"It's Alarming”

Simple Steps To Reduce Nuisance Alarms

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Healthcare Transformation Services
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innovation you

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Objective

Photo courtesy of Lisa Pahl

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

What will you learn…

You'll be able to describe how to capture and analyze alarm data and other findings to identify and implement alarm management changes and evaluate their effectiveness.

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“Alarming” Personal Stories

Unacknowledged alarms cause patients & families to lose trust in you & your organization

“The alarms go off all the time **and nobody seems to notice or to care**”

“When my Mom was in the ICU, it seemed like **alarms were going non-stop**.”

“They said it **didn’t mean anything**. Then **why** is it going off?”

Photo courtesy of Lisa Pahl

“I waited and waited, but **nobody came in to see what the alarm was for**. It eventually went off on it’s own.”

“The nurse told me it **wasn’t anything important** and I could **just silence** it any time it went off. **What if I hit the wrong button or did it for the wrong thing?**”

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Some Interesting Dates & Events

A selected review

2003 JCAHO releases NPSG No. 6 “Improve the effectiveness of clinical alarm systems"

- Part of focus is on assuring alarms are activated with appropriate settings and sufficiently audible

2010 Liz Kowalczyk of the Boston Globe begins series of articles on alarms in hospitals

- Patient death at UMASS identified alarm fatigue identified as a contributing factor

2011 Association for the Advancement of Medical Instrumentation (AAMI) “Summit On Clinical Alarms”

- 300 multi-disciplinary stakeholders attended to “discuss the hazard of alarm noise” and identified seven “Clarion Themes” to focus on

2012 A 17 year old died in an outpatient setting following a routine and uncomplicated tonsillectomy

- $6M award in part on alarms on the monitor being “muted, ignored and/or not properly set”

2013 TJC Sentinel Event Alert Issue 50 around alarm safety

- Identified alarm fatigue as one of the most common contributing factors to reported events

2014 & 2016 TJC NPSG.06.01.01 on Clinical Alarm Safety; AAMI National Coalition for Alarm Safety

- Establish alarm safety as priority, identify most important alarms to manage, establish P&Ps, and educate staff and providers; share best practices and improve alarm management

Alarm Management

- Initiative -

What Is Alarm Fatigue?

There is not an agreed upon or standard definition

Large number of frequent alarms or alerts
Wikipedia

+

Sensory overload
AACN

+

Desensitization
McCartney, 2012

=

Delayed response & missed alarms

Photograph copyright
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Photograph from Philly.com

"A clinical scenario that may occur when alarms sound so often that responders become desensitized to them and may not respond quickly enough or not at all"

FDA, MedSun: Newsletter #65, October 2011

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Actionable vs. Non-Actionable Alarm Signals

Ensure key stakeholders (i.e. providers, nurses, etc.) come to an agreement

Actionable Alarm Signal

REQUIRES clinical intervention or action

- ✓ Life threatening, immediate response & action required
- ✓ Change in patient status, requires action to reverse or prevent further deterioration
- ✓ Requires action to correct a technical problem to assure proper patient monitoring
  - Ex. leads off, SpO_2 sensor disconnected)

Non-Actionable Alarm Signal

DOES NOT require clinical intervention or action

- Short duration, self correcting (ex. SpO_2 alarm signal)
- Anticipated (ex. Suctioning or positioning)
- Due to tight limits rather than actionable ones
- False alarm due to:
  - Incorrect identification by system itself
  - Interferes with system (ex. artifact or low voltage triggered asystole)

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The Potential Impact of Non-Actionable Alarms on Staff and Patients

Alarm add up, distract, and interrupt

5 ICUs had a total of
2.5 million alarms
in a 31-day study period.*

The equivalent of 30 million alarms in a year.

One patient in an ICU had a total of
907 monitoring alarms
in a 24 hour time period.

A disruption every 1.5 minutes for the nurse and for the patient.

*Citation: Drew BJ, Harris JK, et al. (2014) Insights into the Problem of Alarm Fatigue with Physiologic Monitor Devices: A Comprehensive Observational Study of Consecutive Intensive Care Unit Patients. PLoS ONE 9(10): e110274. https://doi.org/10.1371/journal.pone.0110274l

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The Potential Impact of Reducing Non-Actionable Alarms

Less interruptions, noise, and stress

IMPROVEMENTS

Improved Quality of Care	▪ **500,000 less interruptions** for nursing staff in ICN ▪ **15,000 more hours** each month of time nurses can spend with their patients
Enhanced Patient and Staff Satisfaction	▪ **Decreased noise levels** for patients and staff due to decreased alarm and/or alert sounds at bedsides, central stations and on phones ▪ **Staff awareness** of leadership goal to reduce non-actionable alarms
Increased Efficiency	▪ **Less workflow disruptions** related to responding to, acknowledging, and reviewing alarms
Cost Savings	▪ **Less time spent** responding to non-actionable alarms ▪ 30% reduction of alarms on Philips units only translates into **savings hours equivalent to 46 FTEs** or approximately $2.4M in cost savings .

A ***30%*** reduction would result in:

~9 million less alarms per year

~300,000 hours of time for value added patient care

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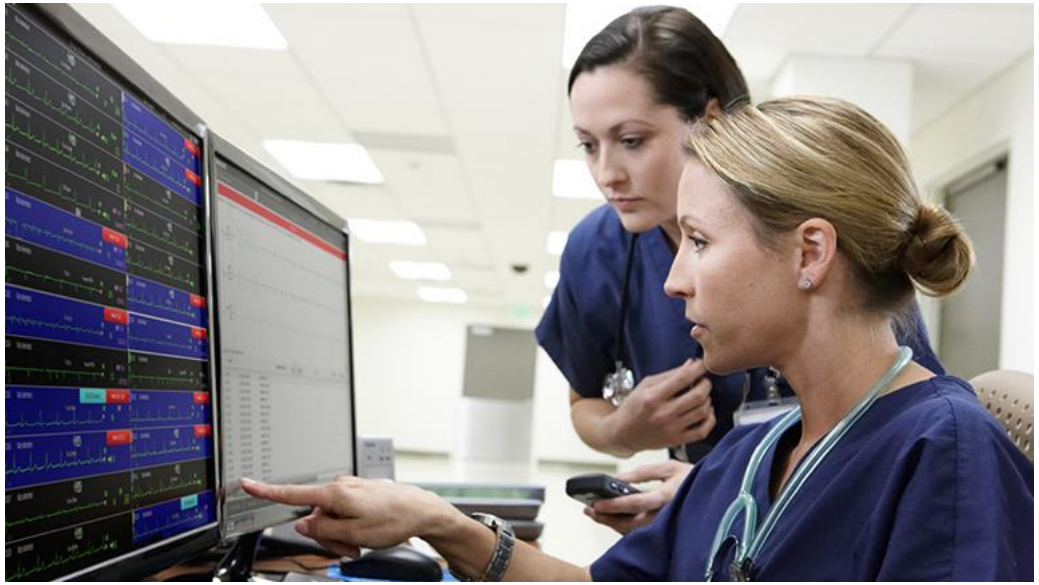
Developing An Effective Alarm Management Strategy

Understanding the problem and where to start



The Challenge

More technology often means more alarms, many of which are not actionable or clinically relevant.

These nuisance alarms interrupt work flow and patient care, disrupt patient's sleep cycles and healing, and creates alarm fatigue for care providers, and can adversely impact patient care.

The Goal

Reduce non-actionable alarms and alarm fatigue:

- Utilize data and other information to modify default setting
- Revise monitoring and alarm management processes, practices, and policies
- Utilize technology to alert care providers to a change in patient status prior to an alarm occurring
- Ensure your culture identifies alarm management as a patient safety priority

Our Approach

Question

Has your unit/organization moved beyond data and have assessed other areas of alarm management, i.e. staff feedback, observation, the monitoring process, etc.?

