“It’s Still Alarming!”

Healthcare Transformation Services
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May 2018

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Still "Alarming" Personal Stories

Has much changed?

"They go off a lot and nobody seems to pay attention."

"My Mom was dying in the ICU and the alarms went off constantly. It was awful, it was never quiet."

"Oh my gosh, the alarms went off the whole time!"

"I know. I'm a nurse and I go home and hear the alarms in my dreams."

"Well, there aren't as many going off here as before, but it's still annoying and they're supposed to keep it quiet for him."

Photos courtesy of Lisa Pahl

Patients and their families want to know care providers are focused on what is important and relevant to their care and recovery.

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Learning Outcomes

- Describe how to capture and analyze alarm data and other findings to identify and implement alarm management changes and evaluate their effectiveness
- List three published best practices that identify how to successfully reduce non-actionable alarms

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Alarm Fatigue Due To Non-actionable Alarms

Alarm Fatigue is a Patient Safety Issue

A patient had a low level leads off alarm that occurred but was not responded to and the patient was then found dead.

Another patient had a low level replace battery alarm so no ECG signal for over an hour. Patient was found unresponsive and could not be resuscitated.

A 17 year old tonsillectomy patient died and her parents were awarded $6M due in part to alarms being not properly set and/or ignored and muted.

A Barbara Drew study captured 2.5M alarms in 5 ICUs over 30 days. This equates to 30M alarms per year.

Patients can experience alarms going off continuously in their rooms.

The majority of alarms (90-99%) are non-actionable.

The Joint Commission NPSG 06.01.01: Still In Place

Has your organization been successful in completing?

As of 2014:

- ✓ **Leaders establish alarm system safety as a hospital priority**
- ✓ **Identify the most important alarm signals to manage based on:**
  - Input from medical staff and clinical departments
  - Risk to patients if alarm signal is not attended to or malfunctions
  - Whether specific alarm signals are needed or unnecessarily contribute to alarm noise and alarm fatigue
  - Potential for patient harm based on internal incident history
  - Published best practices and guidelines

As of January 1, 2016:

- ✓ **Establish P&Ps for managing the alarms identified, that at a minimum, address the following:**
  - Clinically appropriate settings for alarm signals
  - When alarm signals can be disabled
  - When alarm parameters can be changed
  - Who has the authority to set alarm parameters
  - Who has the authority to change alarm parameters
  - Who has the authority to set alarm parameters to “off”
  - Monitoring and responding to alarm signals
  - Checking individual alarm signals for accurate settings, proper operation, and detectability
- ✓ **Educate staff and licensed independent practitioners about the purpose and proper operation of alarm systems for which they are responsible**

www.jointcommission.org/standards_information/npsgs.aspx

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Alarm Management Goal

Reduce non-actionable alarms and unnecessary noise in order to improve patient safety, patient care, patient and staff satisfaction, and to ensure actionable alarms are responded to and appropriate action taken

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Alarm Management Impact: Trust & Your Brand

What do you want your brand to be?

Coca-Cola

UNITED

Image Source: https://www.google.com

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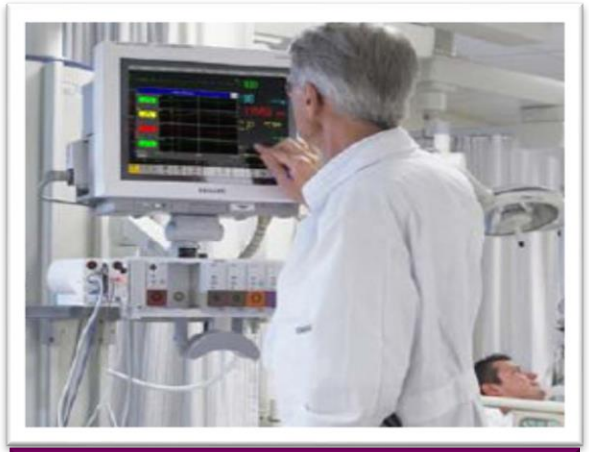
Where Are You Now?

Current State Assessment

Complete a Comprehensive Current State Assessment

Data provides the foundation, so collect baseline data as your starting point

Culture



People | **Process & Practice** | **Technology**

Data Analysis

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In your unit, is Leads Off configured as a:

- ☐ Low Priority Alarm
- ☐ Medium Priority Alarm
- ☐ High Priority Alarm

ECRI states ECG Leads Off should not be a low priority alarm

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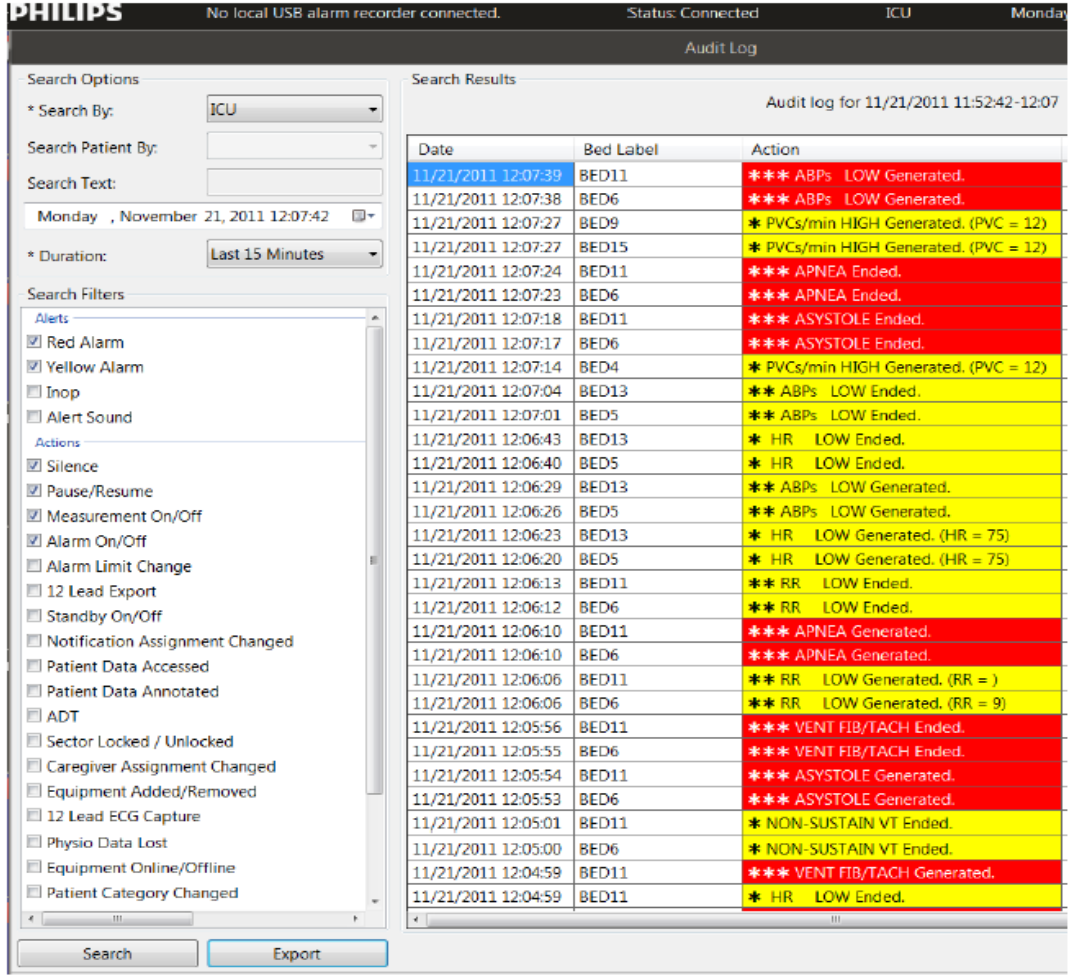
Monitoring Alarm Data Review: PIIC iX Audit Log

