Alarm Safety in 2016: Moving Beyond ECG Monitors

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Learning Outcome

- Discuss a comprehensive approach to alarm management that reduces nuisance alarms while optimizing clinical responses for a broad array of clinical alarms.
A stroke pt on a tele unit was taken to x-ray.

Upon return, the transporter put him in his room, but failed to notify the nurse and ECG monitoring was not resumed.

An hour later, a nurse discovered the patient slumped over in a chair; attempts to resuscitate him were unsuccessful.
What Contributes To Alarm Related Events?

Common themes identified:

- **Alarms that did not sound**, due to absent or inadequate systems, improper settings, inaudible or disabled alarms

- **Alarm-related miscommunication**, misunderstanding about who was supposed to respond to the alarm, or a lack of notification to the responsible clinician

- **Alarms that were not promptly addressed**, mainly physiologic alarms, often technical (e.g., leads off, battery)

- **Alarm fatigue** cited as a common contributing factor
Question #1
Evidence based approaches to reduce alarm fatigue include:

a) Turning down the alarm volume
b) Reducing the time delay on physiologic alarms
c) Increasing the time delay on physiologic alarms
d) Defaulting alarms to ‘off’ when staff are with the patient
Question #1
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How Do Alarms Work?

- **Current designs = Frequent alarms**
  - High sensitivity – detect even minute changes
  - Low specificity – don’t distinguish if real or important

- **Threshold technology**
  - An alarm sounds when a specified threshold is breached (e.g., low HR at 50 bpm).
  - Thresholds are not integrated (e.g., asystole alarm with normal arterial BP).
How to Reduce Alarms

- Disable the parameter.
- Change the threshold.
- Increase the delay to allow “self correction”.

Our Alarm “Make Over”

- Multidisciplinary team to review baseline data and formulate plan
- Phase 1 – alarm default parameters changed to “actionable” settings
- Phase 2 – education and intervention regarding clinical policy/best practices
  - 22 unit-based ‘alarm champions’ in the trenches
  - Lead placement and electrode skin prep
  - Policy – RN expected to change Afib alarm to ‘off’ for non-acute AF; change pacer alarm to ‘on’ when pacing may occur; MD order not needed
Monitoring Strategy

Predicted 65% reduction by eliminating PVC pairs and runs, Multiform PVCs, Bi- and Tri-geminy, and redundancies.

Standardize HR defaults to 135, 50 and SpO2 88%.

Eliminate redundant alarms.
Results: Yellow Alarms/Patient Day - Reductions By Unit

Overall Reduction 77%
From 9515 alarms/146 pts to 1901 alarms/130 pts

# alarms/pt/day

<table>
<thead>
<tr>
<th>Unit</th>
<th>Before</th>
<th>After</th>
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</thead>
<tbody>
<tr>
<td>TICU - Davies</td>
<td>57%</td>
<td>59%</td>
</tr>
<tr>
<td>CCU - PAC</td>
<td>60%</td>
<td>60%</td>
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<tr>
<td>TICU - PAC</td>
<td>82%</td>
<td>85%</td>
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<tr>
<td>SL - tele</td>
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<td>85%</td>
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<tr>
<td>SL - ICU</td>
<td>86%</td>
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<tr>
<td>MS - ICU</td>
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<td>4 - south</td>
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<td>TICU - 3</td>
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<tr>
<td>6 - south</td>
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<tr>
<td>ICU - Davies</td>
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</tbody>
</table>

Reduction 77%
Phase 3: Telemetry
Appropriateness Criteria

- **Class I** – Indicated for nearly all acute pts
  - Potential for **ischemia** (ACS, high risk CAD)
  - Potential for **arrhythmia** (post arrest, drug load, heart block, etc.)
  - Procedural or critically ill (postop heart, PCI, sedation, etc.)

- **Class II** – Indicated for some patients
  - Potential for **instability** (chest pain, syncope, hypotension, etc.)

- **Class III** = Monitoring is not indicated
  - Acute conditions (terminal illness, atypical chest pain, etc.)
  - Chronic, stable conditions (atrial fib, asymptomatic PVCs or NSVT, etc.)

A hospital establishes a complicated set of criteria for nurses to use in discontinuing telemetry, calling it a "standing order." Is this legal?

