm
HR-High Alarm Limit	> 120 bpm	> 120 bpm	> 120 bpm	> 120 bpm	> 120 bpm	> 120 bpm
Anylsis Mode	Multi-Lead	Multi-Lead	Multi-Lead	Multi-Lead	Multi-Lead	Multi-Lead
Asystole On/Off	On	On	On	On	On	On
Asystole Threshold	> 4.0 sec	> 4.0 sec	> 4.0 sec	> 4.0 sec	> 4.0 sec	> 4.0 sec
Vfib/Tach	On	On	On	On	On	On
Vtach	On	On	On	On	On	On
Vtach Limit	> 100 bpm; >= 5 PVCs	> 100 bpm; >= 5 PVCs	> 100 bpm; >= 5 PVCs	> 100 bpm; >= 5 PVCs	> 100 bpm; >= 5 PVCs	> 100 bpm; >= 5 PVCs
Extreme Tachy	On	On	On	On	On	On
Extreme Tachy Limit	Diff. 20 bpm; Max 200 bpm	Diff. 20 bpm; Max 200 bpm	Diff. 20 bpm; Max 200 bpm	Diff. 20 bpm; Max 200 bpm	Diff. 20 bpm; Max 200 bpm	Diff. 20 bpm; Max 200 bpm
Extreme Brady	On	On	On	On	On	On
Extreme Brady Limit	Diff 20 bpm; Min 40 bpm	Diff 20 bpm; Min 40 bpm	Diff 20 bpm; Min 40 bpm	Diff 20 bpm; Min 40 bpm	Diff 20 bpm; Min 40 bpm	Diff 20 bpm; Min 40 bpm
Arrhythmia Off Inop	On	On	On	On	On	On
Patient Paced	Off	Off	Off	Off	Off	Off
Non-Sustained VT	On	On	On	On	On	On
Vent Rhythm	On	On	On	On	On	On
Vent Rhythm Limit	> 14 PVCs	> 14 PVCs	> 14 PVCs	> 14 PVCs	> 14 PVCs	> 14 PVCs
Mode						
Run PVCs	On	On	On	On	On	On
Run PVCs Limit	> 2 PVCs	> 2 PVCs	> 2 PVCs	> 2 PVCs	> 2 PVCs	> 2 PVCs
Pair PVCs	On	On	On	On	On	On
R-On-T PVC	On	On	On	On	On	On
Vent Bigeminy	On	On	On	On	On	On
Vent Trigeminy	On	On	On	On	On	On
PVC Rate	On	On	On	On	On	On
PVC Rate Limit	> 10 PVCs/min	> 10 PVCs/min	> 10 PVCs/min	> 10 PVCs/min	> 10 PVCs/min	> 10 PVCs/min
Multiform PVC	On	On	On	On	On	On
Pacer Not Capture	On	On	On	On	On	On
Pacer Not Pace	On	On	On	On	On	On
Pause	On	On	On	On	On	On
Pause Limit	> 2.00 s	> 2.00 s	> 2.00 s	> 2.00 s	> 2.00 s	> 2.00 s
Missed Beat	On	On	On	On	On	On
SVT	On	On	On	On	On	On
SVT Limit	> 180 bpm; 5 SVBs	> 180 bpm; 5 SVBs	> 180 bpm; 5 SVBs	> 180 bpm; 5 SVBs	> 180 bpm; 5 SVBs	> 180 bpm; 5 SVBs
Irregular HR	On	On	On	On	On	On
Some ECG Alarms Off Inop	On	On	On	On	On	On
SpO2 High	<100	<100	<100	<100	<100	<100
SpO2 Low	>90	>90	>90	>90	>90	>90
NBP Sys High	<160	<160	<160	<160	<160	<160