Look for commonalities as well as what stands out



	A	B	C	
201421	10/23/2016 15:46	809	* Pause Ended.	PIIC iX:
201422	10/23/2016 15:45	815	* PVCs/min 12 >10 Ended.	PIIC iX:
201423	10/23/2016 15:45	815	* Pair PVCs Generated.	PIIC iX:
201424	10/23/2016 15:44	815	* Multiform PVCs Ended.	PIIC iX:
201425	10/23/2016 15:44	815	* PVCs/min 11 >10 Generated.	PIIC iX:
201426	10/23/2016 15:44	804	* Pair PVCs Generated.	PIIC iX:
201427	10/23/2016 15:44	814	*** Apnea 0:20 Generated.	PIIC iX:
201428	10/23/2016 15:43	814	**ARTs 85 <90 Ended.	PIIC iX:
201429	10/23/2016 15:43	814	**ARTs 86 <90 Generated.	PIIC iX:
201430	10/23/2016 15:43	813	* PVCs/min 11 >10 Ended.	PIIC iX:
201431	10/23/2016 15:43	809	* Missed Beat Ended.	PIIC iX:
201432	10/23/2016 15:43	809	* Pause Generated.	PIIC iX:
201433	10/23/2016 15:43	814	**ARTs 83 <90 Ended.	PIIC iX:
201434	10/23/2016 15:43	807	**SpO2 84 <88 Ended.	PIIC iX:
201435	10/23/2016 15:43	809	* Missed Beat Generated.	PIIC iX:
201436	10/23/2016 15:43	802	* Missed Beat Ended.	PIIC iX:
201437	10/23/2016 15:43	814	**ARTs 85 <90 Generated.	PIIC iX:
201438	10/23/2016 15:42	815	* Multiform PVCs Generated.	PIIC iX:
201439	10/23/2016 15:42	814	**ARTs 86 <90 Ended.	PIIC iX:
201440	10/23/2016 15:42	809	* Missed Beat Ended.	PIIC iX:
201441	10/23/2016 15:42	807	**SpO2 86 <88 Generated.	PIIC iX:
201442	10/23/2016 15:42	814	**ARTs 86 <90 Generated.	PIIC iX:
201443	10/23/2016 15:42	804	* Pair PVCs Ended.	PIIC iX:
201444	10/23/2016 15:42	814	**ARTs 82 <90 Ended.	PIIC iX:
201445	10/23/2016 15:41	814	**ARTs 82 <90 Generated.	PIIC iX:
201446	10/23/2016 15:41	815	* Pair PVCs Ended.	PIIC iX:
201447	10/23/2016 15:41	814	**ARTs 85 <90 Ended.	PIIC iX:
201448	10/23/2016 15:41	814	**ARTs 88 <90 Generated.	PIIC iX:
201449	10/23/2016 15:40	813	* Multiform PVCs Ended.	PIIC iX:

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Understand The Types Of Monitoring Alarm In Your System

Philips alarm categories

High Priority Arrhythmia (***)

- Asystole
- Vfib/Tach
- Extreme Tachycardia
- Extreme Bradycardia
- V-Tach

Medium Priority Arrhythmia (**)

- Non-sustained Vtach
- Ventricular Rhythm
- Run PVCs
- Pair PVCs
- Trigeminy
- Bigeminy
- PVCs per minute
- Multiform PVCs
- Pause
- Pacer not capture
- Pacer not pace
- Missed beat
- SVT
- HR High/Low
- Atrial Fib/Atrial Fib End
- Irregular Heart Rate/Irregular Heart Rate End

High Priority Parameter (!!!)

- Apnea
- Spo_2 Desat
- Invasive Pressure Line Disconnect
- Invasive Pressure Extreme Limit

Medium Priority Parameter (!!)

- High or Low Limit Violations:
  - SpO_2
  - Respiratory
  - NBP
  - Invasive Pressure
  - Temp
  - CO_2
  - Other

Inop
(some can be configured a higher priority)

- Leads Off
- Replace Battery
- Cannot analyze ECG
- Others outlined in IFU; not captured by PIIC iX

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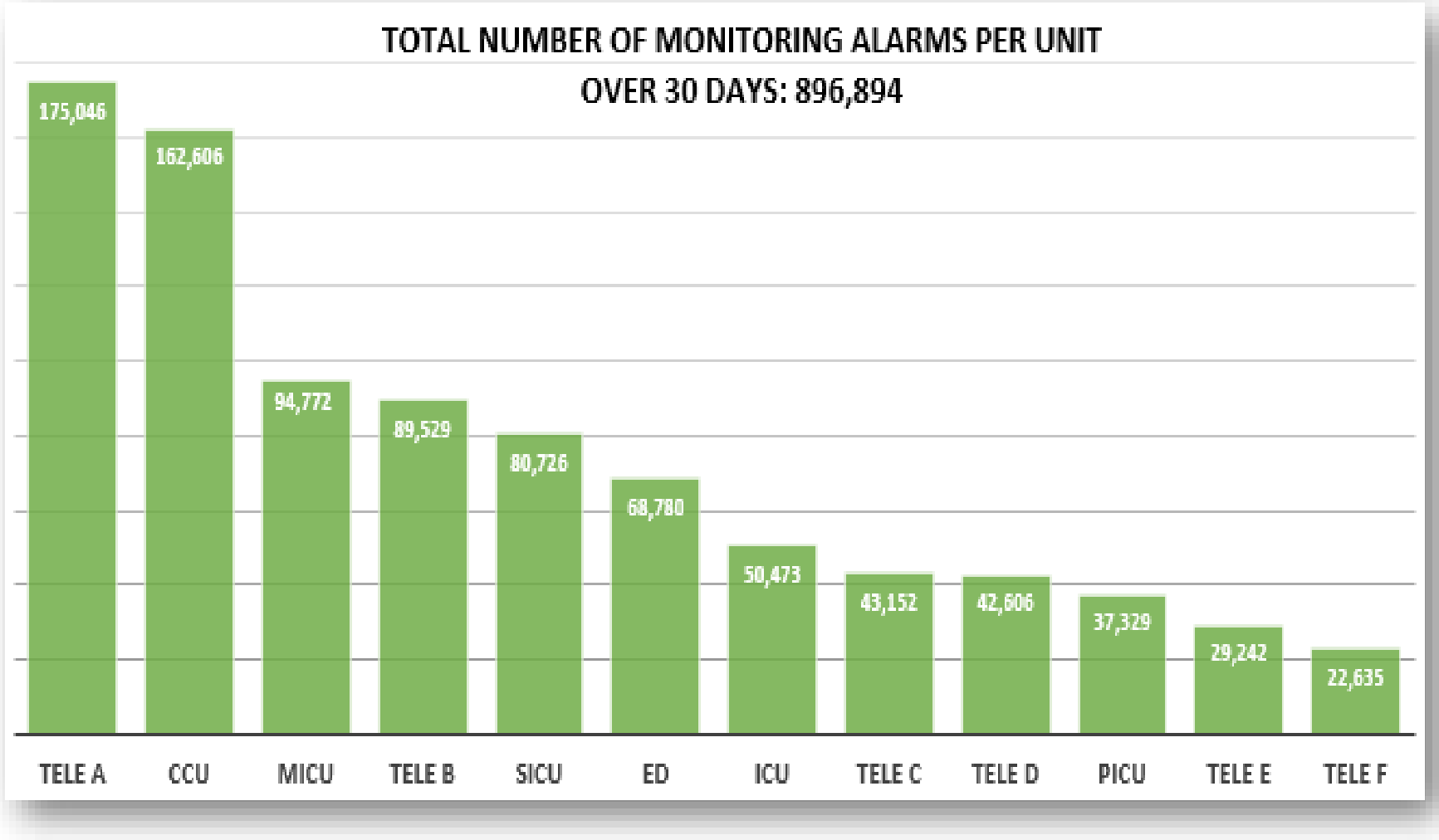
Total Monitoring Alarms Per Inpatient Unit

