

Finding True Harms Amidst So Many Alarms: Getting to the Bedside When It Counts

A quality improvement project to reduce non-actionable alarms and improve response times in an inpatient pediatric unit.
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Background

- Increased use of cardiorespiratory (CR) and pulse oximetry (SpO2) monitoring on inpatient units has led to an increased frequency of alarms.
- Many alarms are false and non-actionable causing:
 - staff desensitization
 - alarm fatigue
 - delayed alarm response times
 - potential threats to patient safety
- Joint Commission issued a National Patient Safety goal in 2014 requiring hospitals to implement policies and procedures for alarm management.

Objectives

SMART aim: In 6 months:

- the number of CR and SpO2 alarms will ↓35%
- the percent response time <1 min will ↑10%
- the number of safety events will be unchanged

Methods

Plan-Do-Study-Act (PDSA) cycles initiated Jan 2015.

Plan:

- Multidisciplinary alarm committee identified problem.
- Hazard Vulnerability Assessment identified physiologic monitors as highest risk.
- Ishikawa diagrams identified potential causes of non-actionable alarms in physiologic monitors.
- Flow Chart of Existing Processes for responding to alarm.
- Failure Mode and Effect Analysis identified highest priority step in process.
- Local data and evidence based literature reviewed.
- Discussed with subject matter experts.
- Reviewed reliable system design concepts.

Do:

- 8 bed unit with pulmonary and general pediatric patients
- Cycle 1: ↑ non-critical SpO2 alarm delay from 5 to 20 sec

Ishikawa



Flow Chart of Existing Processes

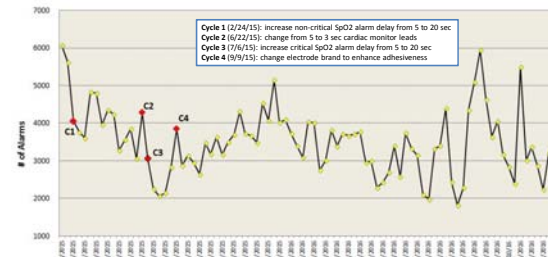


Failure Mode and Effect Analysis

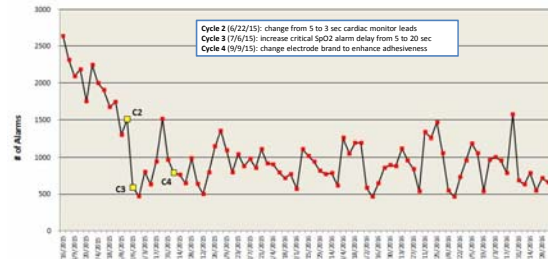
Steps	Failure Mode	RPN
Step 5: Monitoring System Detects Alarm Condition	Alarm Condition Not Detected	75
Step 7: Staff Detects Alarm	Staff Does Not Hear or Detect Alarm	75
Step 7: Staff Detects Alarm	Staff Not Available	75
Step 7: Staff Detects Alarm	Delay in Alarm Detection	75
Step 2: Order for Patient Monitor Received	Order Lacks Patient Specificity	50
Step 9: Qualified Staff Verifies Alarm Condition on Central Monitor Display	Delay in Alarm Verification	40
Step 3: Patient Placed on Monitor	Patient Misidentified	30
Step 8: Qualified Staff Informed of Alarm	Qualified Staff Not Informed	30
Step 12a: Qualified Staff Acknowledges Alarm By Pre-Monitoring	Qualified Staff Silences Alarm Inappropriately	30
Step 1: Patient Assessed and Identified to Require Monitoring	Patient Not Assessed	25

highest risk priority number (RPN) = highest severity, highest occurrence rate, and lowest detectability

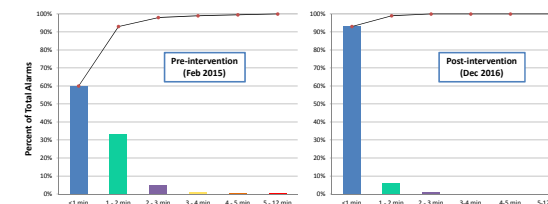
Total Number of Non-Critical Alarms



Total Number of Critical Alarms



Staff Response Time



Methods continued

- Cycle 2: change from 5 to 3 CR monitor leads eliminating arrhythmia monitoring
 - Cycle 3: ↑ critical SpO2 alarm delay from 5 to 20 sec
 - Cycle 4: change electrode brand to enhance adhesiveness
- Study-Act:** Data reviewed.
- Data was collected from central monitoring station from 2 weeks before 1st intervention to 15 months after the last.
 - Response time equals minutes from alarm onset to discontinuation at bedside monitor.
 - Impact on patient safety (balancing measures) tracked by reviewing interim rapid responses, codes, and safety reports.

Results

Baseline:

- 2 weeks before C1 (Jan-Feb/2015): average 5842 non-critical alarms/week
 - 3 months before C3 (March-June/2015): average 2014 critical alarms/week
- Post-intervention** (Dec 2015–Dec 2016):
- average 3392 non-critical alarms/week, a 42% reduction
 - average 880 critical alarms/week, a 56% reduction
- Response time :** ↑ from 60% of responses <1 min to 93% responses <1 min, a 33% increase
- Balancing measure:** no ↑ in # of safety events

Conclusions

- An interdisciplinary team using QI tools can significantly decrease the number of alarms and can improve response time to critical alarms without sacrificing patient safety.
- Compared to projects focused on reducing unnecessary use of CR monitors, this project demonstrated that increasing alarm delay times and reducing monitor leads can be valuable strategies to decrease alarms in patients who require monitoring.