Importance of Using and Sharing Data

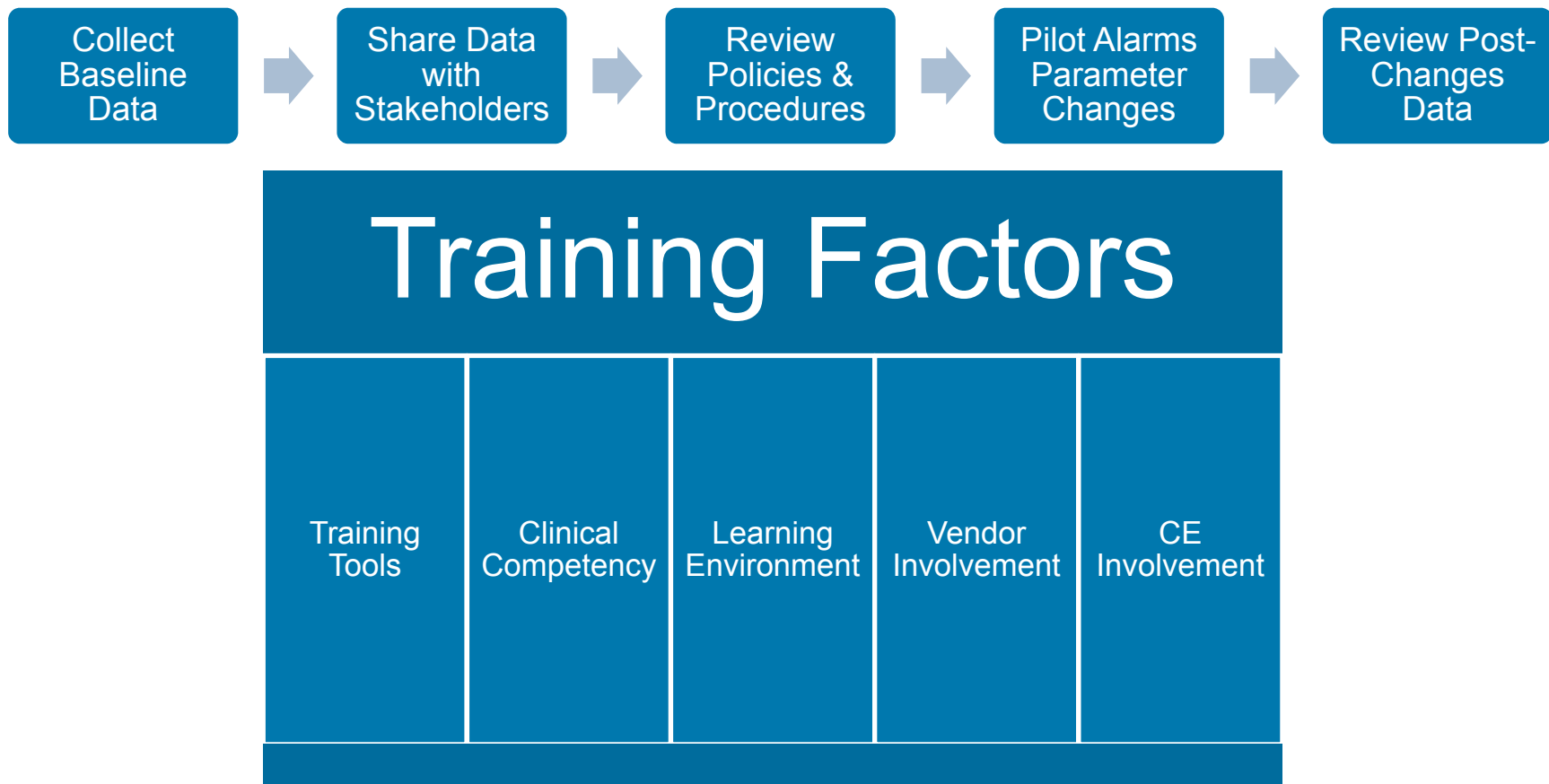
- Export alarms data from the central stations in the CCU and Med/Surg unit 3N
 - Access to all high-priority and medium-priority alarms
- Emphasis on sharing compiled data with clinical stakeholders
- Having a measurable metric for evaluation helps create buy-in
- Tool for clinical educators to see if alarms are being tailored

Data Snapshot

CCU Alarms Distribution: 2/20/13 - 5/13/13



Training Factors – Alarms Optimization Process



Ongoing Education

- Skin preparation – improving signals, reducing noise→ better arrhythmia detection and many fewer false and technical alarms

Ongoing Education, cont.