Alarms adding to noise and interruptions on the unit



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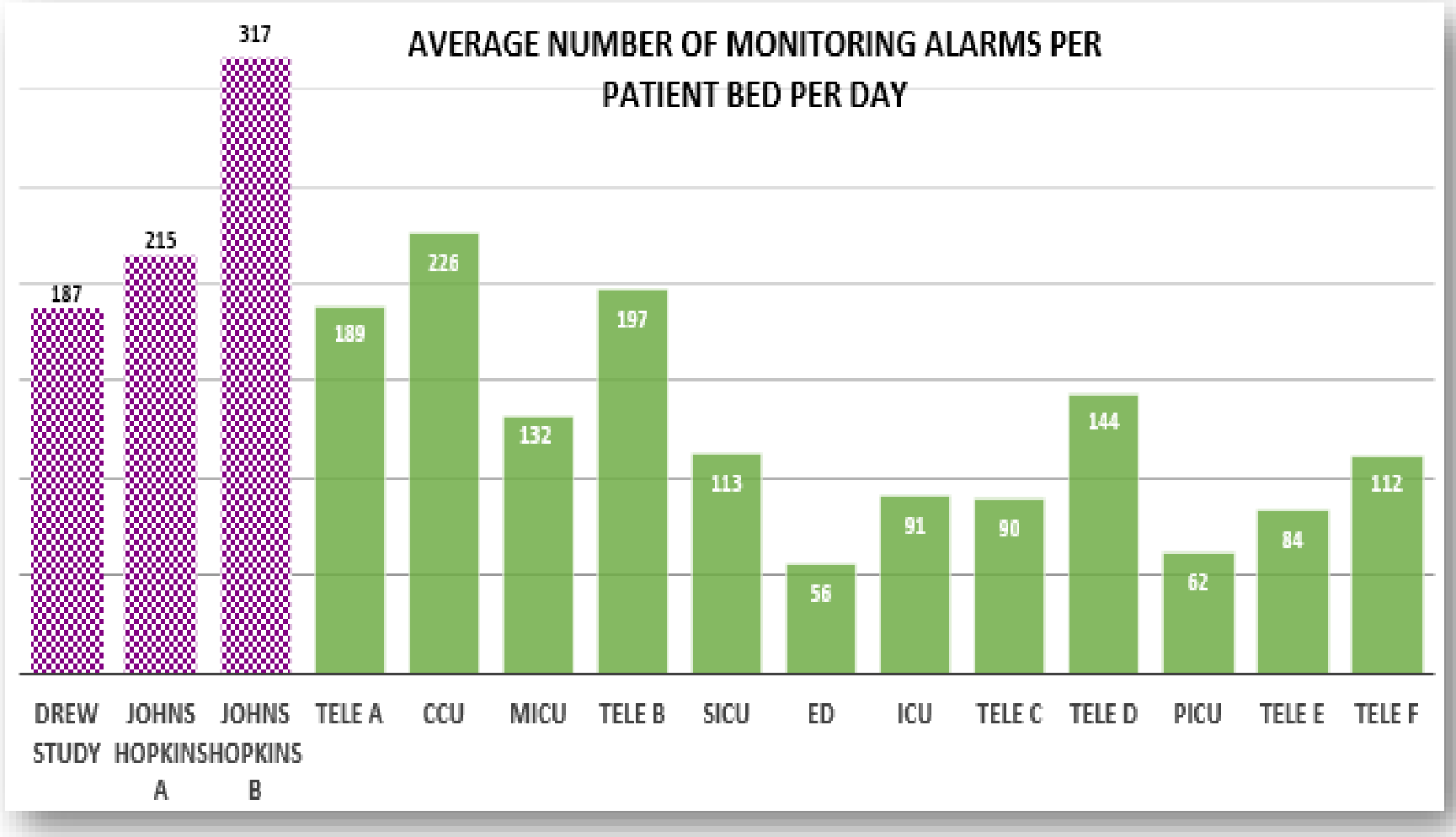
Total Monitoring Alarms Per Patient Bed Per Day

Benchmark to compare and evaluate change impact



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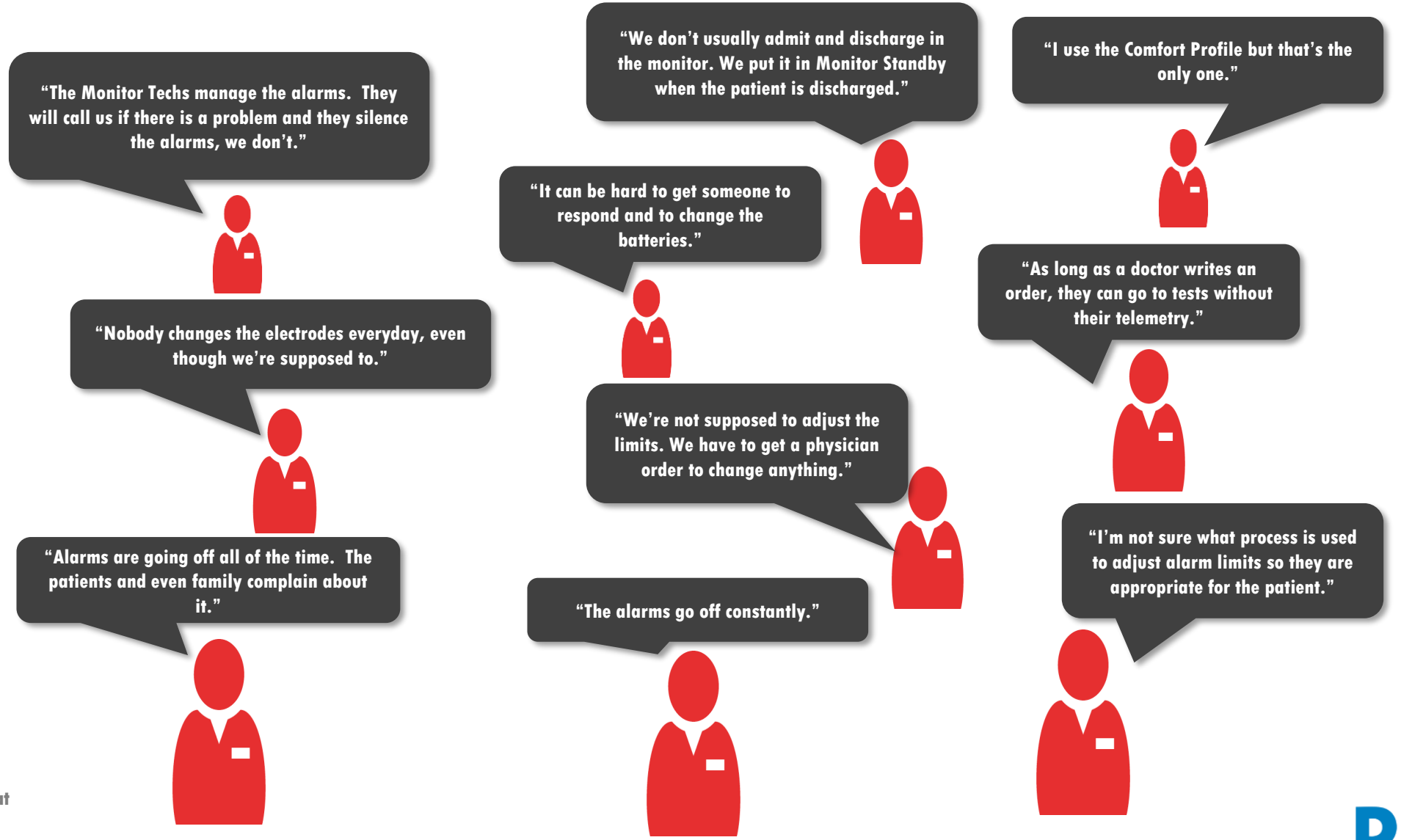
Direct Feedback & Input