Response from Carolyn Buppert, MSN, JD
Healthcare attorney

Is This Standing Order to Discontinue Telemetry Legal?

A reader says: "Our hospital in California has begun to roll out standing orders for registered nurses to discontinue telemetry monitoring on patients who have been on telemetry for 24 hours. The protocol says to discontinue telemetry when the following criteria are met:

- No episodes of heart rate <40 beats/min in the past 24 hours;
- No episodes of heart rate >120 beats/min in the past 24 hours;
- No troponin >0.04 ng/mL in the past 24 hours;
- Serum potassium >3.0 mEq/L and <5.7 mEq/L;
- No significant arrhythmias (no episodes of >4 consecutive premature ventricular contractions or pauses >3 seconds) in the past 24 hours;
- No evidence of chest pain, ST elevation myocardial infarction (STEMI), non-STEMI, or syncope;
- No coronary revascularization during this admission (percutaneous coronary intervention or coronary artery bypass graft);
- Not on telemetry for overdose or toxicology; and
- Not on intravenous (IV) haloperidol, IV amiodarone, IV beta-blockers, or IV calcium channel blockers.

We feel that this is outside of our scope of practice. What do you think?"
Reaudit 1 year later: Yellow Alarms/Patient Day By Unit

Noted fewer patients on monitor despite increased census

# alarms/pt/day

CCU - PAC  | ICU - PAC  | 5-south  | MSICU  | 4-south  | TICU-3  | 6-south

Baseline  | 2014      | 2015     |
Question #2
The National Patient Safety Goal regarding alarm management requires all of the following in 2016 EXCEPT:

a) Identify important alarms to address for your facility.
b) Develop policies and procedures to address alarm safety.
c) Educate staff and physicians regarding alarm safety.
d) Establish a Biomedical Safety Committee to approve all alarm related policies.
Question #2

The National Patient Safety Goal regarding alarm management requires all of the following in 2016 EXCEPT:

a) Identify important alarms to address for your facility.

b) Develop policies and procedures to address alarm safety.

c) Educate staff and physicians regarding alarm safety.

d) Establish a Biomedical Safety Committee to approve all alarm related policies.
The Alarm Safety National Patient Safety Goal

NPSG.06.01.01
Improve the safety of clinical alarm systems

- Phase 1 – Effective January 1, 2014
  - Establish alarm safety as an organizational priority.
  - Determine your facility’s most important alarms to address.
    - Gather data – internal alarm history, adverse events, etc.
    - Review and compare with best practices/guidelines.
    - Determine a plan for reducing unnecessary alarms.

- Phase 2 – Effective January 1, 2016
  - Alarm management policies & procedures
  - Staff educated about appropriate practices
### TJC Elements of Performance

<table>
<thead>
<tr>
<th>Nbr</th>
<th>Elements of Performance (EPs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Leaders establish alarm system safety as a hospital</td>
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<tr>
<td>2</td>
<td>Identify the most important alarm signals to manage</td>
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<tr>
<td></td>
<td>- Input from the medical staff and clinical departments</td>
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<td></td>
<td>- Risk to patients if the alarm signal is not attended to or if it malfunctions</td>
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<td></td>
<td>- Whether specific alarm signals are needed or unnecessarily contribute to alarm noise and alarm fatigue</td>
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<td></td>
<td>- Potential for patient harm based on internal incident history</td>
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<td></td>
<td>- Published best practices and guidelines</td>
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<td></td>
<td>(For more information on managing medical equipment risks, refer to Standard EC.02.04.01.)</td>
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<tr>
<td>3</td>
<td>Establish policies and procedures for managing the alarms identified in EP 2 above that, at a minimum, address the following:</td>
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<tr>
<td></td>
<td>- Clinically appropriate settings for alarm signals</td>
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<td></td>
<td>- When alarm signals can be disabled</td>
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<tr>
<td></td>
<td>- When alarm parameters can be changed</td>
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<tr>
<td></td>
<td>- Who in the organization has the authority to set alarm parameters</td>
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<tr>
<td></td>
<td>- Who in the organization has the authority to change alarm parameters</td>
</tr>
<tr>
<td></td>
<td>- Who in the organization has the authority to set alarm parameters to “off”</td>
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<td></td>
<td>- Monitoring and responding to alarm signals</td>
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<td>- Checking individual alarm signals for accurate settings, proper operation, and detectability</td>
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<td></td>
<td>(For more information, refer to Standard EC.02.04.03)</td>
</tr>
<tr>
<td>4</td>
<td>Educate staff and licensed independent practitioners about the purpose and proper operation of alarm systems for which they are responsible.</td>
</tr>
</tbody>
</table>
What Are Your Alarm Priorities?!?

