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Patient Safety Tip of the Week

September 17, 2024

Reducing Alarms on a Pediatric Unit

Alarm fatigue has been one of our most frequent topics (see full list of prior columns below). Alarm frequency has been reported to be as high as 350 alarms per bed per day in some ICU's and in some NICU's as high as one alarm every 60 seconds.

Texas Children's Hospital was able to achieve a sustained reduction in alarms on a pediatric progressive care unit (Mullen 2024). That unit was experiencing 180-250 alarms per day or 1 alarm every 3 to 4 minutes per clinician. Over the course of 10 years and multiple PDSA cycles, the average number of alarms/day/bed decreased from 177.69 to 96.94, a 45.45% reduction. The percentage of time in alarm decreased from 7.52% to 2.83%, a 62.37% reduction. So, how did they do it?

That PCU was part of the critical care department and included patients who were tracheostomy and ventilator-dependent, and other critically ill patients requiring continuous monitoring. Many nurses on that unit were experiencing "**alarm flooding**". That's where there are more alarms in a period of time than a person is physically able to respond to or more than 10 alarms in 10 minutes. That unit, in fact, experienced on average 87 floods per day! Like the situation in most hospitals, many of those alarms were false alarms or "nuisance" alarms or alarms that required no physical response.

They began by forming an alarm management steering committee, consisting of bedside nurses, nursing management, physicians, advanced practice providers, and representatives from biomedical engineering, information services, and a vendor from the software company that provided their alarm data.

Analysis of their alarm data found that 15 types of alarms were responsible for 98% of alarms in the unit. Moreover, one patient accounted for over 600 alarms in a 24-hour period. The alarm data clearly identified the first target for their intervention: oxygen saturation (SpO2) alarms accounted for greater than 50% of total alarms in the unit, and many of these required no intervention. So, the key element of their first PDSA cycle was a policy change that changed the SpO2 alarm limit from 93% to 90%.

An important component of PDSA cycle #2 was empowering nurse **alarm champions**. Alarm champions would round with the medical team and discuss the benefit of adjusting alarm limits for specific patients. The alarm champions would also review the alarm load for the nurses working on the unit, helping redistribution of patient assignments. And, importantly, they were key to changing the culture.

In addition to the alarm champions, the PCU clinical specialist played a key role in development of the alarm champions program and served as a resource and change agent for this initiative. Clinical specialists in that organization are masters-prepared pediatric nurses responsible for staff development, education, evidence-based practice, and quality outcomes.

The third PDSA cycle focused on technology. SpO2 alarms remained the most frequent alarms but many of these were false alarms, caused by patient movement, blood pressure monitoring, or other short-term interference. The technological solution was use of a "**smart delay**". Typically, an alarm would be triggered immediately when the SpO2 fell below the threshold. Basically, "smart delay" means that an alarm can be set to alarm only if the SpO2 remained below threshold after a designated number of seconds. They piloted extending the duration of the "smart delay" on several patients and expanded this to all patients once they found no adverse effects. They also noted that the second most frequent alarms were related to failures of ECG or respiratory leads. They changed from 3-lead to 5-lead systems to reduce false alarms due to lead failure.

All 3 PDSA cycles resulted in improvements. The change in SpO2 setting resulted in a 10% reduction in SpO2 alarms per day and alarm champions found no significant adverse effects. The lengthening of the "smart delay" and the switch to 5-lead systems resulted in a reduction of 28.51% of alarms/bed/day and time in alarm by 29.4%.

As in many successful quality improvement projects, use of a multidisciplinary steering committee and use of clinical champions were crucial drivers for the success of this program.

Though this was a pediatric unit, we see no reason the quality improvement project could not be replicated on almost any inpatient unit. Kudos to all the people at Texas Children's Hospital who worked on this project.

Prior Patient Safety Tips of the Week pertaining to alarm-related issues:

- March 5, 2007 "Disabled Alarms"
- March 26, 2007 "Alarms Should Point to the Problem"
- April 2, 2007 "More Alarm Issues"
- June 19, 2007 "Unintended Consequences of Technological Solutons"
- April 1, 2008 "Pennsylvania PSA's FMEA on Telemetry Alarm Interventions"
- February 23, 2010 "Alarm Issues in the News Again"

- March 2, 2010 "Alarm Sensitivity: Early Detection vs. Alarm Fatigue"
- March 16, 2010 "A Patient Safety Scavenger Hunt"
- November 2010 "Alarms in the Operating Room"
- February 22, 2011 "Rethinking Alarms"
- February 2013 "Joint Commission Proposes New 2014 National Patient Safety Goal"
- May 2013 "Joint Commission Sentinel Event Alert: Alarm Safety"
- July 2, 2013 "Issues in Alarm Management"
- August 2013 "Joint Commission Formalizes 2014 NPSG on Alarm Management"
- February 4, 2014 "But What If the Battery Runs Low?"
- October 2014 "Alarm Fatigue: Reducing Unnecessary Telemetry Monitoring"
- December 15, 2015 "Vital Sign Monitoring at Night"
- February 9, 2016 "It was just a matter of time…"
- August 16, 2016 "How Is Your Alarm Management Initiative Going?"
- February 21, 2017 "Alarm Fatigue in the ED"
- April 18, 2017 "Alarm Response and Nurse Shift Duration"
- April 25, 2017 "Dialysis and Alarm Fatigue"
- October 17, 2017 "Progress on Alarm Management"
- November 21, 2017 "OSA, Oxygen, and Alarm Fatigue"
- May 1 2018 "Refrigerator Alarms"
- April 16, 2019 "AACN Practice Alert on Alarm Management"
- September 2019 "Alarm Fatigue in the Emergency Room"
- October 8, 2019 "Another Freezer Accident"
- June 23, 2020 "Telemetry Incidents"
- August 2020 "Pulse Oximetry in Children"
- September 15, 2020 "An Eerily Familiar Incident"
- January 26, 2021 "This Freezer Accident May Cost Lives"
- February 7, 2023 "Reducing Unnecessary Telemetry"
- January 2024 "Alarm Fatigue Better or Worse?"

References:

Mullen J, Sattari S, Rauch M, et al. Utilizing Data and Alarm Champions to Enhance Alarm Management: A Pediatric Quality Improvement Initiative. Journal of Nursing Care Quality 2024; 39(4): 369-375
https://journals.lww.com/jncqjournal/abstract/2024/10000/utilizing_data_and_alarm_champions_to_enhance.14.aspx

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