From all key stakeholders



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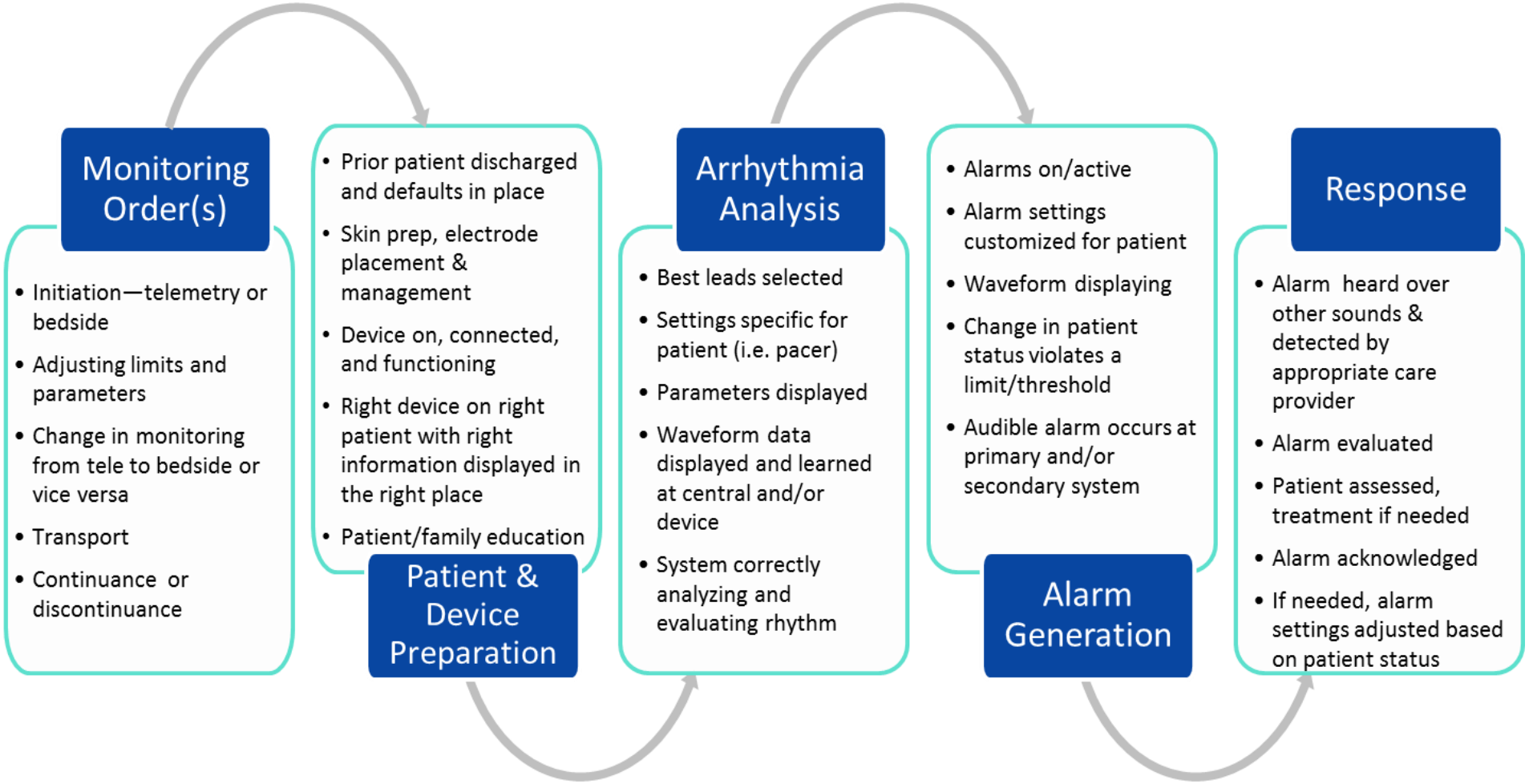
Monitoring Processes & Practices

From beginning to end



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Technology: How Is It Configured & Used?

Do users understand and use appropriately?

> **I'm not sure I know what a profile is, or how you use it**

	Profiles	Default Settings	
ICU	ICU Adult Night Adult Comfort	HR High 135 HR Low 50 PVCs/min 10 SpO2 Low 90	All Yellow Arrhythmia ON
ED	Profile Adult Profile Peds Profile Neo	HR High 120 HR Low 50 PVCs/min 10 SpO2 Low 88	All Yellow Arrhythmia ON, except for Irregular Heart Rate

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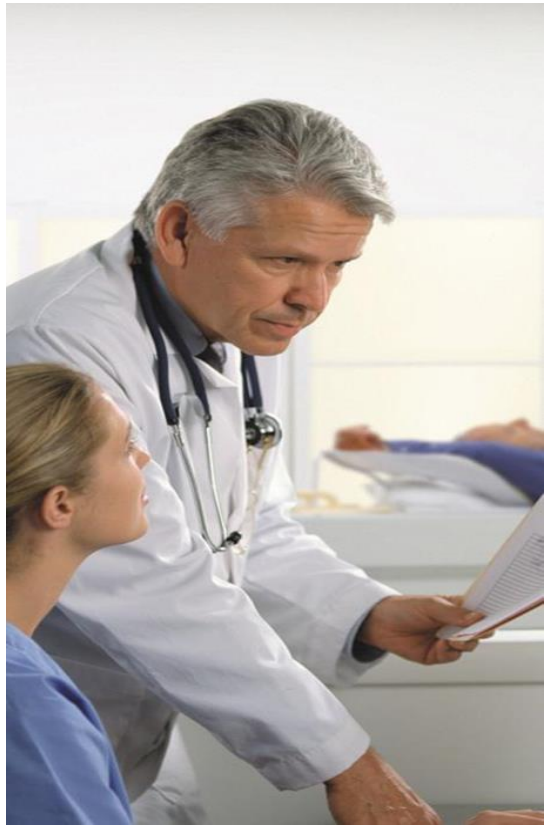
What Are Your Ways Of Working Together?

What tools do you use?

Safety culture

Our way of working?

Who decides and adjusts alarm limits and settings?



What happens if an adverse event occurs?

"Meyer said hospital administrators are not interested in assigning blame to individual staff members because that would be unfair and counterproductive in trying to encourage open reporting and discussion of problems. Rather, he said, hospital officials want to fix the underlying systemic issues with monitoring patients . . ."