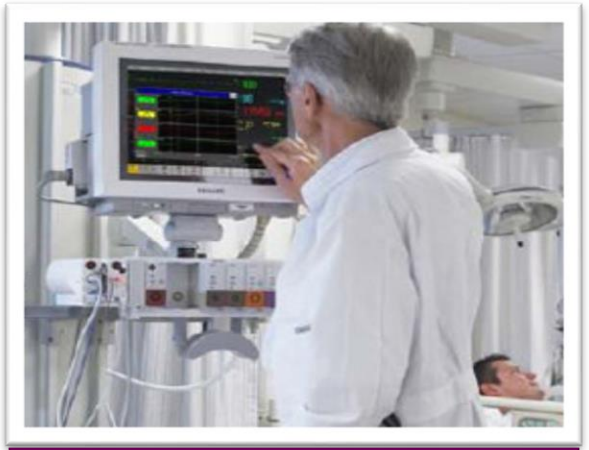
☐ Yes

☐ No

Alarm Management Evaluation

Using an end-to-end strategy to identify opportunities

Culture



People

Process & Practices

Technology

Data Analysis

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Obtain Direct Feedback and Input

From leadership, frontline staff, providers, and patients and families

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Clarify Roles & Responsibilities Through Observation

Can everyone articulate their role in patient monitoring and alarm management?

NURSING ASSISTANT

- Connects patient to telemetry device when they are admitted
- Reattaches disconnected leads and electrodes
- Replaces batteries in telemetry

NURSE

- Admits their own patients to the central
- Reviews rhythm strips every shift
- Is notified by the Monitor Tech if there is a change in patient rhythm
- Goes with monitored patient to tests
- Contacts physician for changes and to see if alarm settings can be adjusted

CHARGE NURSE

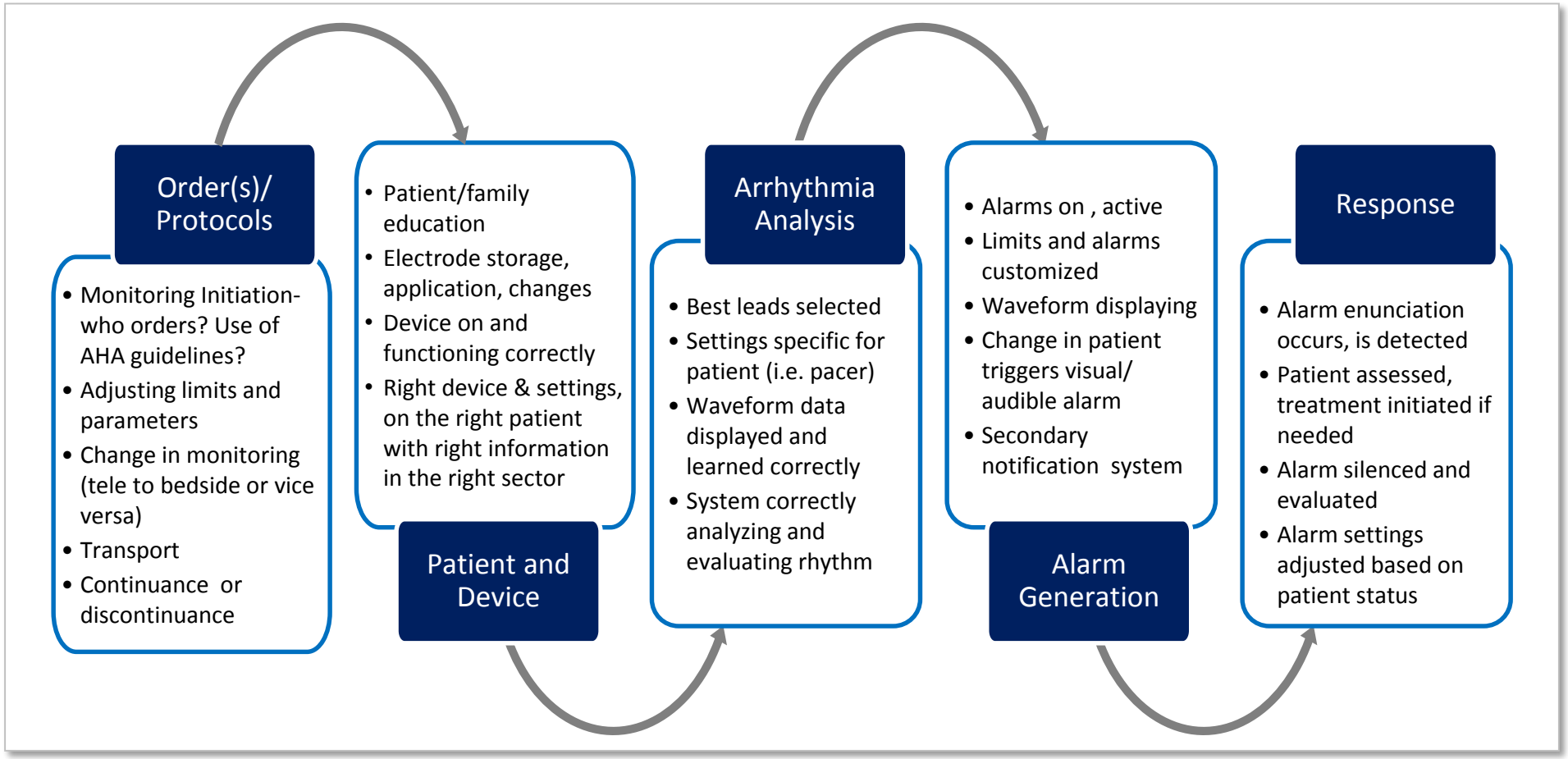
- In addition to patient care load, is the backup if the Monitor Tech is unable to reach a nurse
- Verifies that staff have their pagers and have assigned patients at the start of the shift

MONTIOR TECH

- Continuously monitors between 32 to 48 patients at the central
- Acknowledges alarms when they occur
- Calls primary nurse if there is a change; if no response, calls the Charge Nurse, if no response calls the unit directly
- Makes alarm limit adjusts on their own

Review Your Entire Monitoring and Alarm Process

Assess workflow, patient flow, data flow, environment, and patient safety



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Technology Assessment

Do staff know how to adjust settings and how to return to defaults?

Settings	Tele 1	ICU	MICU
High Limit	120	135	135
Low Limit	50	50	50
Extreme Tachy Diff	20	30	30
Tachy Clamp	200	240	240
Extreme Brady Diff	20	20	20
Brady Clamp	40	30	30
Asystole Thresh	4.0 SEC	4.0 SEC	4.0 SEC
Vtach HR	100	120	120
Vtach Run	5	10	10
Vent Rhythm	14	14	14
PVC's/min	10	10	10
Non-Sustain VT	ON	ON	ON
V ent Rhythm	ON	ON	ON

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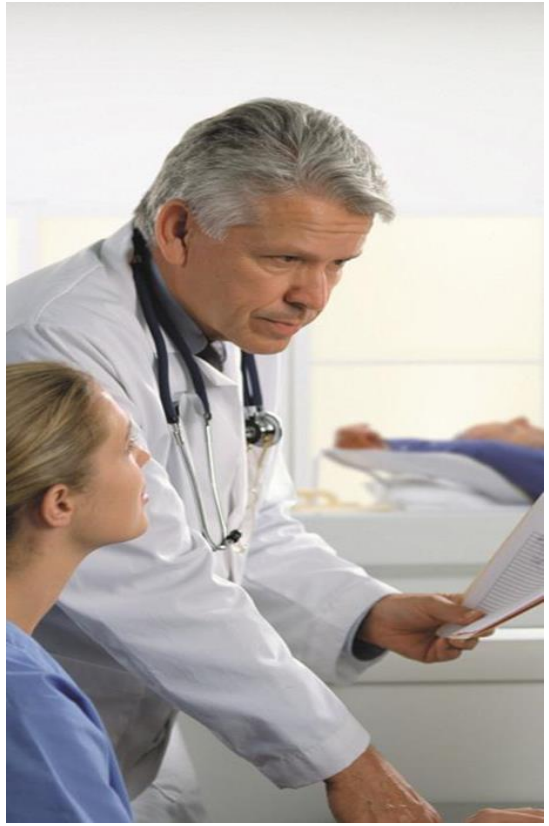
Your Culture

What are your ways of working together?

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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Question

Do you currently collect and analyze data about the number and types of monitoring alarms occurring on your unit?