- Infusion Pumps
- Foot Pumps
- Warming Devices
- SpO2 Monitors
- Bed Alarms
- Ventilators/CPAP
- Hemodynamics
Infusion Pump Alarms

- Frequent reports/observations of alarms
- QI task force assigned to project
- Gathered data: nursing survey to explore issues

![Alaris Infusion Pump Alarm Questionnaire for Nursing Staff at CPMC](image)
Nursing Survey Data
- Nurse responses about how to reduce infusion pump alarms (253 responses)

- “Careful priming of the line will help prevent a lot of air bubbles.”
- “Pausing the infusion only gives a minute, not long enough for a patient to go to the bathroom.”
- “Stocking IV pumps. They need to be plugged into an outlet. All the IV pumps have dead batteries in supply room.”
- “Educate patient about avoiding occlusion on patient side.”
- “Get the prior nurse to set up the pump correctly.”
Question #3
Effective strategies to reduce infusion pump alarms include:

a) Defaulting most alarm parameters to “off”

b) Optimizing delays for self correction of alarms

c) Educating ancillary staff to silence alarms more quickly

d) Programming alarms to alert pharmacy of medication errors
Question #3
Effective strategies to reduce infusion pump alarms include:

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Pump Alarm Data: 3Q 2015

Infusion Pump Alarms (Top 5)
3Q 2015

215,000 Alarms per Qtr
2,237 Alarms per day
How Alarms Impact Patient Care

One example:

- Nurse to administer Vedolizumab, starts infusion at 9:19
- First alarm at 9:30
- Nurse spends 22 minutes trying to correct
- Infusion pump alarms 26 times

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<tr>
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</tbody>
</table>
There go our HCAPS!

SO, YOU JUST GOT YOUR PATIENT TO SLEEP?

LET ME PLAY YOU THE SONG OF MY PEOPLE!
Opportunity: Infusion Pump Settings

- >50% of pump alarms were due to patient side occlusion

- Re-configuration of ‘Auto-Restart’ recommended
  - Feature gives patient 15 seconds to straighten his or her arm, allowing infusion to continue automatically if self corrected
  - Learned all pumps had this defaulted “off” (0 attempts to correct)

- Change implemented: Auto-Restart attempts increased
  - 4 attempts to correct - critical care, NICU/PICU, pediatrics
  - 8 attempts to correct - telemetry, med-surg, OB
Results: Auto-Restart Change Implemented

Change in Alarms After 30 Days

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<tr>
<th>Pac</th>
<th>Cal</th>
<th>Dav</th>
<th>STL</th>
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<tbody>
<tr>
<td>-13.9%</td>
<td>-8.1%</td>
<td>-17.7%</td>
<td>-10.3%</td>
</tr>
<tr>
<td>-23.5%</td>
<td>-17.7%</td>
<td>-19.2%</td>
<td>-19.2%</td>
</tr>
</tbody>
</table>

- Pt Side Occlusion Alarms/Patient Day
- Total Number of Alarms/Patient Day
Phase 2: Pump Education

- Consultant available 5-days all campuses/units

- Topics included:
  - Proper set-up, including priming
  - Air-in-line mitigation techniques
  - Quick start/Restore
  - Tamper resistant feature
  - Use of guardrails

- Feedback from nurses overwhelmingly positive
  - Requested additional in-services
  - Piggyback (secondary) alarms identified as knowledge deficit
Sample Results: Davies Campus
Alarms Reduced 29% per Month

Total Alarms per Patient Day

Top Alarms Include:
- Patient Side Occlusion
- Air-in-Line
- Door Open
- Free Flow
- Door Closed

• Auto-Restart Changes
• Consultant Education

Total Alarms Per Month

Tools for Continued Education

- Tip Sheets
- Video Training
- Quick Tips in Newsletters
- Hang Tag for Pumps
- Additional Classes
Alarm Process Improvement: Beyond ECG Monitors