- Proper Electrode Placement
 - Disposable recyclable lead wires
 - Reduced workload
 - Improved signal quality
 - Less chance of infection transmission



Ongoing Education, cont.

- Troubleshooting
 - Four Steps to Improve Signal Quality
 1. Skin preparation
 2. New lead wires
 3. Single lead analysis
 4. Re-learn

Case Study

- Problem:
 - Patient admitted on a surgical telemetry unit with a brain tumor causing continuous whole body tremor
 - Artifact from tremor resulting in constant false alarms

Case Study, cont.

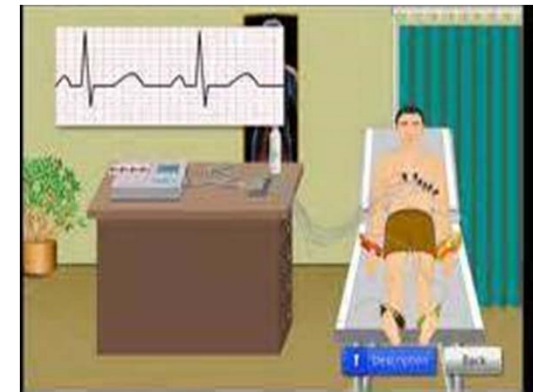
- Interventions:
 - The nursing staff contacted providers and determined the clinical concern requiring monitoring was extreme high or extreme low ventricular rates
 - The nursing staff tailored alarms by:
 - Turning off all other unnecessary arrhythmia alarms
 - Trying multiple electrode placements and configurations and using a single lead analysis

Case Study, cont.

- Result:
 - This is an example of how the nurses have developed comfort with managing alarms
 - If the patient's condition does not match the alarm, then they are looking at the root causes
 - This represents a cultural change because nurses are worried about missing significant alarms due to false alarms

Ongoing Education to Improve Clinical Competency

- ACLS
 - Every 2 years
- Annual Medical Equipment Day
 - Focus: alarm chaining and latching
- Ongoing monthly series
 - Arrhythmia-specific alarms and management
 - Monthly mock codes



Ongoing Education to Improve Clinical Competency, cont.

- Ongoing emphasis on critical thinking
 - Nurses consider 2 things in this order:
 - Is the alarm condition correct, i.e., if the monitor is ringing for irregular (IR) heart rate (HR), is the HR truly IR?
 - Is the condition significant for the patient?

Future Plans

- Implement computer-based training (CBT) modules to provide flexibility for the staff
- Consider use of CBT in the development of revised competency assessments for annual verification
- Work with vendors to integrate their educational materials into our CBT education and tracking system
- Consolidate alarm policies



Future Plans Beyond Cardiac Telemetry

- Use a phased approach to address other devices, such as SpO₂, infusion pumps, nurse call, and bed exit alarms as identified by our risk analysis



Alarm Management Initiatives at Asheville VA

Russell S. Coggins, RN, MSN

Clinical Nurse Advisor for Critical Care
Office of Nursing Services, Washington, DC

Nurse Manager, Surgical ICU

Charles George VAMC, Asheville, NC

New to Alarms Initiatives

- Clinical Alarms Task Force less than 6 months old
- Still in the early stages of development
- There are many tools available to help get started from AAMI and AACN



Alarm Management Initiatives: Alarms Task Force

- Multidisciplinary Clinical Alarms Task Force officially formed October 2013
 - Completed inventory of all equipment with clinical alarms to include parameters
 - Prioritized all clinical alarms in the facility based on the highest impact on patient care and patient safety
 - Exploring with our vendor the ability to retrieve alarm data from our physiological monitors in each care unit to determine high-frequency, non-actionable alarms

Alarm Management Initiatives: Monitor Techs

- Expanded use of monitor technicians by adding 24/7 monitoring by Tele Techs for the emergency department, MICU, and SICU to support the Critical Care RNs in those areas
- Computers and display CIC monitors installed in the telemetry “war room” and hiring additional Tele Techs for increased work load
- Ongoing refinement of training program for the new staff

Alarm Management Policy Initiatives: Future Plans

1. Current: policies and procedure guidance related to monitoring, skin prep, and alarm defaults for ECG
2. Multi-professional workgroup to determine non-actionable alarms allowed to be disabled in each care unit by designated staff
3. Develop educational plans related to all devices with clinical alarms based on survey of staff needs, quality improvement data, risk analysis, and incidence reports leading to competency development needs identification

Alarm Management Policy Initiatives: Future Plans, cont.