☐ Yes

☐ No

Monitoring Alarms: How They Are Classified and Prioritized

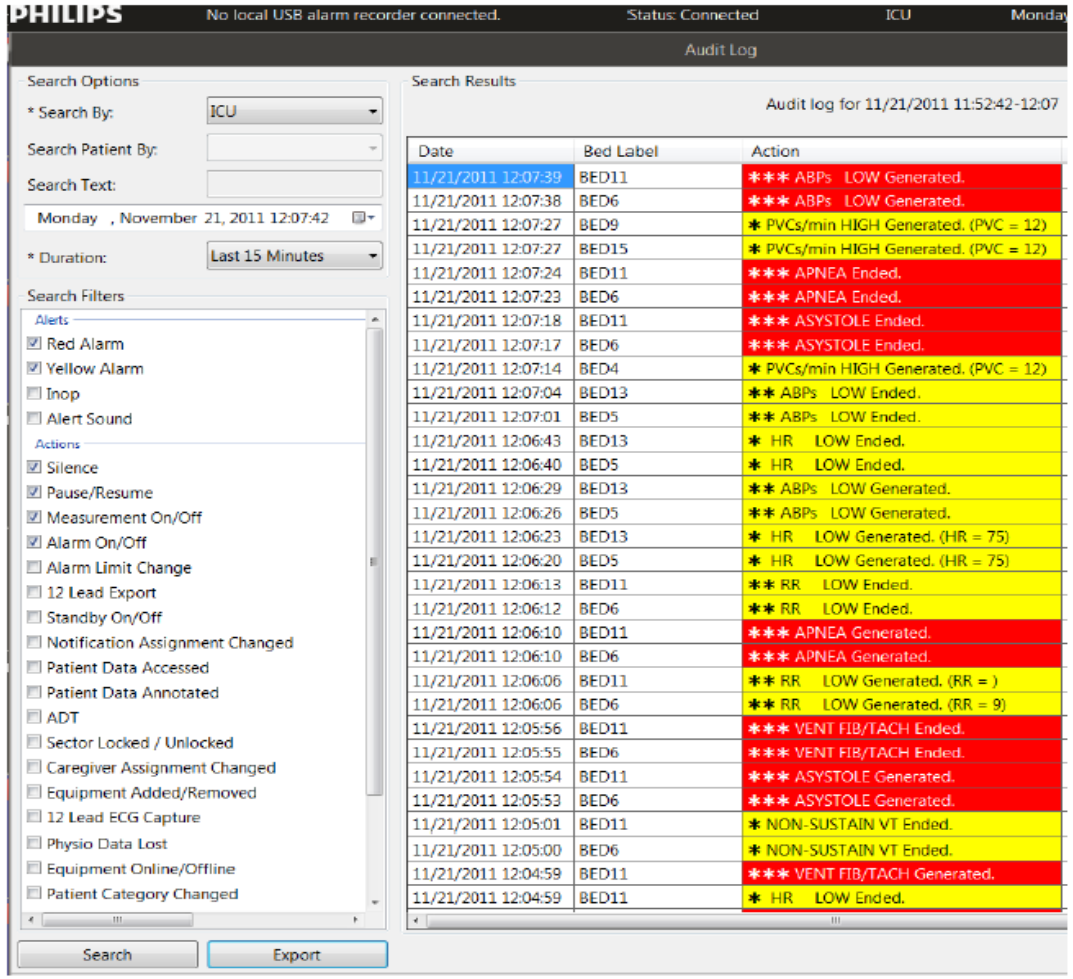
Use common terminology rather than vendor specific

High Priority Arrhythmia (***)	Medium Priority Arrhythmia (**)	High Priority Parameter (!!!)	Medium Priority Parameter (!!)	Inop/Technical (priority can be changed for some)

• Asystole
• Vfib/Tach
• Extreme Tachycardia
• Extreme Bradycardia
• V-Tach
	• 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
		• Apnea
		• Spo_2 Desat
		• Invasive Pressure Line Disconnect
		• Invasive Pressure Extreme Limit
			• High or Low Limit Violations:
			  • SpO_2
			  • Respiratory
			  • NBP
			  • Invasive Pressure
			  • Temp
			  • CO_2
			  • Other
				• Leads Off
				• Replace Battery
				• Cannot analyze ECG
				• Others outlined in IFU; not captured by PIIC iX

Data Collection: How, What, and Where

At Philips, we use the PIIC iX or the IAR Tool



	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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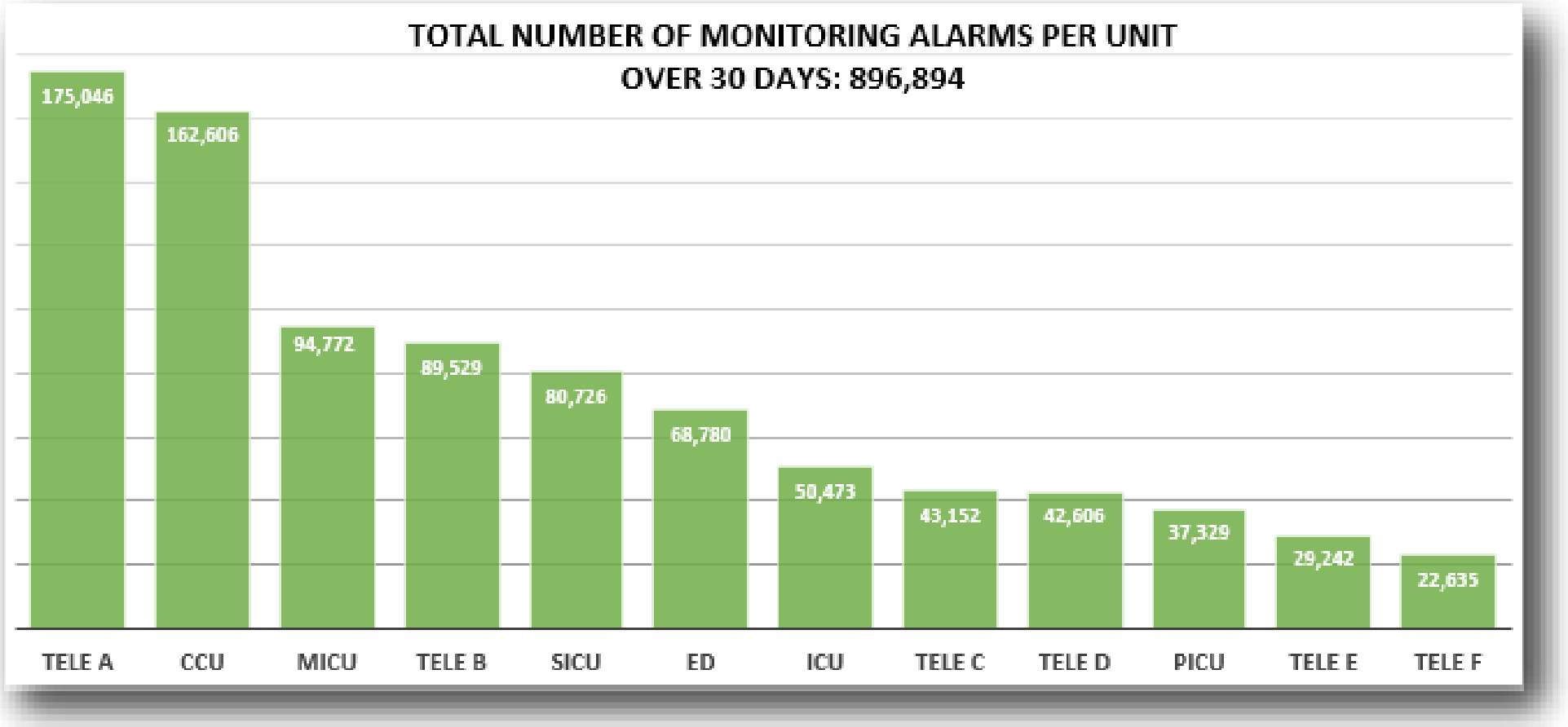
Monitoring Alarm Data Analysis