"MGH death spurs review of patient monitors,"
Kowalczyk L. Boston Globe. February 21, 2010

What is your on-boarding process?
Is education provided on monitors and alarm management expectations?

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Changes & Impact

Prioritize and pilot

Utilize Published Best Practices: Default Setting Changes Made 10yrs Ago

Recommendations for Alarm Signal Standardization & More Innovation

- The Christiana Care Health System Experience

In all cases below, manufacturer (Phillips) default monitor alarm settings are given first, followed by new default settings used at Christiana Care more than 10 years ago with no adverse change in outcomes. Similar setting changes may be done with monitors from other manufacturers.

- Default V-TACH value ≥ 5 PVCs. Christiana Care changed to ≥ 10 PVCs.
- RUN PVCS, PAIR PVCS, R-on-T PVC, Ventricular Bigeminy, Ventricular Trigeminy & Multiform PVCS – In all cases, Default ON. Christiana Care turned OFF.
- IRREGULAR HR – ON, but nurse may turn off if patient currently in atrial fibrillation.

***When these changes were made, there was not a separate A-Fib alarm**

Has your organization implemented any default setting changes?

*Copied with the permission of the AAMI Foundation and the Healthcare Technology Safety Institute

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Adjusting Only Default Settings Will Decrease The Occurrence Of Those Alarms

Ensure all monitors and appropriate Profiles are re-configured

Category	Default Pre Pilot	Default Post Pilot	Total Pre	Total Post	Percent Change
Ventricular Rhythm	On	Off	335	1	-100%
Run PVCs	On	Off	3,548	10	-100%
Pair PVCs	On	Off	9,369	174	-98%
Ventricular Bigeminy	On	Off	169	0	-100%
Ventricular Trigeminy	On	Off	61	0	-100%
Multiform PVCs	On	Off	7,414	314	-96%
Missed Beat	On	Off	877	258	-71%
Irregular HR	On	Off	1,799	77	-96%
End Irregular HR	On	Off	1,020	10	-99%
Pause	1.50 seconds	2.0 seconds	5,141	1,095	-79%
PVCs/minute	10	15	3,152	4,358	38%

Decrease of 30% of the total alarms and in the total alarms per patient bed per day

Lesson Learned – Impact on overall unit reduction will vary

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Adjusting Only Default Settings: One Units Results

After initial changes, maintaining improvements over time

	Current	New
HR High Limit	120	130
HR Low Limit	60	55
Paced Mode (On, Off)	On	Off **
** Change to "Ask for Paced Mode Status"		
Extreme Brady	10	5
V Tach HR	100 bpm	120 bpm
VTach Run	5	10
PVC/min	11	15
Non Sustained VTach	On	Off
Run PVCs	On	Off
Pair PVCs	On	Off
R on T	On	Off
V Bigeminy	On	Off
V Trigeminy	On	Off
Multifocal PVC	On	Off
Missed Beat	On	Off
Irregular HR	On	Off
ST Analysis/ ST Alarms	On	Off
SPO2 low/high	89/100	88/100
RR low/ high	10/30	8/35

	Pre	Post	Percent Change
Total Yellow Arrhythmia Alarms	**55,477**	**16,411**	**-70%**
Total Alarms	**108,264**	**54,920**	**- 49%**
Total Alarms Per Patient Bed Per Day	**202**	**129**	**- 36%**

8 months later: Total Alarms Per Patient Bed Per Day 130

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Electrodes and Skin Prep:

"We don't really do anything for skin prep

Outside of Critical Care, most staff only change electrodes as needed

Most RNs/NAs admit to not doing any or proper skin prep.

This can result in artifact and nuisance / false alarms

One study showed daily electrode changes reduced the average alarms per bed per day by 46% on two Critical Care units*

At one site, q24 hour electrode changes and appropriate lead set size decreased alarms per bed per day by 64%

*Cvach MM , Biggs M , Rothwell KJ , Charles-Hudson C . Daily electrode change and effect on cardiac alarms: an evidence-based practice approach . J Nurs Care Qual . 2012 ; 28 (3): 265 – 271 .

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Wide Variation In Alarm Customization Practice

…But how can I??

> We need a doctor's order to make any change

> I think the monitor techs do that

> I don't really know what we're supposed to do per policy

Inconsistent customization practices can lead to inappropriate patient settings

↓

Inappropriate patient settings can lead to excess alarms and pose a potential patient safety risk

↓

Lesson Learned - At one site TJC indicated they prefer to see a clear guideline such as 'adjust 10% above or below' or 'adjust +/-10 above or below' baseline

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Customization Pilot On A Critical Care Unit

Multidisciplinary team developed guidelines

- Guidelines were developed that identified what nurses could change and what would require a physician decision
- Staff received education on guidelines
- First week of pilot, clinician on site to remind and support staff in the customization process
- Data evaluated after 30 days

↓

Total alarms per bed per day decreased by 26% and staff and leadership perception was there were less alarms sounding

↓

After 3 months, customization had dropped off and alarm levels had returned to pre-pilot

Lesson Learned – Customization guidelines need to be simple and there must be a plan in place to ensure sustainability

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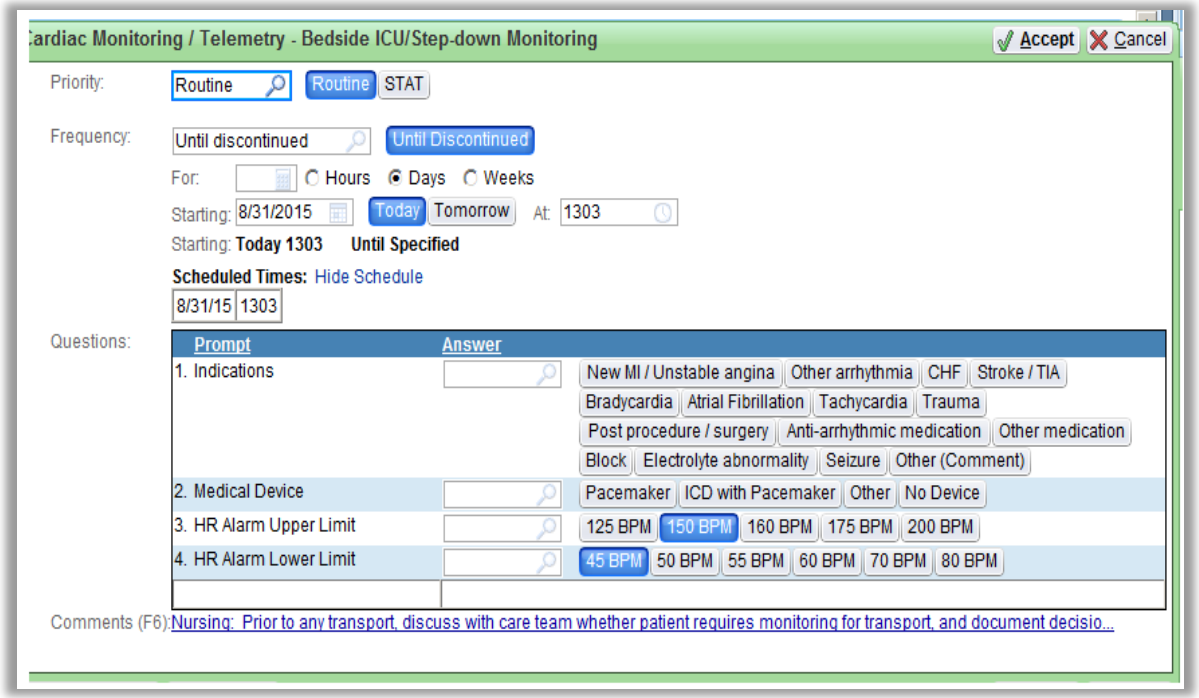
Telemetry Initiation & Continuation Orders