4. Develop policy guidance to allow alarm settings to be tailored to patient presentation by nursing staff
5. Policy guidance development will include tailoring alarms limits for our various devices to the patient presentation; we will follow a phased approach for device-specific guidance based on our risk analysis and our prioritized clinical alarm list on all equipment with alarms, ranging from the departure alert system in our Community Living Center to our physiological monitors in critical care units

Alarm Management Policy Initiatives: Future Plans, cont.

6. Educational plans development to include:
 - Computer-based education and competency assessments based on needs assessments by Nursing Shared Governance structure
 - Develop multiple learning venues to include simulation lab, classroom, computer-based, equipment fairs, and alarms rounds

Developing an Alarm Policy



Maria Cvach, DNP, RN, CCRN

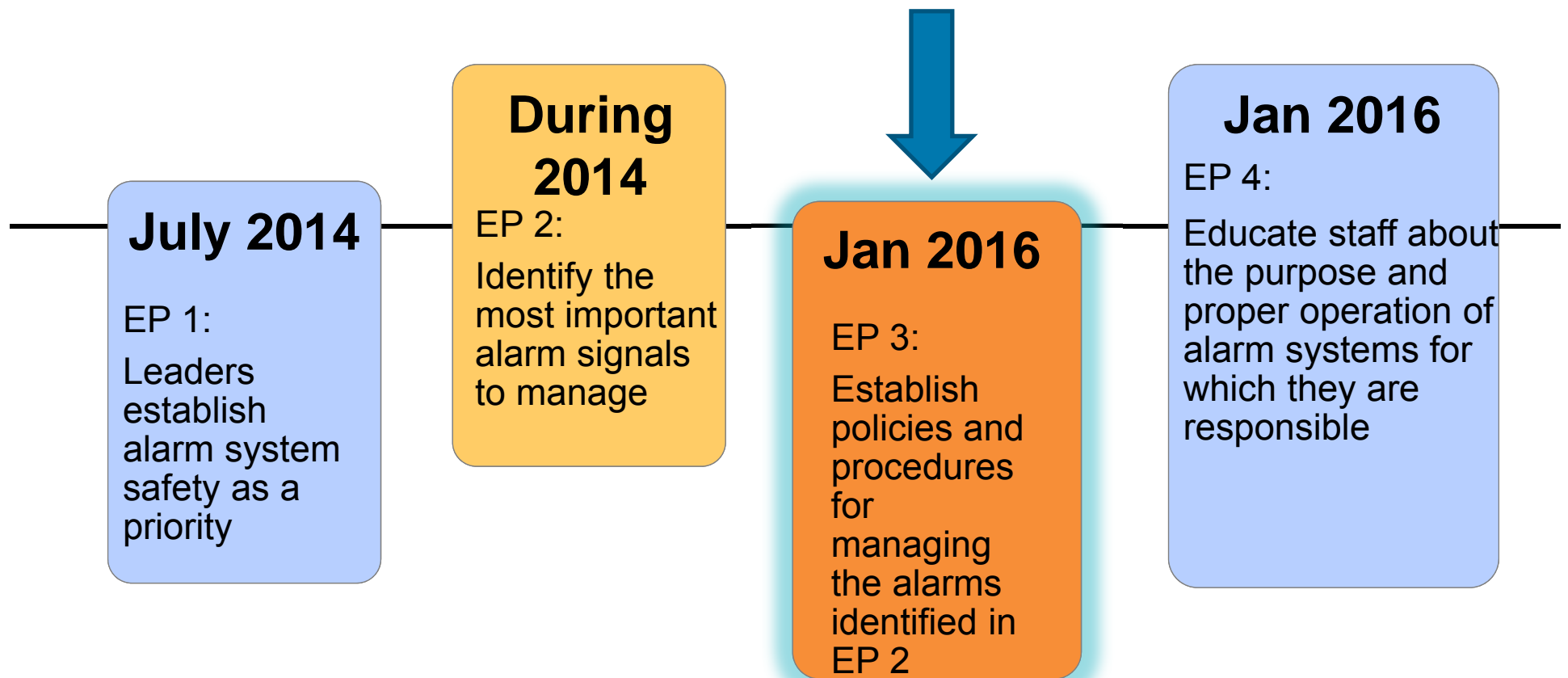
Assistant Director of Nursing, Clinical Standards