Start by comparing totals across units



Number of alarms adding to noise and interruptions on the unit as a whole

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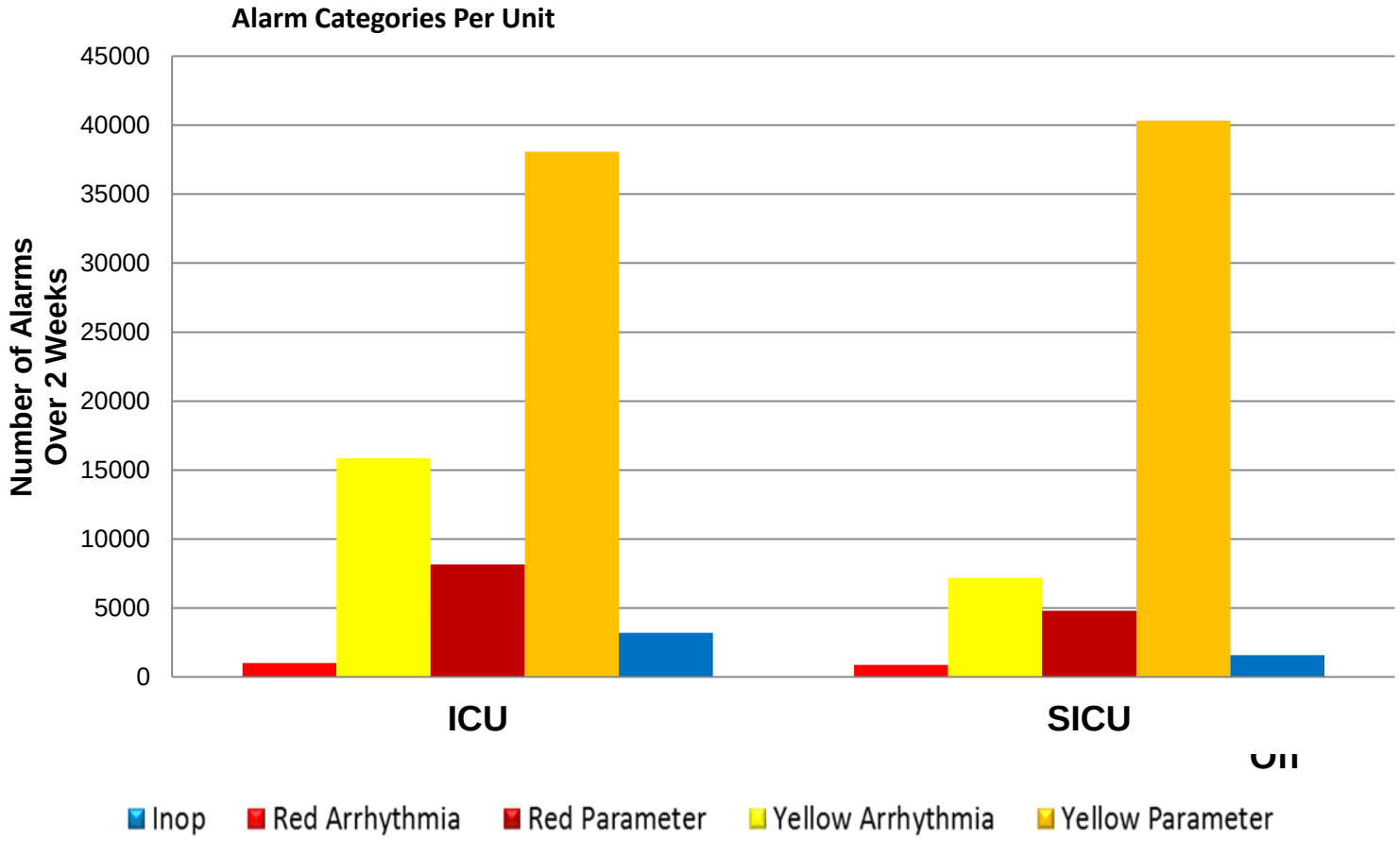
Monitoring Alarm Data Analysis

Start by comparing totals and categories across units



Identify areas of focus that could potentially have the largest impact across the organization

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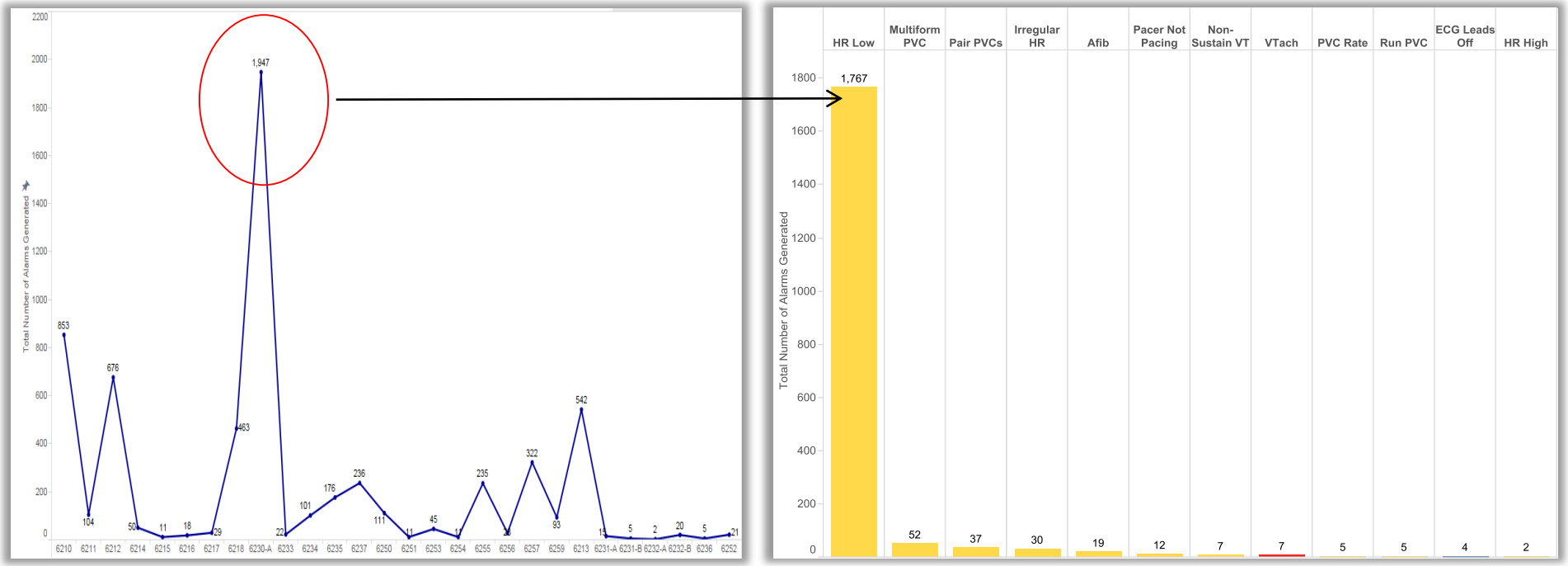
Check For Outliers

Deep dive can provide information on customization and practices

Total Alarm Signals Per Patient Bed Over 24 Hours



Summary

A total of 1,947 alarms were generated by one patient and the majority of the alarms for Low Heart Rate. The low limit was set at 75. Except for 12 of the alarm, all of the alarms that occurred were triggered by heart rates between 70 and 74.

Are one or two patients contributing the most to the alarm load? Is it because the alarms are actionable or do they need to be customized?

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Data Based Default Settings Improvements

Use data to identify system wide and unit specific opportunities

Who and How

- Alarm Management/Technology Committee
  - Multidisciplinary and key stakeholder representation
- Published Best Practices and other resources
  - Utilize Near Miss, Incident, RRT, and Code Blue reports
- Keep focus on whether an alarm is clinically relevant and/or actionable
  - Based on patient populations, care models, and treatment protocols

Where To Start

- Could some medium priority arrhythmia alarms be safely defaulted off?
- Review all parameters
  - Evaluate limits, balance so not too tight, not too wide
  - Can some parameter alarms be safely defaulted off?
  - Review delay times before an alarm is triggered, e.g., SpO2 low limit, Desat, Apnea
- Identify redundant settings and determine when they should be utilized or eliminated
- Ensure Leads Off & Replace Battery are high priority across all units

Pilot incremental changes on one unit and evaluate results and discuss lessons learned before implementing house wide

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Secondary Notification:

Automated Middleware or Central Monitoring Unit

Question

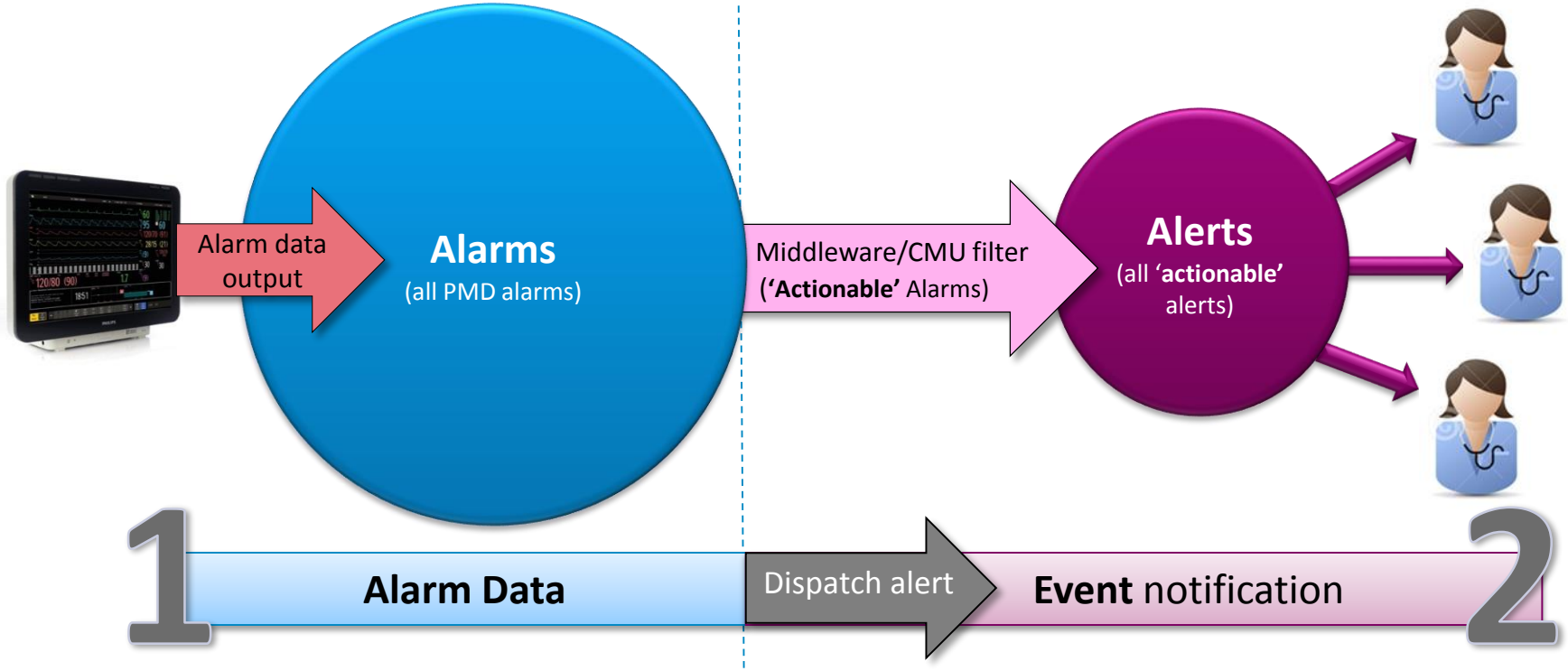
Does your institution use any type of automated secondary notification system for clinical alarms?

☐ Yes

☐ No

Alarm/Alert Communication Process

Understand your system: What is being sent, to whom, what are the delay times, escalations patterns, and reminders?



Alarm data capturing and analysis

Focus: Baseline alarm data and default settings

Alert Communications and analysis

Focus: Alert workflow and processes and data

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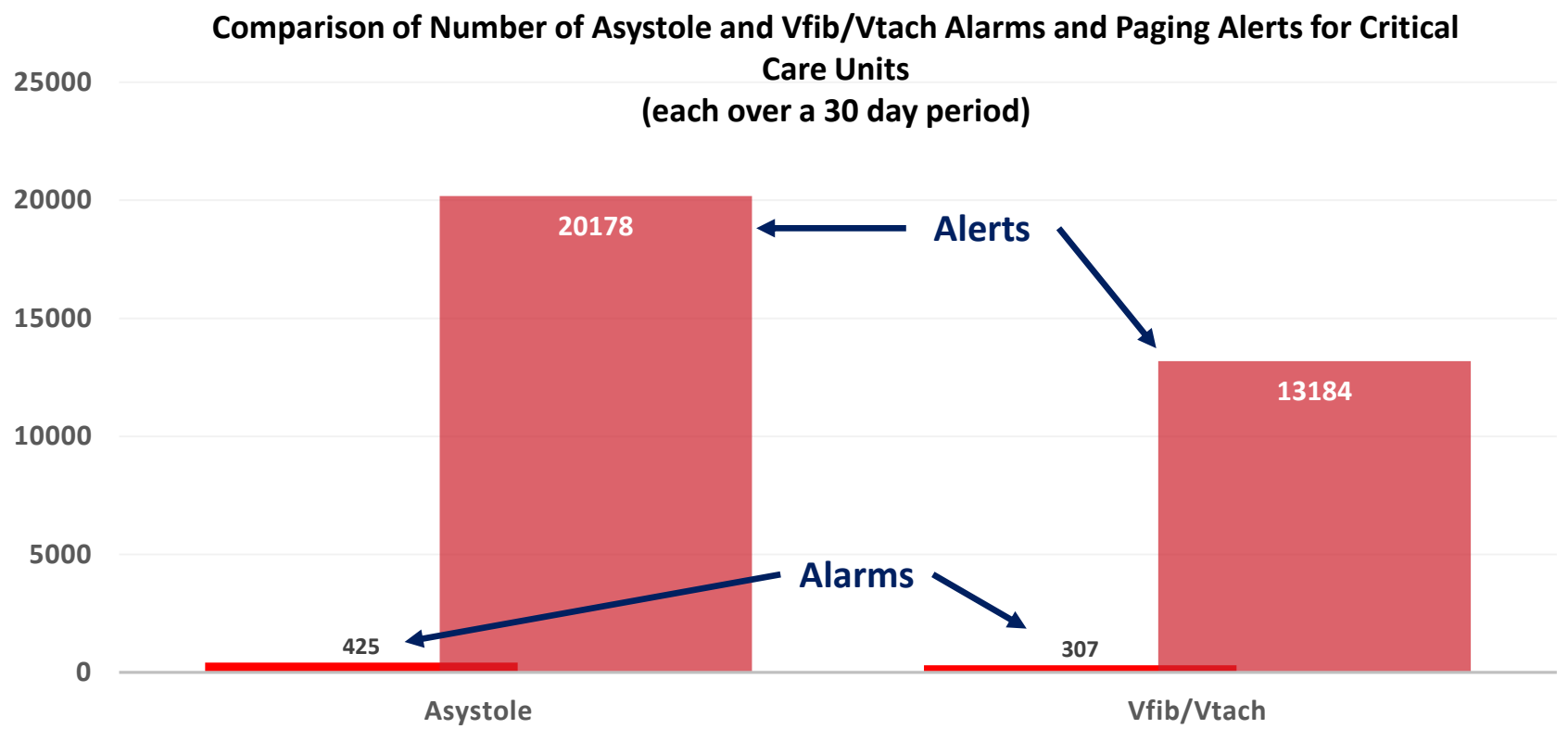
The Potential Impact of Alerts

If not utilized effectively, staff will also become desensitized to alerts



This was an automated system. What is the impact on Monitor Watchers?

