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ALARM MANAGEMENT & BEST PRACTICES

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MAY 2019

History of Alarms



The word “alarm” originates from the Latin “ad arma” or French “a l’arme” which translates to ‘to your weapons’¹



Some of the first documented alarms dates back to the Middle Ages



An alarm is a warning that results from a measurement variance and indicates a deviation from the normal state



Alarms are essential and necessary in monitoring vital signs necessary for supporting life



The word “alarm” indicates a call for immediate action or defense



Alarms are intended to prevent patient harm by providing rapid reaction to critical situations **BUT** only if they are not false alarms

ALARM FATIGUE

Clinicians become desensitized, overwhelmed or immune to the sound of an alarm

What Is Alarm Fatigue?



Alarm fatigue is the direct result of the constant bells, blips and alarm signals emitted by medical devices.



Care givers may become “immune” to these sounds which increases the risk of these alarms being absorbed into the auditory landscape of hospital corridors and subsequently being ignored²

Fatigued Clinicians May:



Turn down
alarm volume



Turn off
alarm



Adjust alarm
settings

These actions can have serious or fatal consequences

Alarm Fatigue



Hazard Faced by Hospitals

“In a hospital setting, the frequency of alarms poses a risk of some hospital staff becoming **desensitized** to the constant beeps and in the worst cases, **lowering the volume too much**”³

—ECRI Institute

Patient Safety Issue



Sentinel Alert: (OAKBROOK TERRACE, Ill. – April 8, 2013)
The constant beeping of alarms and an overabundance of information transmitted by medical devices such as ventilators, blood pressure monitors and ECG (electrocardiogram) machines is creating “alarm fatigue” that puts hospital patients at serious risk, according to a [Sentinel Event Alert](#) issued today by The Joint Commission.



#2
Missed Alarms
Technology Hazard

Missed Alarms Can Have Fatal Consequences!⁴

The Joint Commission

Scope of the Problem

Medical Device Alarm Safety

100s

of alarm signals per
patient per day

1,000s

of alarm signals on
each unit

10,000s

of alarm signals
throughout a hospital
per day



85-99%

of alarm signals don't require
clinical intervention⁵

The Joint Commission: Patient Events

Joint Commission Sentinel Event database



National Patient Safety Goals on Alarms

The Joint Commission Announces 2014 National Patient Safety Goals in June 2013

PHASE 1

(2014 to January 1, 2016)

Establish alarm system safety as hospital priority

Identify the most important alarm systems to manage (EC.02.04.01)

PHASE 2

(began January 1, 2016)

Establish policies and procedures for managing the alarms identified

Educate staff and communicate changes



Official Publication of Joint Commission Requirements
National Patient Safety Goal on Alarm Management

NPSG on Alarm Management: Phase 1

NPSG on Alarm Management⁶ in Phase 1 (beginning January 2014)

Hospitals were required to



Establish alarm management as an organizational priority



Identify the most important alarms to manage based upon internal situations



Seek input from medical staff and clinical departments



Identify risks to patients due to lack of response and/or malfunction



Identify actionable alarms vs alarms contributing to noise/fatigue



Pro-actively think: Identify potential for patient harm based on internal incident history



Publish best practices/guidelines

NPSG on Alarm Management: Phase 2

NPSG on Alarm Management⁷ in Phase 2 (beginning January 2016)

Hospitals were expected to develop and implement specific components of policies and procedures that address at minimum:



Clinically appropriate settings



Process for monitoring alarms and expectations moving forward



When alarms can be disabled



Checking individual alarm signals for accurate settings, proper operation and detectability



When parameters can be changed



Educate those in the organization about alarm policies



Who can set, change or turn “off” parameters



Clinical Leadership responsible for ensuring accuracy, safety, education and communication around new alarm policies

Common Cause for Nuisance Alarms



Improper lead placement⁸



Many parameters set to always sound an alarm



No schedule for changing leads



Multiple **unverified alarms** being routed to nurse pager or phone



Frayed or malfunctioning lead wires



Lack of patient education, thus decreased patient compliance with wearing the device



Alarms not customized



Alarm defaults still per manufacturer recommendations, not customized to reflect unit/hospital policies.