The Johns Hopkins Hospital

Webinar Goals

- Discuss NPSG Alarm Management
 - Element of Performance 3.0
- Discuss information that should be considered for alarm policy development

TJC NPSG Alarm Management



EP, Element of performance

System's Approach to Alarm Management



- Review unit alarm coverage



- Identify patient safety vulnerabilities and potential failures



- Determine underlying causes of potential failures



- Develop realistic, implementable strategies to address underlying causes



- Implement strategies and evaluate their effectiveness



- Monitor effectiveness of strategies and provide feedback to staff



- Implement hospital policy and educate



Alarm Management Policy: Purpose

- Identify the purpose of the alarm policy:
 - Differentiate the types of alarms/alerts and associated response required
 - Discuss primary and secondary (auxiliary) alarm notification
 - Delineate alarm accountability
 - To document alarm inventory

Alarm Management Policy: Definitions

- Alarm/alert – an audible or visual signal intended to get someone's attention
- Primary notification – notification of device status from the alarm-enabled medical device
- Secondary notification – notification from a device other than the primary device
- Alarm priority level – classification level that delineates the type of response required based on the alarm-enabled devices risk/level of oversight (example: high-, medium-, low-priority)

Alarm Management Policy: Responsibilities

- Role of the Alarm Management Committee chairperson(s)
 - Develop and manage the alarm policy, including authority to set alarm parameters, change alarm parameters, turn alarm parameters / signals to “off”
 - Maintain an inventory of alarm-enabled devices, default parameters, and alarm priority grid
 - Provide regular feedback (i.e., alarm reports) to units
 - Advise units on best practice for alarm default settings and secondary alarm notification methods

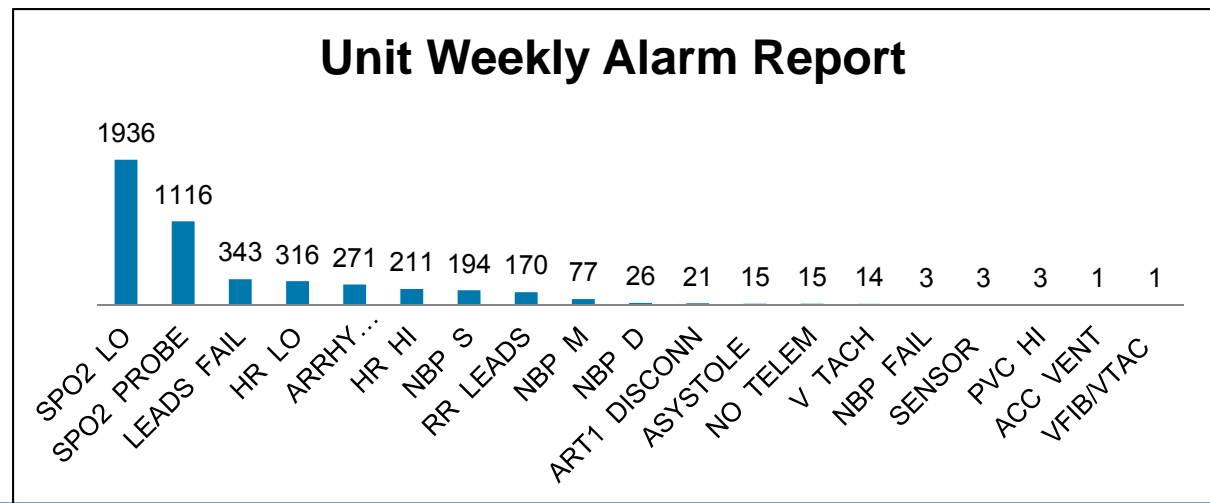
EXAMPLE:

Monitor Alarm Inventory Grid

Parameters Departments	PULSE OX %		HEART RATE BPM		BP SYSTOLIC mmHg		BP DIASTOLIC mmHg		BP MEAN mmHg	
	Low	High	Low	High	Low	High	Low	High	Low	High
Medical ICU	88	105	50	140	90	180	40	110	65	120
Surgical ICU	89	105	50	120	90	180	40	110	55	120
Coronary Care	88	105	50	120	85	180	40	110	55	120
Cardiac Surgical ICU	89	105	50	120	80	150	40	110	55	120
Neurologic ICU	88	105	50	120	90	180	40	110	55	120
Weinberg ICU	89	105	50	120	90	180	40	110	55	120
Oncology Department	88	105	50	130	90	180	40	110	55	120
Surgical Progressive Step-down Care unit	89	105	50	140	90	180	40	110	60	120

Alarm Management Policy: Responsibilities

- Role of the Unit-based Alarm Management Committee Representative
 - Reviews alarm data reports and identifies alarms most important to manage and those that may result in desensitization
 - Identifies strategies to reduce clinically non-significant alarms

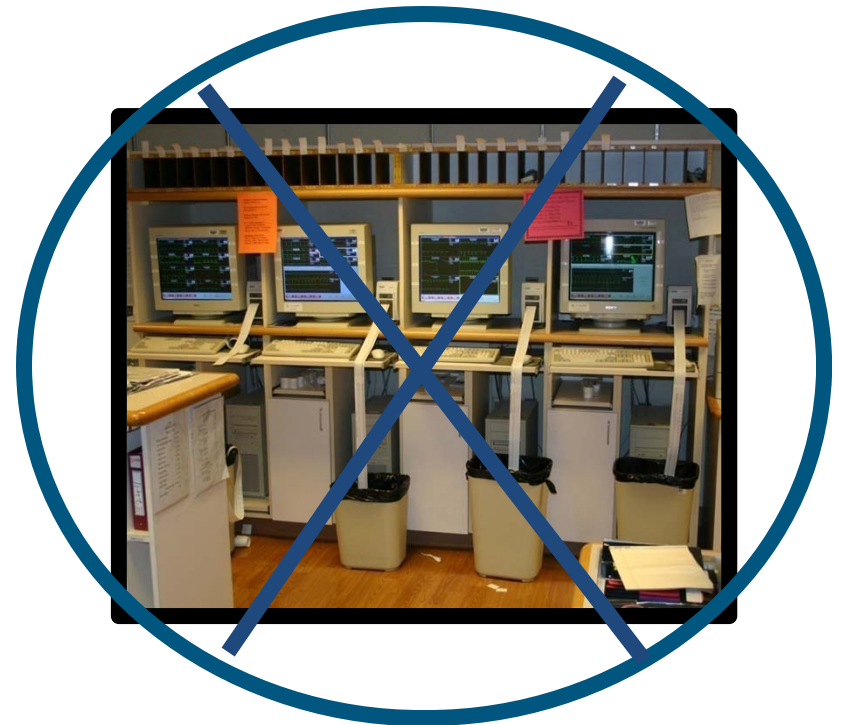


Alarm Management Policy: Responsibilities

- Role of the Unit Manager
 - Assure unit alarm accountability
 - Select most important alarms to manage
 - Identify a secondary notification plan for those alarms that are the most important to manage
 - Identifies strategies to reduce clinically non-significant alarms
 - Establish a unit “culture of safety” **Example:**
 - Plan to address alarm fatigue, unanswered alarms
 - Conduct alarm drills

Alarm Management Policy: Responsibilities

- Role of Unit Clinicians
 - Respond to clinical alarms as indicated by priority level
 - Troubleshoot clinical alarms
 - Maintain a unit “culture of safety”



Alarm Policy Should Include:

- Delineation of responsibility and accountability for alarm response **Example:**
 - Responsibility for clinical alarms shall be established by the unit manager and should include:
 - Determining who has primary responsibility for responding to clinical alarms
 - Determining if a back-up is needed based on the criticality of the clinical alarm
 - Establishing a culture of alarm safety
 - Providing education on the most important clinical alarms to manage

Alarm Policy Should Include:

- Process steps for alarm response
 - Criticality of clinical alarms by priority level

Example: Priority Level A, B, C

- A level – life-threatening audible alarms requiring immediate attention and could result in temporary or permanent harm
- B level – warning, audible alarms that require attention, but inattention for several minutes is not likely to result in temporary or permanent harm
- C level – advisory audible or visual alarm meant to call attention to a medical device or patient condition that needs re-assessment. A response is required but inattention for a short period is not likely to result in patient harm.