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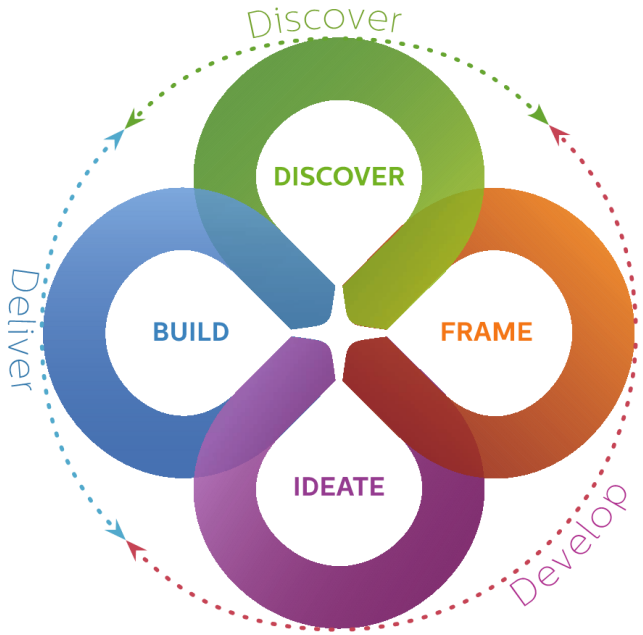
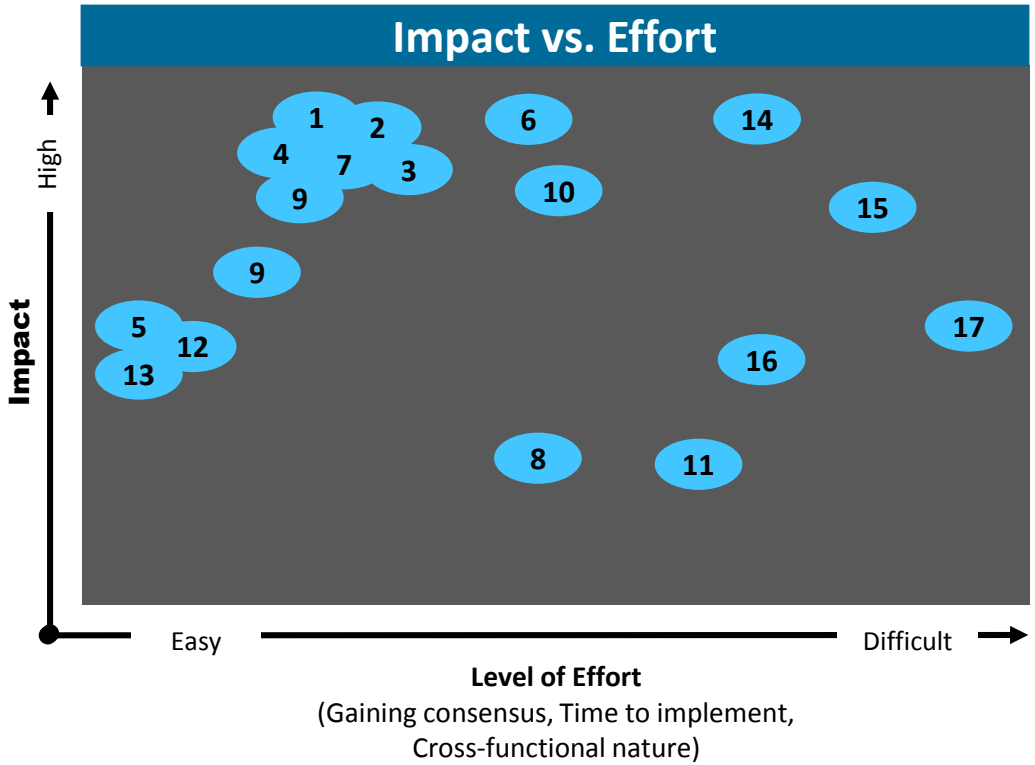
Other Opportunities

The CoCreate Approach

…The beginning of the journey towards improvements for a better future





***Consistent with your Organizations' vision**, Philips partnership resolves to **discover** the gaps and challenges, co-**develop** solutions with the stakeholders and **deliver** results.*

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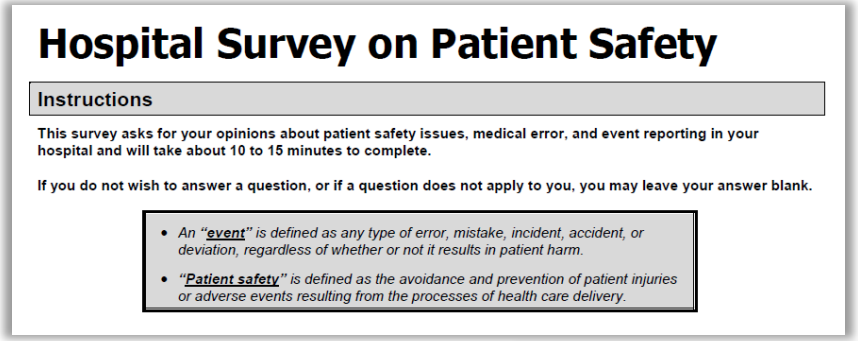
Understand & Enhance Your Culture

Ensure everyone views alarm management as a patient safety issue that is everyone's responsibility



Hospital Survey on Patient Safety

Instructions

This survey asks for your opinions about patient safety issues, medical error, and event reporting in your hospital and will take about 10 to 15 minutes to complete.

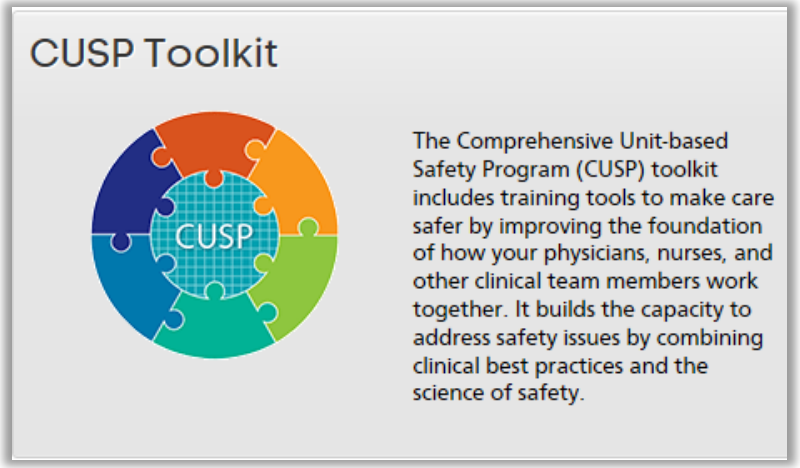
If you do not wish to answer a question, or if a question does not apply to you, you may leave your answer blank.

- An "***event***" is defined as any type of error, mistake, incident, accident, or deviation, regardless of whether or not it results in patient harm.
- "***Patient safety***" is defined as the avoidance and prevention of patient injuries or adverse events resulting from the processes of health care delivery.

Near Miss Reporting

AACN Standards for Establishing and Sustaining Healthy Work Environments

Critical Thinking Skills



CUSP Toolkit

The Comprehensive Unit-based Safety Program (CUSP) toolkit includes training tools to make care safer by improving the foundation of how your physicians, nurses, and other clinical team members work together. It builds the capacity to address safety issues by combining clinical best practices and the science of safety.

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Start With Basic Process and Move to Advanced Processes

Often a lack of clarity and wide variation in practice

Artifact Prevention

- Skin prep prior to electrode attachment
- Electrode storage & placement
- Lead wire inspection
- Electrode evaluation for daily use and special needs
- Replace electrodes q24 hours
  - This is an AACN recommendation
  - One study showed daily electrocardiogram electrode change reduced the average alarms per bed per day by 46% on two Critical Care units.

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 .

Alarm Customization

- Use Alarm Committee and other internal experts to develop a consistent customization process
- Identify which settings nurses can individually adjust versus which require further input from others (physicians, charge, manager, etc.)
  - Limit adjustments
  - Turning individual alarms off
  - Changing alarm criteria (e.g. increasing pause trigger from > 2 seconds to > 3 seconds or Vtach rate trigger from 100 bpm to 120 bpm)
- Update policies and procedures so they align with the process
- Establish alarm settings review process as part of hand-offs and rounds
- Consider incorporating alarm review and actionable settings as part of patient rounds