Adopt AHA Guidelines For Non-ICU Cardiac Monitoring

- **Have physicians provide a reason for initiating telemetry monitoring**
  - **Some EMR vendors have partnered with sites to develop this in the order set**
  - **Utilize key stakeholders and Providers to finalize**
- **Consider automated 24 hour or 48 hour renewal in EMR**
  - **Make sure the system again requires a reason**
  - **Ensure the physician must select either continue or discontinue**
- **Some sites have tried having nursing be responsible for discontinuing telemetry using an algorithm or flow chart**



Lesson Learned – Most places we have observed that have tried a nursing driven discontinuation process have not been successful

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Telemetry Utilization Based On Guidelines Supported By AACN & Others

Released February 21, 2013

Don't order continuous telemetry monitoring outside of the ICU without using a protocol that governs continuation.

- Telemetric monitoring is of limited utility or measurable benefit in low risk cardiac chest pain patients with normal electrocardiogram.
- Published guidelines provide clear indications for the use of telemetric monitoring in patients which are contingent upon frequency, severity, duration and conditions under which the symptoms occur.
- Inappropriate use of telemetric monitoring is likely to increase cost of care and produce false positives potentially resulting in errors in patient management.

shm
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Telemetry Utilization At Christiana Healthcare System

Success adopting the AHA Guidelines For Non-ICU Cardiac Monitoring

Initial Work and Results in 2012:

- Conducted a time motion study related to telemetry
  - Nurses spent 92 hours on average per day managing telemetry equipment
  - False alarms pulled nurses away from other duties
- Used AHA to develop and incorporate standard telemetry order sets in their electronic ordering system.

They reduced daily telemetry use by 70%, had no adverse events, and estimated they saved $4.8M annually.

Update in 2014:

- Tele utilization rates remain constant
- Reduction in mean weekly telemetry orders from 1032.3 to 593.2 (43 percent)
- Reduction in mean telemetry duration from 57.8 to 30.9 hours (47 percent)
- Approximately 250 fewer daily patients on telemetry
- Decrease in mean daily cost for non-ICU telemetry from $18,971 to $5,772

Source: LESS IS MORE: Altering Overuse of Cardiac Telemetry in Non–Intensive Care Unit Settings by Hardwiring the Use of American Heart Association Guidelines, Journal American Medical Association Internal Medicine, September 22, 2014

CHRISTIANA CARE HEALTH SYSTEM

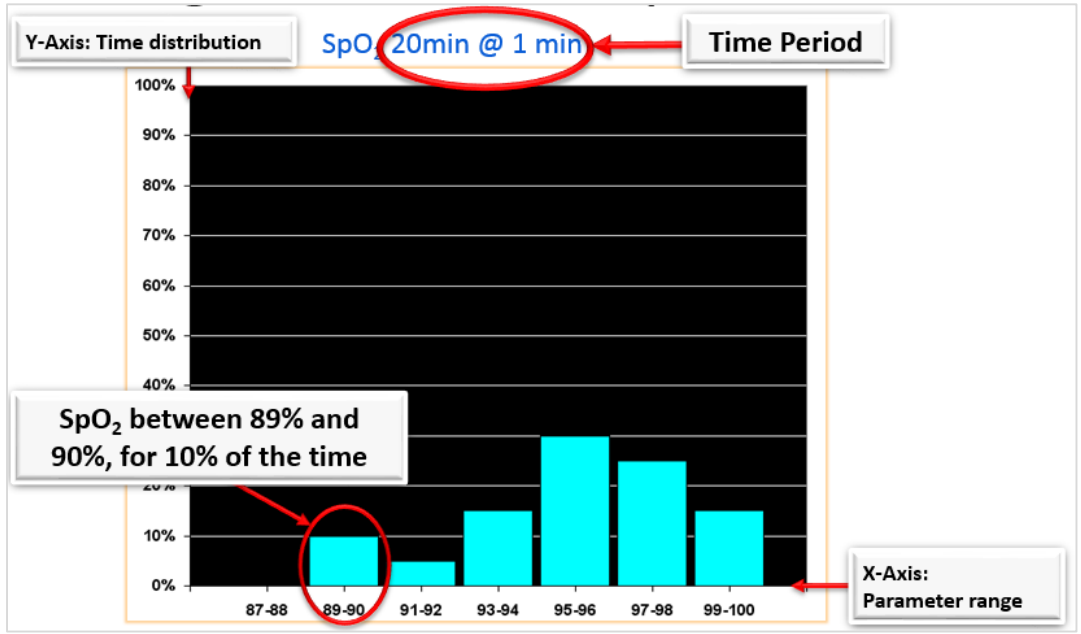
Technology Review

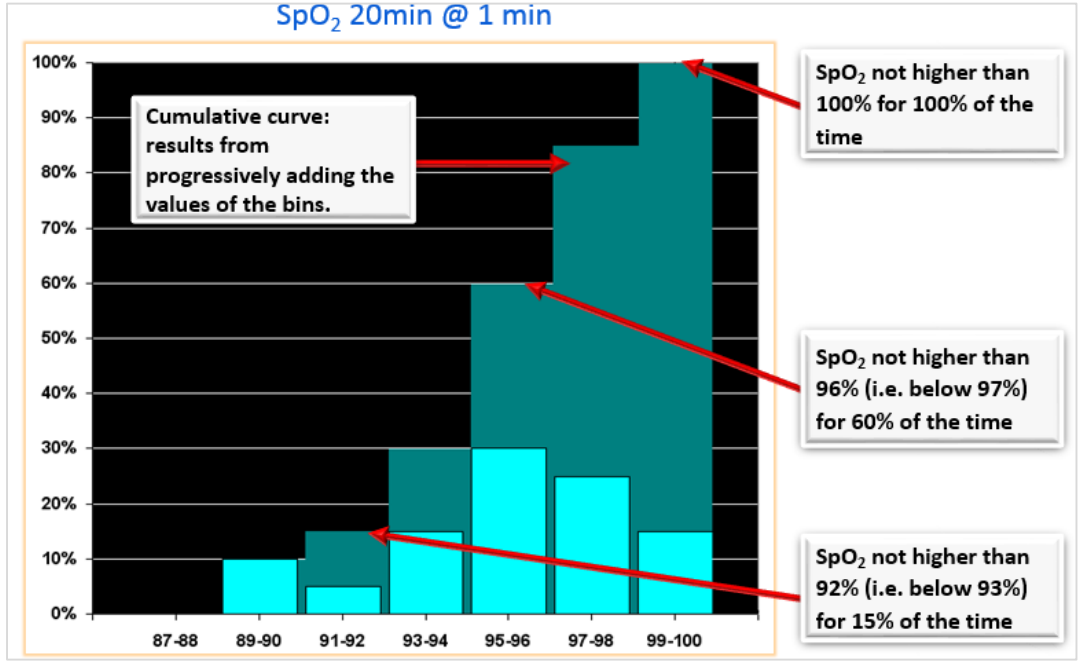
What capabilities would be beneficial in your alarm management strategy?

CDS Options: Histograms

A graphical representation of the distribution of a patient's measurements over an extended time period.

