Mitigating Alarm Fatigue and Improving the Care Provider, Patient and Family Experience through Reduction in Non-actionable Bedside Alarms

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INTRODUCTION

- Burden of bedside alarms is a well-established patient safety hazard with >85% of alarms in ICU settings considered non-actionable or "false alarms"
- Alarm fatigue can lead providers to have prolonged response times and silencing of clinically meaningful alarms
- Alarms can frequently disrupt care and cause unnecessary stress for patients and families
- Prior implementations of age based vital signs at Lucile Packard Children's Hospital (LPCH) and changes to pulse oximetry parameters at Cincinnati Children's Hospital have proven effective

HYPOTHESIS

- Creating alarm triggers for bedside monitors can decrease the frequency of non-actionable alarms without compromising patient safety
- The decreased burden of alarms on nurses, patients, and families may promote increased satisfaction and wellness

METHODS

- Single center quality improvement initiative in 26-bed cardiac acute care and 36-bed PICU
- Alarm burdens for pulse oximetry (SpO2), respiratory rate (RR), and premature ventricular contractions (PVC) were tallied on all monitored patients in the cardiac acute floor and PICU. **The primary outcome was alarms per monitored patient day**
- Pre-intervention observation period: 07/15/19 – 08/11/19
- Post-intervention observation period: 09/28/20 – 10/26/20
- Intervention
  - RR alarm <0 & >100 (RR <3 triggering apnea alarm)
  - PVC alarm 20/min (trigeminy)
  - Hierarchical SpO_2 alarm delays (0-60sec)

Activate the appropriate setting based on your patients goal baseline O2 sats			
Mixers (goal 75-85%)		Septated (normal > 90%)	
SpO2 range	Time to Trigger		Alarm
(1) High Sat	600s	SpO2 > 92%	Event: High Sat
(2) 80-89%	60s		Event: 80-89%
(3) 70-79%	30s		Event: 70-79%
(4) 60-69%	15s		Event: 60-69%
(5) 60-89%	30s	Catchall setting	Event: 60-89%
(6) 60-74%	30s		Event: 60-74%
<60%	0s	No delay trigger	Desat SpO2 <60

METHODS

- Nursing attitude surveys and family rest surveys with Likert scales during the pre and post intervention observation periods
- Balancing metrics include number of care escalations and codes in the year prior and after intervention

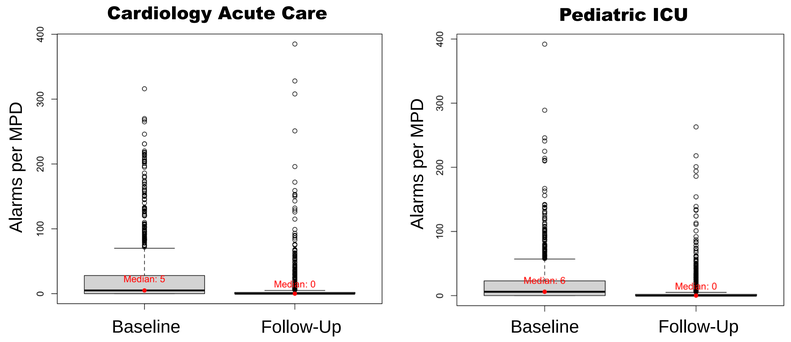
RESULTS

- A total of **2034** and **1968** monitored patient days (MPD) were evaluated in the pre- and post- intervention periods, respectively
- The median number of cardiorespiratory monitor alarms (PVC, SpO2, RR) per MPD decreased from **5 to 0 (p < 0.001)** in acute care cardiology floor and **6 to 0 (p < 0.001)** in the PICU

Figure 1. Mean Alarms per Monitored Patient Day (MPD)

	Cardiology Acute Care			Pediatric ICU	
	Mean Alarms per MPD			Mean Alarms per MPD	
	Pre	Post		Pre	Post
Total	25.67	8.66		19.11	6.20
PVC	1.07	0.18		0.28	0.13
RR	7.52	2.53		8.57	3.15
SpO2	16.85	5.95		10.26	2.92

Figure 2. Box Plots – Alarms per Monitored Patient Day (MPD)



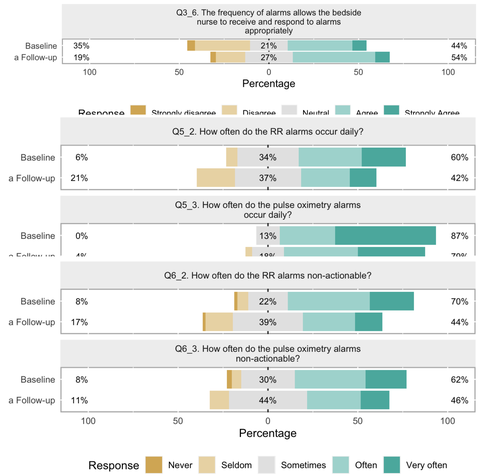
RESULTS

- When evaluating patient days with at least 1 alarm, median alarms decreased by 73% (15 to 4, p < 0.001) in both acute care and ICU. Alarm burden in RR, SpO2, and PVC categories also decreased.
- No increases in frequency of care escalations or code events in either unit
- A total of 253 nursing attitude surveys and 160 family rest surveys were performed during pre and post intervention periods

	Family Rest Surveys		Nursing Attitude Surveys	
	Pre	Post	Pre	Post
English	109	51	117	136
Spanish	26	9		

- Nursing surveys reported positive trends of more manageable alarm burden and decreased perceived number of alarms
- Family surveys, however, had negative trends towards increased frequency of perceivec alarms and decreased sleep

Figure 3. Selected Nursing Attitude Survey Questions



Conclusions

- Implemented changes to bedside monitor alarm conditions decreased total alarm frequency in both cardiac acute care and pediatric ICU without compromising safety.
- Nursing surveys reflect improved alarm burden and decreased non-actionable alarms. The negative trend in the family attitudes may reflect different patient populations in the two time periods and confounded by COVID-19 pandemic.