Perform random audits related to processes to ensure practice aligns

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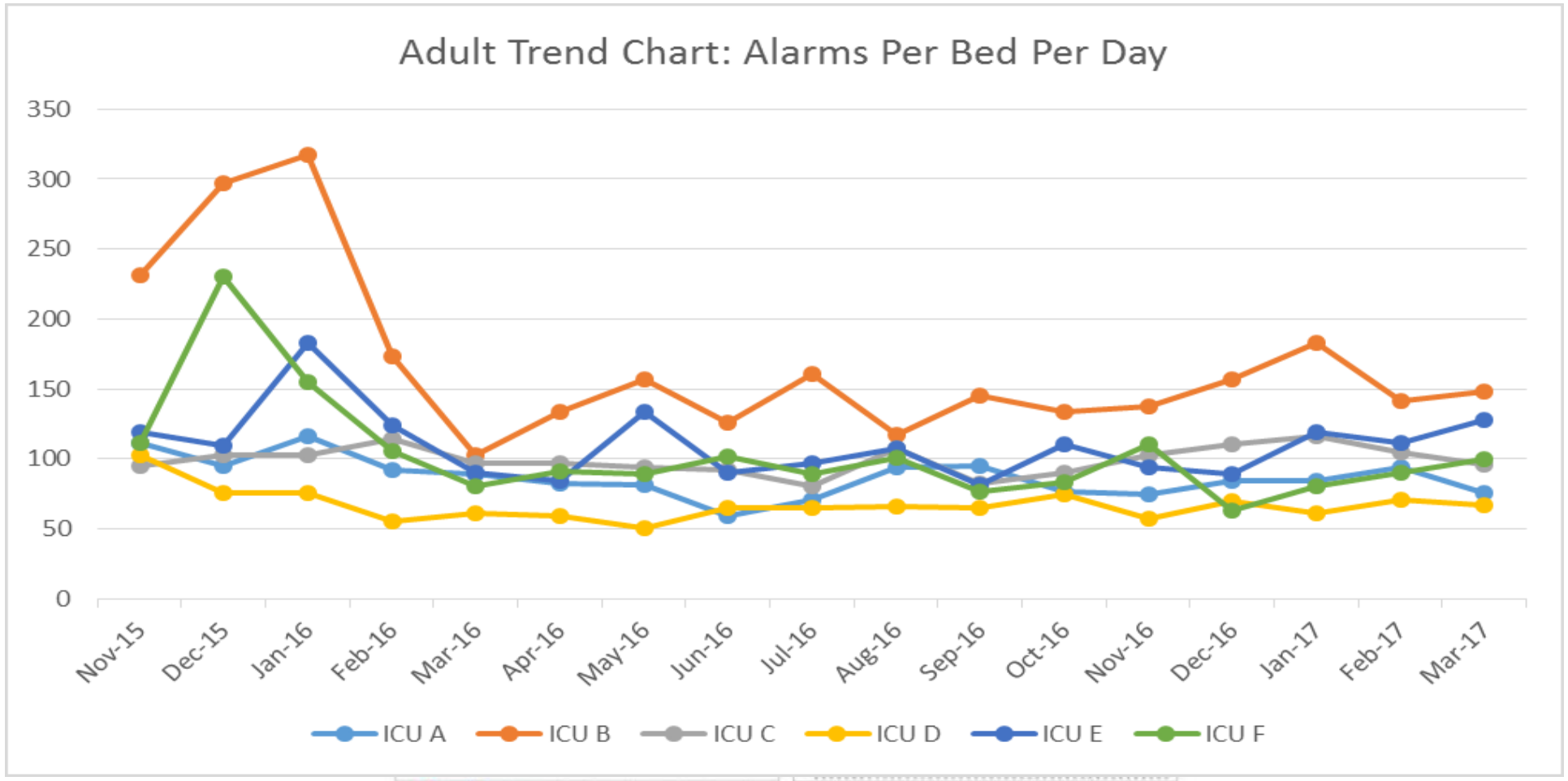
Results

Some other examples

	Type	Total Alarms Per Patient Bed Per Day
Hospital A	**Lead** Changes Q24 hours & obtaining appropriate lead set sizes	**-60%**
	Default Changes: Arrhythmia Settings	**-41%**
	Default Changes: SpO2 Low Limit Decrease	**-39%**
Hospital B	**Default** Changes: Arrhythmia & Parameter Settings (Unit 1)	**-36%**
	Default Changes: arrhythmia Settings (2 Units)	**-42%**
Hospital C	**Default** Changes: Arrhythmia Settings (Unit 1)	**-30%**
	Default Changes: Parameter Settings (Unit 2)	**-19%**
	Customization Guidelines Only (Unit 3)	**-26%**
Hospital D	**Default** Setting Changes (Unit 1)	**-28%**
	Default Setting Changes (Unit 2)	**-33%**

Results

Some other examples



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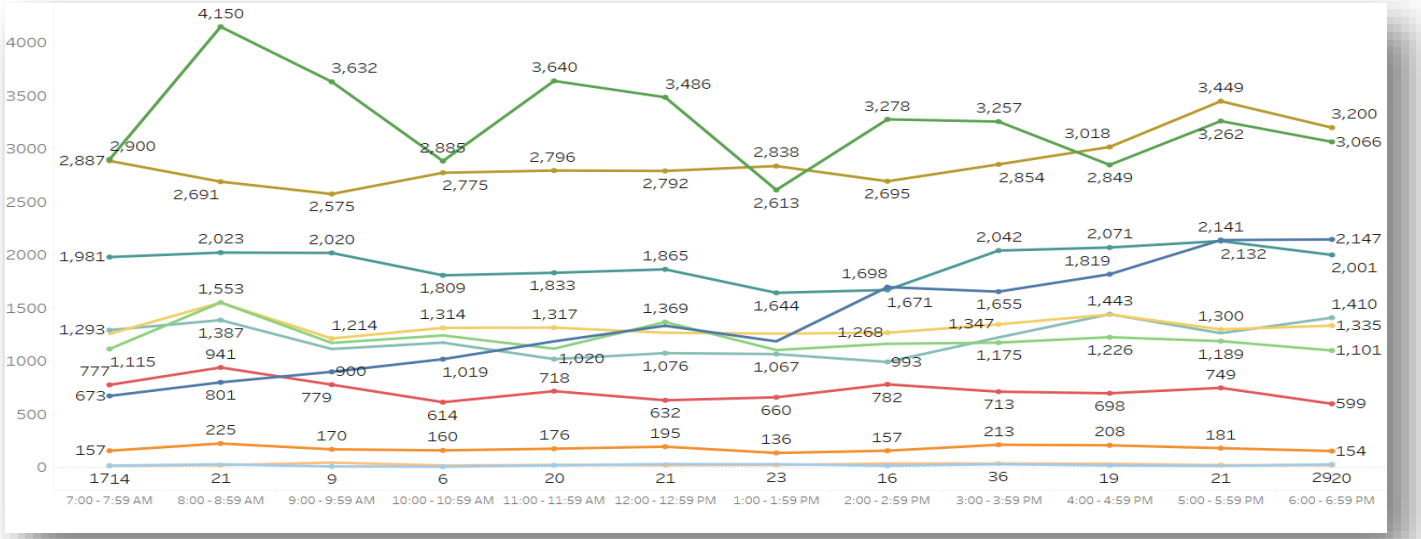
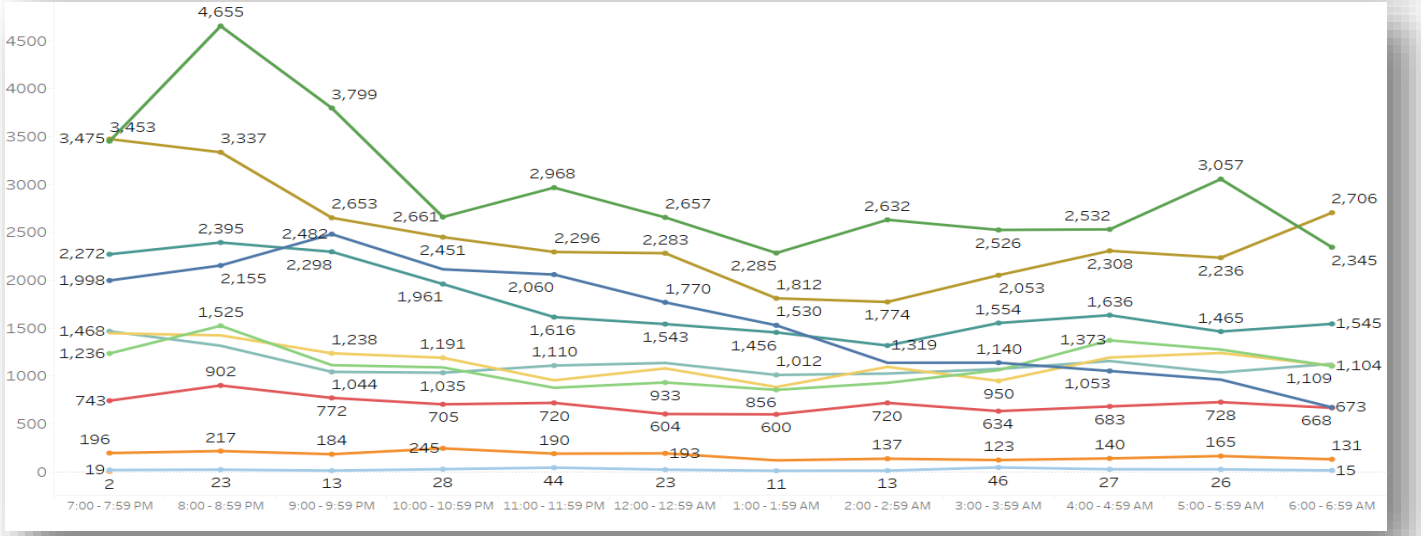
Results