It shows for how much of a certain period of time a patient was within or outside a certain range of values.





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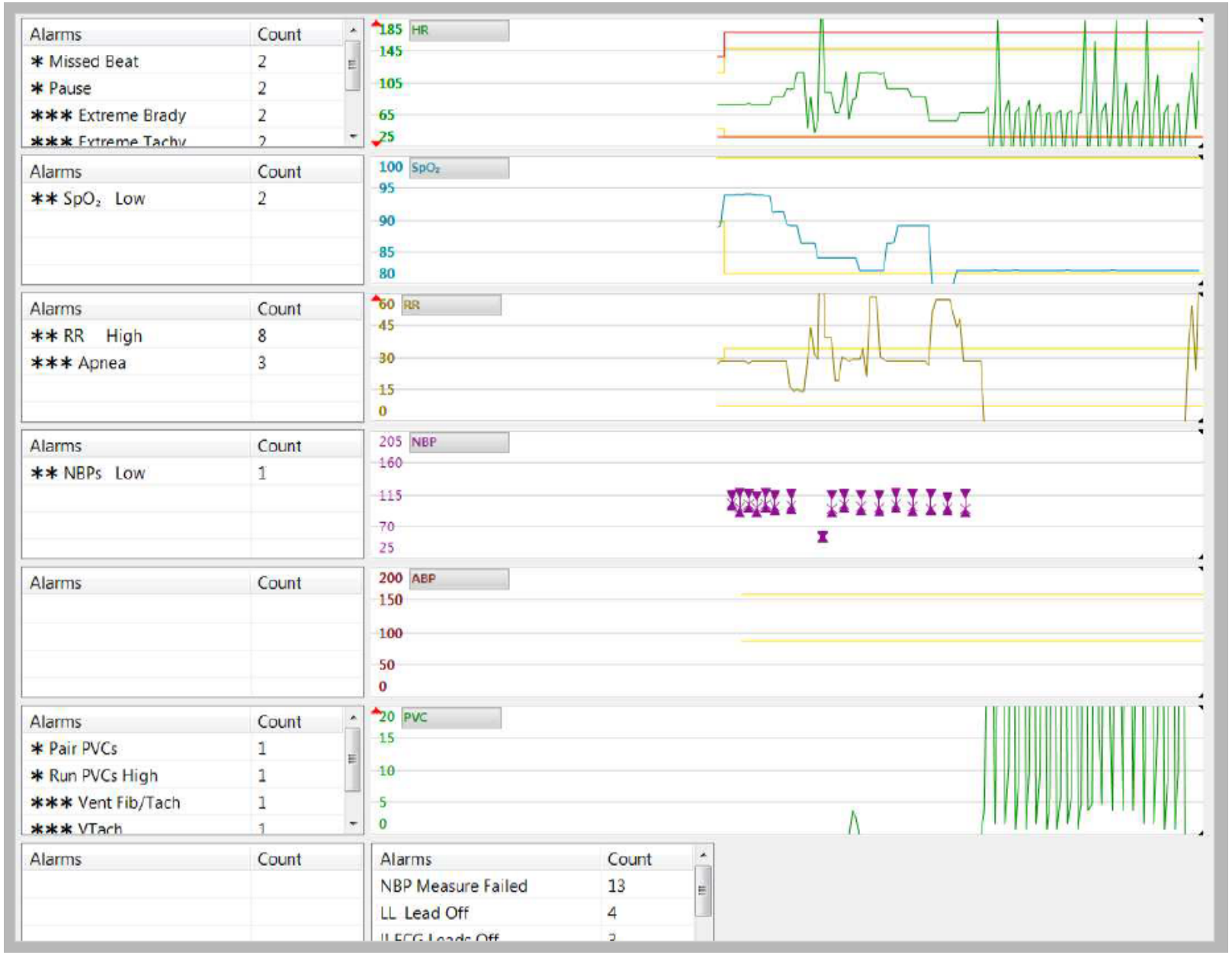
Alarm Summary in PIIC iX

A summary of the monitoring alarms that have occurred for the selected patient.

This could help with customization and treatment plans.



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Other Alarms/Alerts

What next?

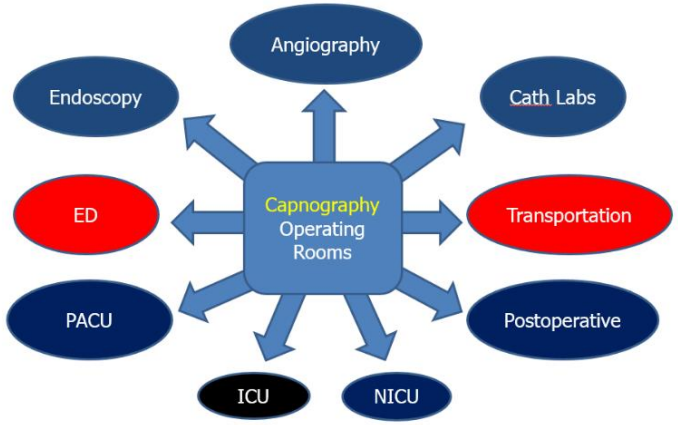
Other Monitoring Needs & Other Alarms: Future Direction?

> "Postoperative patients are subjected to significant harm or death while receiving sedating medications without appropriate monitoring and intervention."
>
> - San Diego Patient Safety Council

What Are the Problems with the Current Standard of Care?

Current monitoring protocols at most hospitals call for "spot checks" of patients receiving opioids on general care floors.

Where are we heading?



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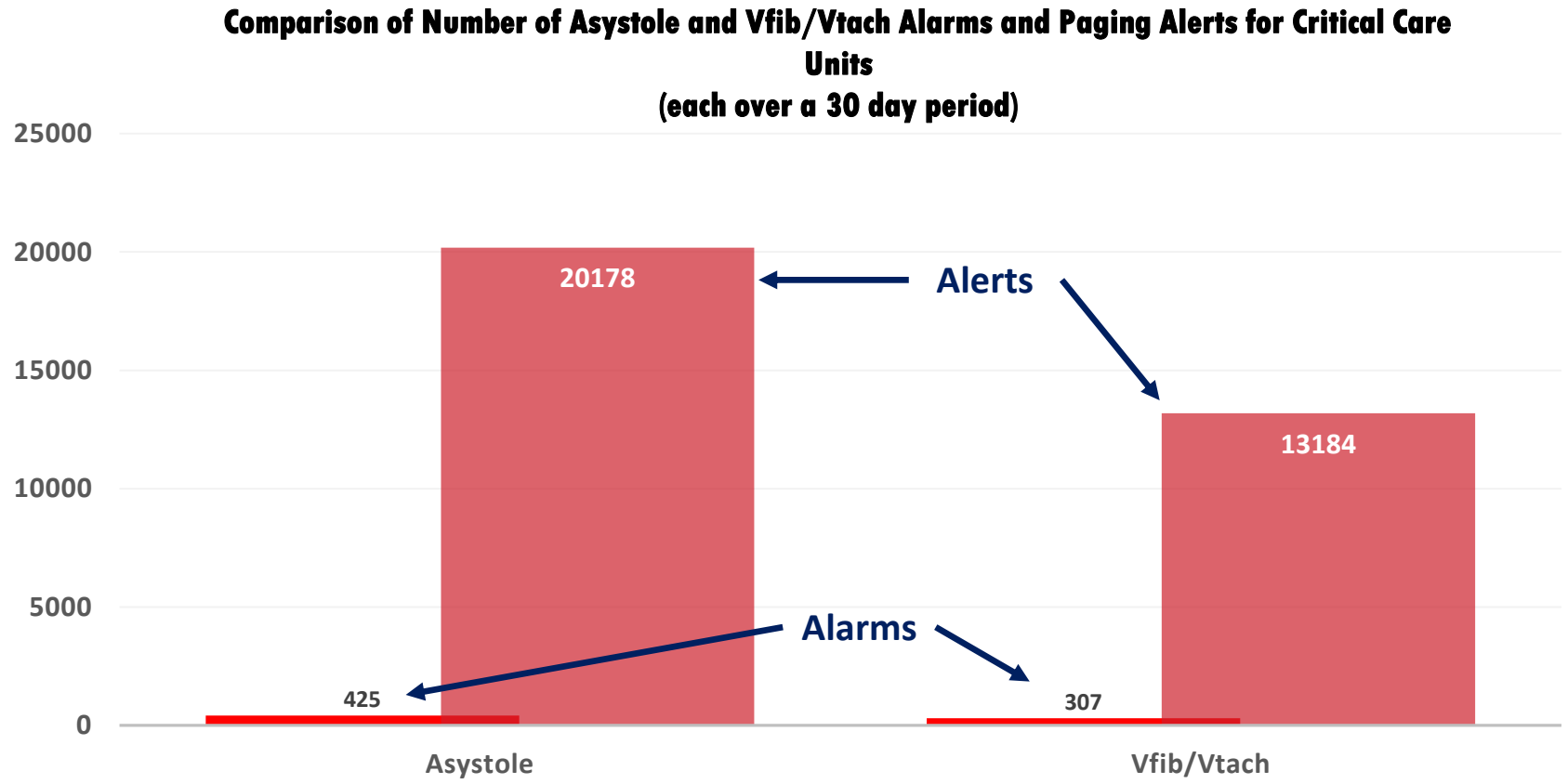
Understand The Impact Of Notification Systems

