

# Improving cardiac monitoring: What is contributing to alarm fatigue?

## Vizient Patient Safety Organization Safety Alert May 2018

### Background

Health care workers are exposed to an overabundance of alarms each day, the majority of which require no response.<sup>1-4</sup> Consequently, clinicians become desensitized to alarms, which can result in delayed response time and critical alarms being missed.<sup>1-4</sup> Recognizing the potential safety risks that can occur if there is no response to alarms for patients on cardiac monitors, hospitals have worked to reduce alarm fatigue, improve the appropriate use of clinical alarms and define appropriate and timely responses to clinical alarms. In 2013, to promote and enforce improvements in safety, The Joint Commission published a *Sentinel Event Alert* raising awareness about alarm fatigue and harm associated with clinical alarms, followed by its National Patient Safety Goal on the safe use of alarms.<sup>1</sup>

In 2016, the Vizient<sup>®</sup> Patient Safety Organization (PSO) disseminated analyses and leading practices to the PSO membership on cardiac monitoring in two separate documents: "[Clinical Alarm Management: Cardiac and Physiologic Monitoring](#)"<sup>5</sup> and "[Systemwide Management of Clinical Alarms](#)."<sup>6</sup> While there have been efforts to improve safety by reducing nuisance alarms and unnecessary monitoring, failures in patient monitoring and appropriate responses to cardiac alarms continue to be identified in high-harm events, such as cardiac arrests and patient death; these events were reported to the Vizient PSO in 2016 and 2017.

### Assessment

A comprehensive analysis of Vizient PSO safety events was conducted from Jan. 1, 2016, through Dec. 31, 2017, and revealed almost 800 cardiac monitoring safety events. Ten percent of these required additional treatment or resulted in harm or death. A majority of these events resulted in patients being transferred to a higher level of care, activation of emergency response teams or attempted cardiopulmonary resuscitation (Figure 1).

In over 30 percent of all the cardiac monitoring safety events, there were gaps or omissions in cardiac monitoring. Nearly 60 percent of those events resulted in emotional distress; required additional treatment; or resulted in temporary, permanent, or severe permanent harm or death. Omissions in monitoring occurred most frequently during patient transport from one unit to another, typically from the emergency department or surgery to the inpatient unit. Other omissions occurred when an order for monitoring was not addressed, monitoring equipment was unavailable, or during equipment failures and unplanned downtimes. Additionally, in 21 percent of the cardiac monitoring events, there was an omission in monitoring because leads were off the patient. The inpatient general care areas saw the greatest number of patients with leads off (43 percent).

Three percent of the cardiac events noted with leads off resulted in death (Figure 1). One case involved a

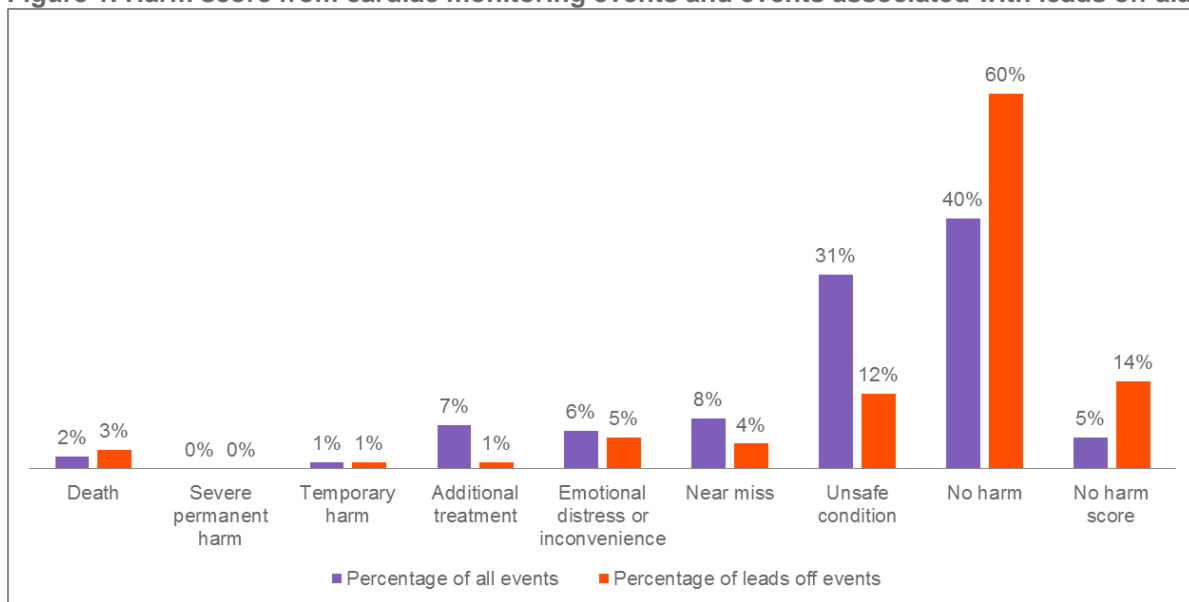
patient who was on remote cardiac monitoring and hypotensive for the majority of a shift. During shift change, the patient was found to be unresponsive. A cardiac code was called; however, the patient was unable to be resuscitated. It was noted during post-code review that the patient had telemetry leads off for a prolonged period of time prior to being found unresponsive, and neither the nurse nor patient care team was alerted to this fact. In other cases, when telemetry technicians notified the direct patient care team that the patient had leads off, they received unprofessional responses and were told that resolving the leads off alarm was not perceived as an urgent patient care task.