EXAMPLE: Alarm Priority Grid

Inpatient Clinical Equipment Alarm-Enabled Device Inventory	Risk to Patient and Response	Level of Oversight Typically Available	Secondary Alarm Notification
High-priority cardiac monitor alarms	A	Varies by unit	Varies by unit; includes beside split screens, auto-view on alarm, hallway waveform screens, acknowledgement pagers/phones, unit-based monitor watch
Medium-/technical cardiac monitor alarms	B	Varies by unit	
Low-priority cardiac monitor alarms	C	Varies by unit	
Ventilator	A	Varies by unit	Nurse call auxiliary outlet
ECMO	A	High	Direct supervision
Bed/chair exit alarm	B	Low	Nurse call auxiliary outlet
Sequential compression device	C	Low	None identified

A – Requires immediate attention

B - Requires attention as soon as possible

C - Timely response required

Alarm Policy Should Include:

- Back-up plan for alarm notification, as appropriate
 - Use of secondary alarm notification
 - Indicate how the most important alarms are managed if alarm is not acknowledged at the primary device
 - Variety of methods may be used **Examples:**
 - Monitor watch
 - Middleware
 - Zoning

Alarm Management Policy

Consider having an overarching alarm management policy with device-specific alarm management incorporated into the device protocol

Example:

- Cardiac monitor management
- Patient call system management
- Ventilator management
- Infusion pump management
- PCA pump management

Other Things to Consider

- How is alarm verification performed?
- What are admission / discharge criteria to a monitor?
- How are alarms managed during patient transports?

Still a work in progress!!!

Free Alarms Resources



- Safety Innovations Series
 - [White Papers](#)
 - [Webinar Recordings](#)
- Alarms Management Webinar Series
 - [Webinar Recordings](#)
 - [Webinar Slides](#)
 - [Key Points Checklists](#)

Mark Your Calendars!

2014 AAMI Annual Conference and Expo

May 31–June 2, 2014
Philadelphia, PA

www.aami.org/meetings/aami2014/

Sessions on Alarms:

- The Impact of Distributed Alarms Systems on Patient Safety: An Overview of the New Technical Report IEC 80001-2-5
- Integration of Alarm Notification Systems at The Johns Hopkins Hospital
- Transforming Care in Non-ICU Settings through Disruptive Continuous Monitoring Technology
- Building a Strategy to Support Medical Device Integration and Alarm Management
- HTF/HTSI Alarm Management Roundtable

AAMI-FDA Summit on Ventilator Technology

September 16-17, 2014
Herndon, VA

www.aami.org/summit2014/

AAMI and the U.S. Food and Drug Administration invite you to play an active role in improving the safety and effectiveness of ventilation technology used in operating rooms, critical care units, and other settings.

Questions?



Please visit HTSI's LinkedIn page to post a question:
<http://www.linkedin.com/groups/Healthcare-Technology-Safety-Institute-HTSI-4284508>

Or you can email your question to ehughes@aami.org.

Continuing Nursing Education 1.0 contact hour

For those desiring CNE, please visit the link below
for the test, evaluation form, and certificate:

<http://www.aacn.org/DM/CETests/Overview.aspx?TestID=1105&mid=2864&ItemID=1097&menu=CETests>

The American Association of Critical-Care Nurses (AACN) is accredited as a provider of continuing nursing education by the American Nurses Credentialing Center's Commission on Accreditation.

Evaluation Form and Certificate of Attendance (Non-CNE)

Please let us know how we did!

<http://aami.confedge.com/ap/survey/s.cfm?s=Policies>

After you fill out the evaluation form and enter your email address, you will receive an electronic certificate by email