If not utilized effectively, they can add to alarm/alert fatigue with staff becoming desensitized to alerts



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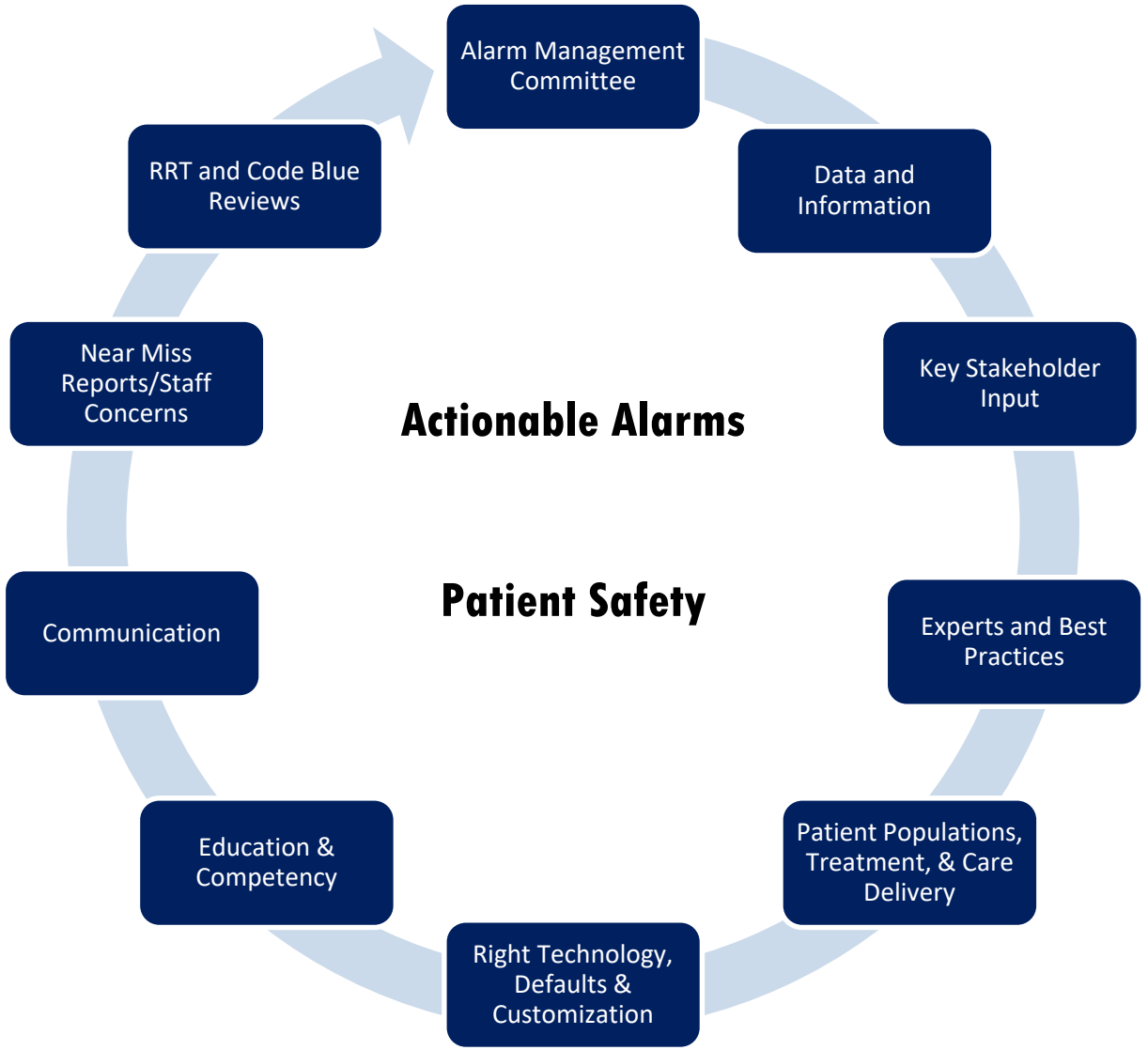
Continuous Improvement Cycle

Do you have an ongoing plan in place?

Alarm Management is a Continuous Process



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“There is no one-size-fits-all, institution-wide solution to addressing alarm hazards. Because the needs of each care area are unique, the team will need to understand the particular risks present in each and develop strategies that address those risks.”

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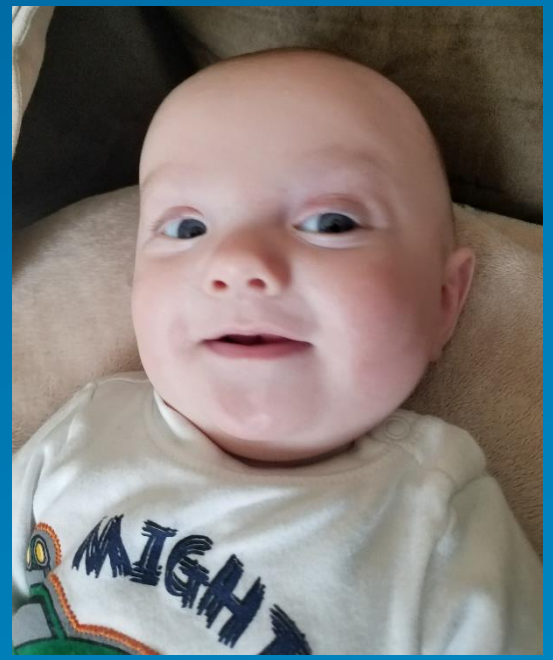
ECRI Institute, ”The Path To Alarm Safety,” TechNation, March, 2014 p. 33



Thank you!