NPSG on Alarm Management: Taking Action



Create or participate in an Alarm Management Committee



Change transmitter batteries daily or when the system indicates the need for them



Stress loops on ECG lead wires for tremulous patients



Customize individual patient alarms based on assessment and condition to assure alarms are valid



Establish organizational alarm defaults by unit

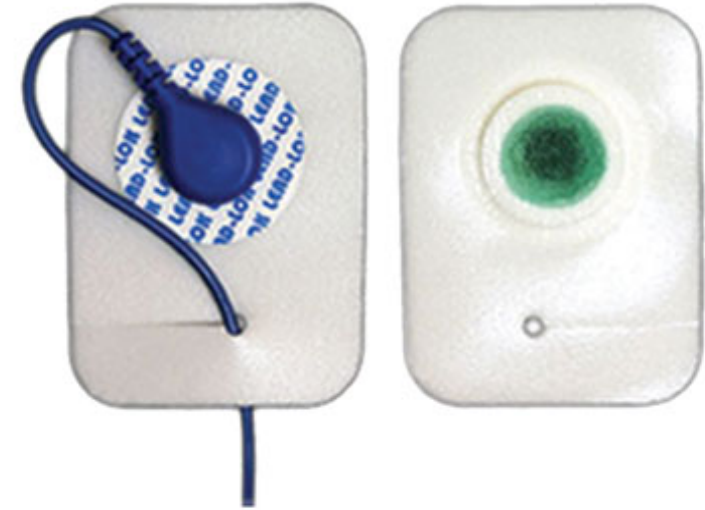
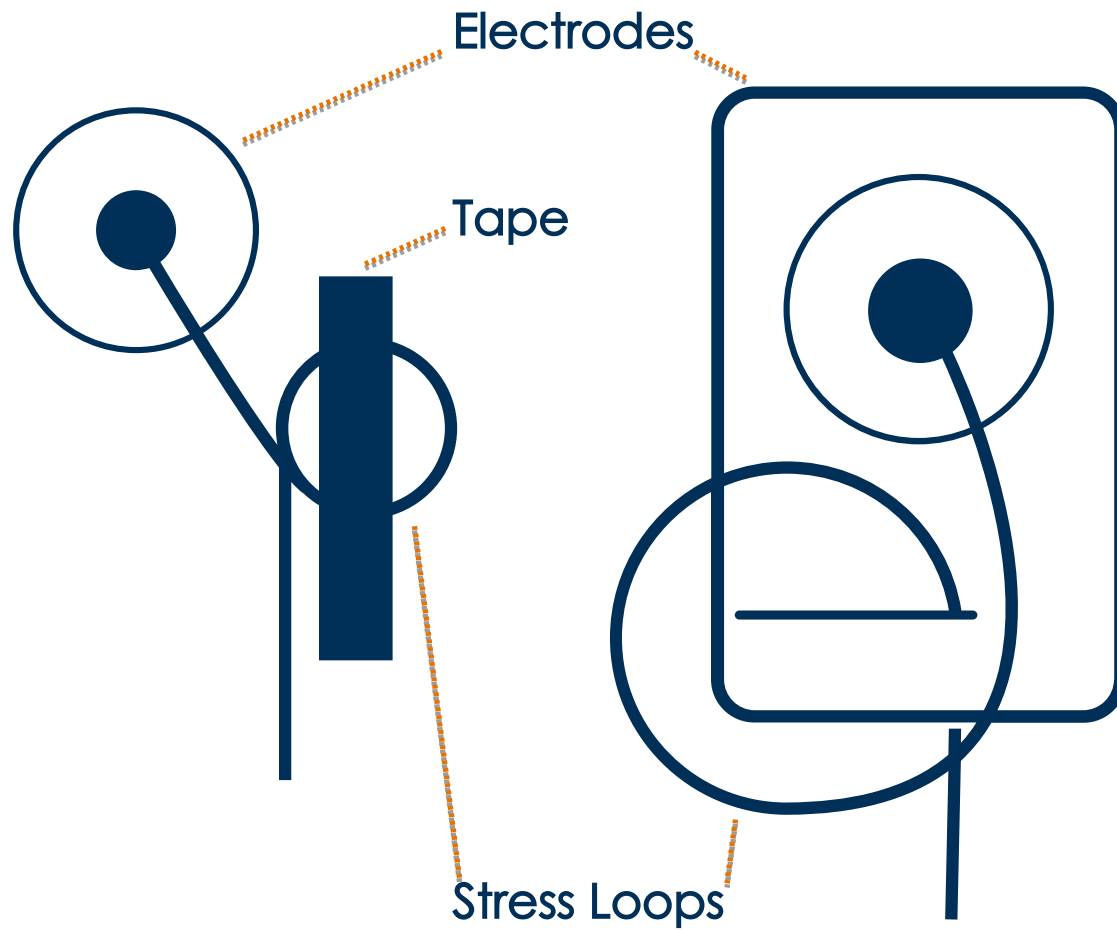


Customize alarms based on patient assessment and report/verify at shift changes



Change electrodes daily using recommended procedures. Add this to daily routine tasks such as baths or PM care to assure practice change⁹

Stress Loops for ECG leads



Best Practices: Alarm Settings

Alarm settings, limits and delays¹⁰



Establish appropriate default settings for hospital unit and patient population



Turn off duplicate alarms



Ensure alarm priority is set to **actionable levels**



Review high/low settings and other limits



Small changes can yield big results:
Example: Decreasing SpO₂ lower threshold by one point from 90%–89% can have large effects on reducing nonactionable alarm signals.