- ALL alarm policies must address:
  - Clinically appropriate alarm settings
  - When alarms can be disabled
  - When alarms can be changed
  - Who can disable alarms
  - Who can set alarm parameters
  - Who can change alarm parameters
  - Appropriate monitoring practices
  - Appropriate response to monitor alarms
  - Processes for checking alarms for accurate settings, appropriate operation, detectability
Comprehensive, System-Wide Policy

POLICY AND PURPOSE

Alarm management is a Joint Commission National Patient Safety Goal (NPSG.06.01.01) that this organization has identified as a priority. Clinical alarm systems are intended to alert caregivers to an important change in the patient’s physiologic condition or a medical device equipment issue and, if not managed properly, can compromise patient safety.

SCOPE

This policy applies to [To be completed by Affiliate].

POLICY AND PURPOSE

Alarm management is a Joint Commission National Patient Safety Goal (NPSG.06.01.01) that this organization has identified as a priority [may reference to affiliate committee, PI Plan, Patient Safety Plan]. Clinical alarm systems are intended to alert caregivers to an important change in the patient’s physiologic condition or a medical device equipment issue and, if not managed properly, can compromise patient safety. This policy addresses clinical “alarm fatigue”, defined as staff desensitization to frequent, non-actionable alarm conditions resulting in inappropriate or absent responses to subsequent alarms. The purpose of this policy is to improve the effectiveness of clinical alarm systems in all areas of the [Hospital Name] and provide a safe environment for patients and staff. This policy will differentiate types of clinical alarms, define the required response when clinical alarms are activated, specify accountability for alarms, and foster best practices in alarm management.

DEFINITIONS

A. CLINICAL ALARMS - any alarm that is intended to protect the patient receiving care and/or alert the staff that a patient is at increased risk and in need of assistance. This includes all patient physiologic monitoring and patient care equipment alarms such as cardiac monitor alarms, fetal monitors, apnea alarms, cell-salvaging devices, CVVH/dialysis alarms, wound vacuum device alarms, elopement alarms, infusion pump alarms, ventilator alarms, pulse oximeters and emergency assistance alarms.

B. MEDICAL DEVICE - a piece of equipment designated by the Food & Drug Administration as a medical device.

C. CRITICAL ALARMS - medical equipment alarms designed to alert staff to the presence of a life-threatening condition.
## Alarm Priority Levels

<table>
<thead>
<tr>
<th>Priority</th>
<th>Criteria</th>
<th>Response Time</th>
<th>Level of Oversight</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>• Potentially life-threatening, loud audible alarm</td>
<td>Immediate Goal &lt;2 minutes</td>
<td>Need for close observation of patient and device all or most of time*</td>
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<td></td>
<td>• Inattention could result in permanent harm or death</td>
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</tr>
<tr>
<td>Moderate</td>
<td>• Not life-threatening, medium priority, audible warning</td>
<td>Rapid Goal 2-5 minutes</td>
<td>Need for close observation of patient and device many times throughout shift</td>
</tr>
<tr>
<td></td>
<td>• Non-emergent; requires attention as quickly as possible</td>
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<tr>
<td>Low</td>
<td>• No harm to patient if evaluated within short time period</td>
<td>As soon as possible Goal 5-7 minutes</td>
<td>No need for intervention throughout shift anticipated or patient harm if unattended</td>
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<td></td>
<td>• Audible advisory signal indicates need for reassessment</td>
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Modified from policy graciously provided by Johns Hopkins Medical Center
Education: ALL Staff
Responsibility For Alarm Safety

- Ensure that alarms are activated with adequate volume to be heard throughout the unit/area.
- Ensure that critical alarms (those alerting us to a life-threatening condition) are not turned off under any circumstance.
- They may be paused/silenced briefly, only when appropriate staff are at the bedside.
Provide a timely response:
- Trouble shoot alarm conditions.
- Any employee who hears an alarm should investigate; if response is out of their scope, notify appropriate staff immediately.
- Remain with the patient until help arrives.

Properly report any device malfunction and remove defective equipment from patient care areas.
Summary

- The Joint Commission NPSG requires more of us in 2016 and beyond to address alarm safety.

- Performance improvement strategies can yield similar results for a variety of alarm safety projects.

- There are still some relatively easy “wins” to be had.

- Bedside staff are critical participants in all aspects of alarm safety.