Some other examples

Day Shift



Night Shift



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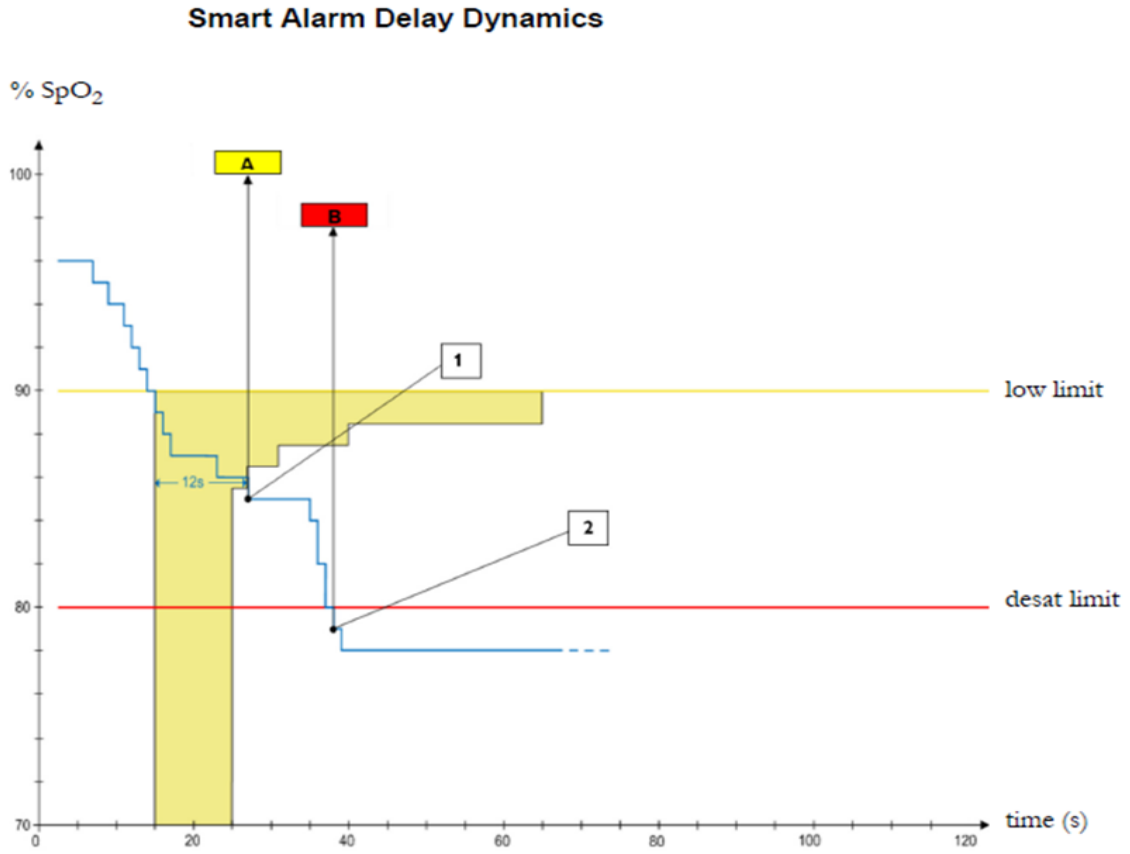
Technology Optimization

What can you use to alert you to a change in patient status?

SpO_2 Smart Alarm



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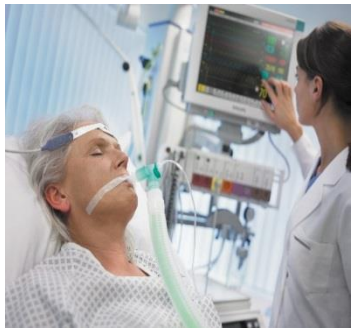
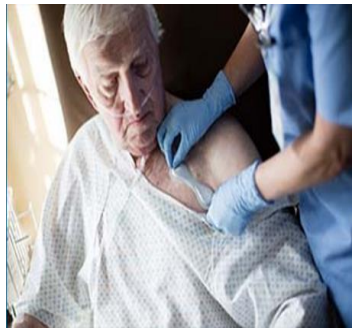
Right Size Your Monitoring Solution

The Right Monitor





*Christiana Care used the AHA Guidelines and reduced their telemetry use by **70%** and estimate they saved **$4.8M** in a year*

For The Right Patient

At The Right Place

At The Right Time

*"Our survey revealed that the use of monitor watchers is prevalent, but the efficacy of monitor watchers in **improving patient outcomes** has never been established."**

*Citation: Funk, Marjorie et al. Use of Monitor Watchers in Hospitals: Characteristics, Training, and Practices, Biomedical Instrumentation and Technology. Nov/Dec 016

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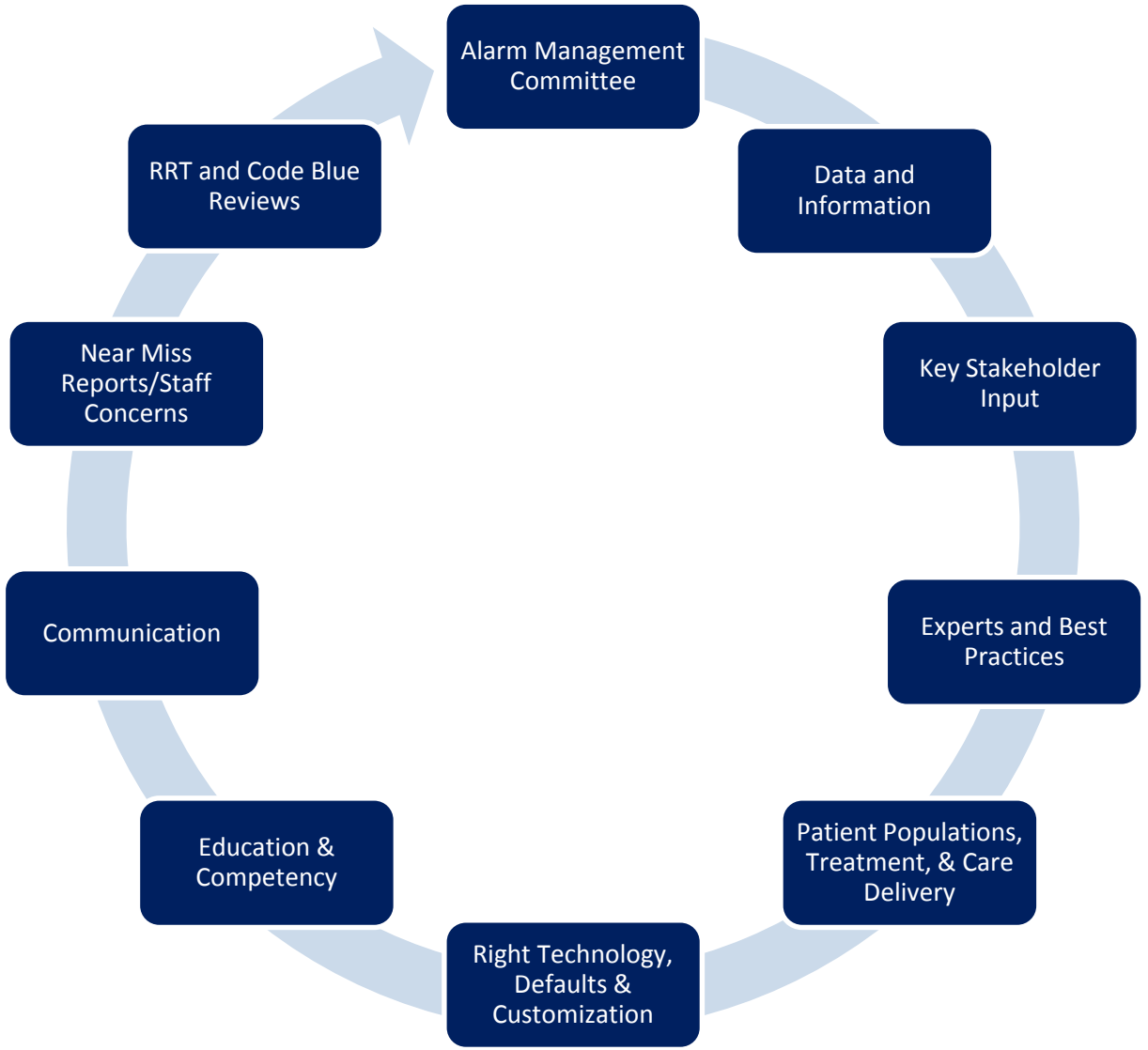
The Process is Cyclic

Alarm Management isn't a one and done initiative



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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!