Consider using **alarm signal delays** for alarm autocorrection



Consider using secondary alarm notification to improve audibility



Consider alarm escalation to increase priority

Best Practices: Alarm Settings



Establish alarm limits and defaults based on the **population served**
(Adult ICU vs. NICU vs. Emergency Department)?



Create a process to customize alarm settings based on **individual patients**



One size does not fill all

Staff Education



Educate clinicians on their roles related to alarm management



Empower staff to manage nonactionable alarms by changing limits to actionable levels (in accordance with organizational policy)



Ensure staff are trained and competent in recognizing and troubleshooting equipment alarm signals



Encourage staff to review trend data for repetitive alarms, especially during sleep. A perceived false alarm may be a sleep apnea patient with multiple clinical relevant alarms that self-correct when the nurse enters the room and wakes the patient

Best Practices: Alarm Settings

Patient Education



Educate

patients and families about the physiologic monitoring systems and their role in patient safety and alarm malmanagement¹¹



Encourage

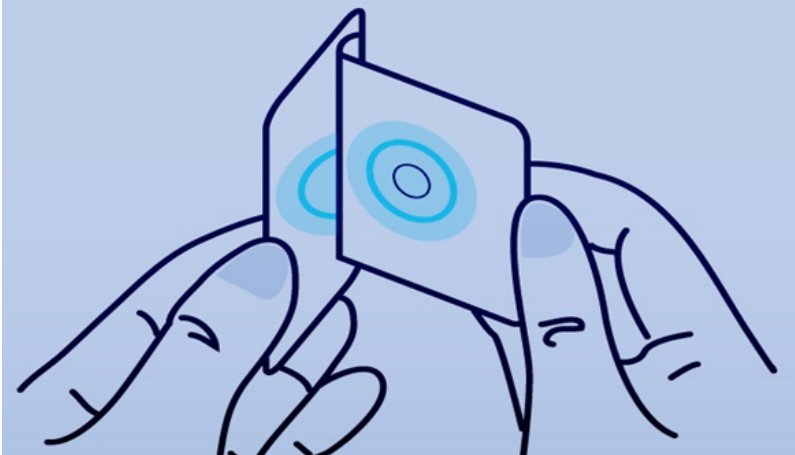
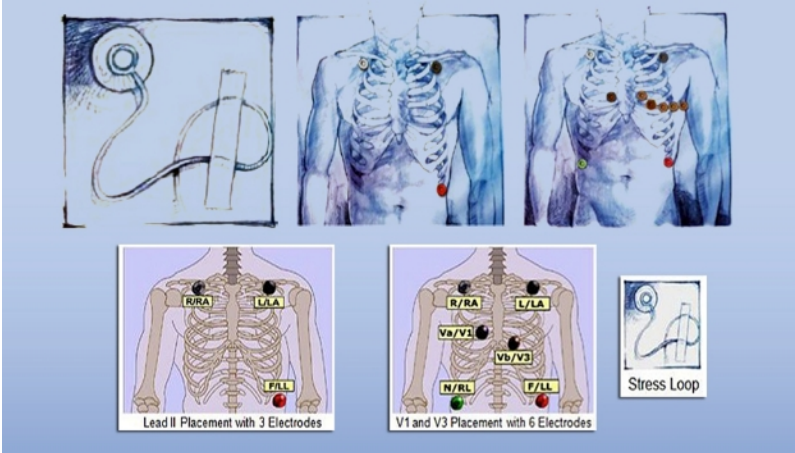
patients and families to notify staff when an alarm signal is not being addressed in a timely manner



Consult

with other hospitals to determine where they have set their default physiologic monitor settings

Best Practices



Waveform Artifact/ECG/SPO2¹²



Review proper skin and electrode prep



Maintain regular schedule for changing electrodes



Inspect reusable lead wires to ensure they are intact, and for proper connections and frayed wires



Consider use of disposable lead wires and SPO2 probes



Check sensor placemat for adhesion



Stress looping

Smoothing & Time Delays

A large percentage of clinical alarms are caused by only a mild threshold violation¹³



Implementation of time delays on certain parameters have proved to be effective in alarm reduction



Research has shown that a 14-second smoothing algorithm on SpO₂ reduced false alarms by 50%



Smoothing Algorithms: Remove artifact and smooth the vital sign data collected



Program average periods for heart rate/pulse rate (usually 0-10 seconds), SpO₂ and respiration rates (usually 0-30 seconds)

Responding to Notification Systems



Acknowledge
the Notification in a
Timely Manner



Assess the PATIENT
When Alarms Occur



Take Action to Correct
Patient Problem



Replace probe(s)



Replace/Change
Electrodes



Adjust Alarm
Parameters

Based on Clinical
Assessment and Stability



Assess Trends Proactively

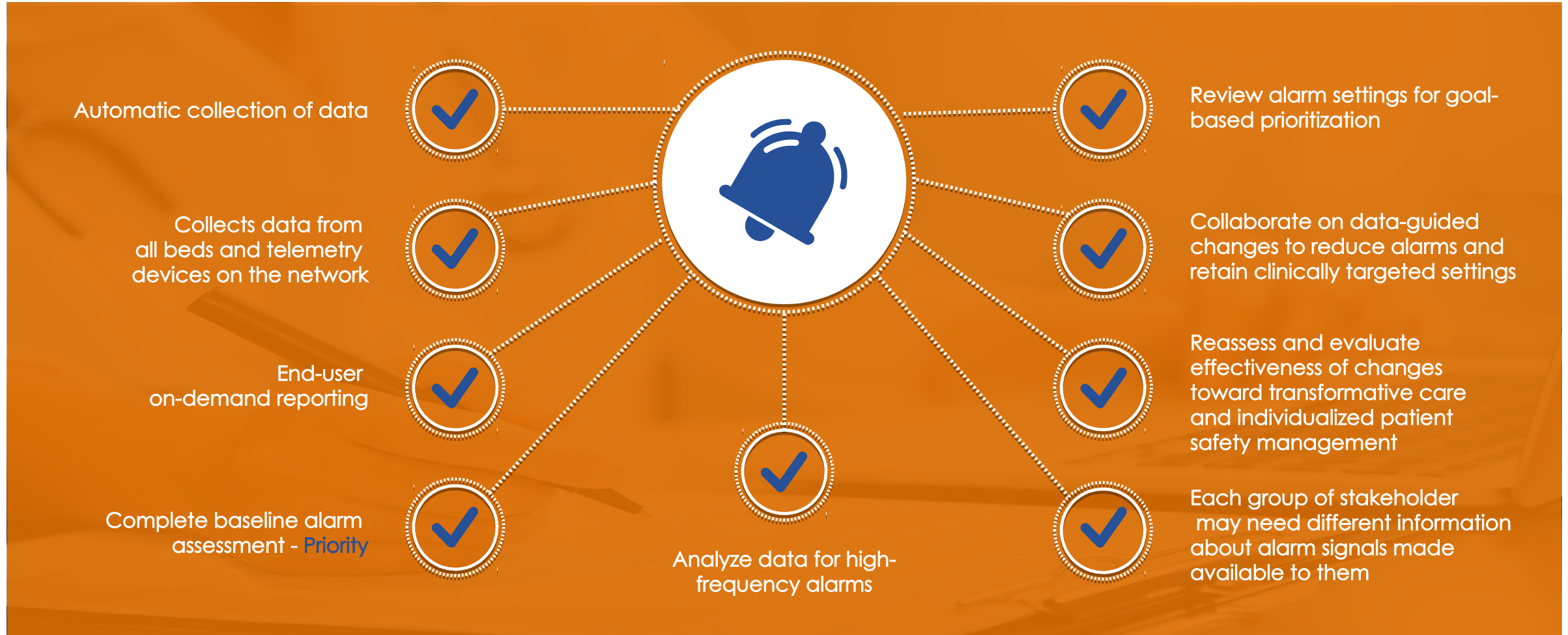


Educate Patient

On need for continuous
monitoring to increase patient
understanding and nursing's
commitment to patient safety

How Do I Measure My Changes?

Data: What to Look for in Alarm Reports¹⁴



How Do I Measure My Changes?

Data: What to Look for in Alarm Reports¹⁵



Real-Time Data or Metrics for Dashboard Reporting



Typically Most Useful to Point-of-Care Nurses



Shifts with Most Alarms



Alarms by Nursing by Unit



Time of Week for Most Alarms



Alarms by Bed, Shift or Time of Day



Type of Alarm Sounding Most Often

How Do I Measure My Changes?

How Does the Committee Determine Actionable vs. Non Actionable Alarms?¹⁶



Critical Factors



Include point of care professionals



Consider how information about alarms and types of alarms could affect work environments



Staffing

Workflow Analysis

Alarms Settings and Management

Immediate Impact of Alarm Flood
(10 or more alarms in 10 minutes)

Protocol Management and Review

Metric Comparison Against Peers

Monitoring for Outcomes

Clinically Relevant Process to Ensure No Negative Outcomes¹⁷



**Monitor Noise Level
in the Unit**



**Survey Patient
Satisfaction**



Evaluate Incident Reports

Determine if issues are a result of
alarm management changes



**Convene Regular
Safety Huddles**



Monitor for Any Increases

Increase in rapid response calls, codes
or unplanned transfers to critical care

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