In 35 percent of leads off alarm events reviewed, patients refused to wear or removed themselves from the cardiac monitor and chose to leave the hospital against medical advice (AMA). In 3% of the leads off cases, leads were pulled off by patients who were observed to be confused or agitated, and who later had a clinical deterioration while off the monitor.

Considering the impact that the leads off alarm has on alarm fatigue, the number of cardiac leads off events reported to the PSO database is a cause for concern. The inadequate notification of leads off from central telemetry to the patient care team — as well as delayed or no actions taken to resolve leads off alarms — are symptoms of a care team experiencing alarm fatigue.

Discussions with members of the Vizient PSO expert advisory team on cardiac monitoring (Appendix A) confirmed that the leads off alarm is one of the top nuisance alarms at their organizations, as it is a frequent alarm that often requires no action. The team also acknowledged there is risk for patient harm when there is a delayed or no response to the leads off alarms. Seven percent of the cardiac monitoring events reviewed that required additional treatment or resulted in harm or death involved patients whose cardiac monitoring leads were off either preceding or during the event. Alarm fatigue is dangerous for the health care team and the patient, because it is difficult to distinguish when the leads off alarm is a serious and actionable alarm until it is too late.

**Figure 1. Harm score from cardiac monitoring events and events associated with leads off alarms<sup>a</sup>**



Source: Vizient Patient Safety Organization.

<sup>a</sup>Period of data: Jan. 1, 2016-Dec. 31, 2017; number of total cardiac alarm-related events = 768; number of leads off events = 138.

## Recommendations

### Follow American Heart Association practice guidelines

The leads off alarm sounds frequently, and it can be difficult to determine when it indicates a serious and actionable event. The leads off alarm is widely perceived as a nuisance by the health care team, is usually not addressed promptly and can not only mask a serious patient decline, but distract the health care team from other serious cardiac alarms.

The American Heart Association (AHA) has updated its practice standards for electrocardiographic monitoring; these standards provide guidelines on use, duration and indications for cardiac monitoring in the hospital setting<sup>7</sup>:

- Evaluate alternatives to cardiac telemetry monitoring — such as wearable biosensors — and assess their impact on alarm fatigue.<sup>8</sup>
- Evaluate prediction software that can be embedded within the electronic medical record to help the health care team determine who is at highest risk for clinical deterioration. Accompany this clinical prediction with the AHA's indications for cardiac monitoring to determine appropriate care and monitoring for patients.<sup>9</sup>



### Decrease alarm fatigue

Hospital leadership has a responsibility to decrease the alarm fatigue caused by the leads off alarms and to hold staff accountable for managing these alarms appropriately:

- Define roles and responsibilities for appropriate response to alarms, as well as the amount of time expected to resolve issues.<sup>10</sup>
- Create clear criteria for the notification process that should be used between central telemetry and the nursing care team, and between nursing and the provider. Identify notification alternatives if unable to directly communicate with the primary care nurse, patient care team or both.<sup>4</sup>
- Embed an escalation process (chain of command) into the cardiac alarm policy and procedure when appropriate action and resolution associated with a cardiac alarm has not been taken.<sup>4</sup>
- Promote consistent accountability to ensure compliance with the policy despite patient outcome.<sup>11</sup>

### Assess current state and measure progress

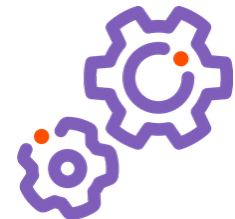
The negative impact on patient outcomes that can result when there is no response to leads off alarms — as well as the alarm fatigue experienced by health care providers — may not be fully appreciated by the health care team. A majority of leads off alarms occur because patients remove themselves from the cardiac monitor and decide to leave AMA. When this occurs, monitoring is not promptly suspended or placed on hold until the patient issue is resolved, causing the leads off alarm to unnecessarily alert the health care team. An assessment of leads off alarms at your organization can help you understand the impact they have on the health care team:

- Complete a retrospective review of patients who had an emergency response team activation or cardiopulmonary arrest outside of a critical care area for leads off alerts for more than 10 minutes but less than one hour before the emergency response team was alerted. Determine if criteria for cardiac monitoring were met, and identify breakdowns in communication and opportunities to improve responses to alarms, both of which can be used to prevent clinical declines in patients.<sup>4,10</sup>
- Measure the frequency and resolution rates of secondary and tertiary notifications to determine the effectiveness of the current procedure.
- Review patients on cardiac monitoring who left AMA to determine that they met indication criteria for cardiac monitoring prior to leaving the hospital. In addition, identify opportunities to collaborate with social worker or to deescalate patients to decrease the number of patients that leave AMA.
- Create a cardiac alarm dashboard to identify successes and opportunities for improvement. Analyze data by unit to compare the time it takes to resolve leads off alarms, implement telemetry from time of order and comply with clinical indications for monitoring. In addition, identify the failures to communicate rate or rhythm changes, and the reason for notification for each case.<sup>4</sup>

### Enhance standard work

Leads off alarms can be reduced by implementing several standard interventions within the health care team's current workflow:

- During shift-to-shift handoffs, review alarm settings and patient criteria for cardiac monitoring.<sup>2</sup>
- Use AHA practice standards for electrocardiographic monitoring, which provide guidelines on use, duration and indications for cardiac monitoring in the hospital setting.<sup>7</sup>
- Provide the direct phone number of the patient nurse to the telemetry technician with each nurse handoff.<sup>11</sup> Use a crisis phone to prevent delays in notification or provide guidelines that indicate when the telemetry technician should notify the medical emergency team.<sup>4</sup>
- Reduce nuisance alarms by eliminating non-life-threatening alarms, duplicate alarms and adjusting current alarm parameters so that alarms sound only when action is required.<sup>2,7,12</sup>
- Promptly address leads off alarms to reduce nuisance alarms. Train staff on ways to prevent leads from detaching with proper skin preparation<sup>7</sup> and to proactively communicate to the care team (nurse, provider, monitoring technician) if there is a gap in monitoring because the patient's leads are off.



For additional information contact [Jessica Schoenthal](#), collaborative advisor, Vizient.

### References

1. Sentinel Event Alert Issue 50: Medical device alarm safety in hospitals. The Joint Commission website. [https://www.jointcommission.org/sea\\_issue\\_50/](https://www.jointcommission.org/sea_issue_50/). Published April 8, 2013. Accessed February 20, 2018.
2. Allen JS, Hileman K, Ward A. Simple solutions for improving patient safety in cardiac monitoring — eight critical elements to monitor alarm competency. AAMI website. <http://www.aami.org/patientsafety/content.aspx?ItemNumber=1522&navItemNumber=3168>. Accessed February 20, 2018.
3. Linnen D, Quiton M, Staley D. From data to action: Developing next-gen enterprise dashboard analytics to reduce clinical alarm fatigue. *Nurs Inform Today*. 2015;30(4).

4. Cantillon DJ, Loy M, Burkle A, et al. (2016). Association between off-site central monitoring using standardized cardiac telemetry and clinical outcomes among non-critically ill patients. *JAMA*. 316(5), 519-24.
5. Vizient Patient Safety Organization. System-wide management of clinical alarms. [https://www.vizientinc.com/-/media/Documents/SitecorePublishingDocuments/Secured/Solutions/Clinical/ClinicalAlarmManagement\\_Systemwide.pdf?la=en&hash=F88DA3D3D449814B9D0D5B0E9EF70A6F4D74C9EE](https://www.vizientinc.com/-/media/Documents/SitecorePublishingDocuments/Secured/Solutions/Clinical/ClinicalAlarmManagement_Systemwide.pdf?la=en&hash=F88DA3D3D449814B9D0D5B0E9EF70A6F4D74C9EE). Published May 2016. Accessed May 8, 2018.
6. Vizient Patient Safety Organization. Clinical alarm management: Cardiac and physiologic monitoring. [https://www.vizientinc.com/-/media/Documents/SitecorePublishingDocuments/Secured/Solutions/Clinical/ClinicalAlarmManagement\\_Cardiac.pdf?la=en&hash=036C8FC4B0DF00D0AA823F6FBB50C081BA6BA7F7](https://www.vizientinc.com/-/media/Documents/SitecorePublishingDocuments/Secured/Solutions/Clinical/ClinicalAlarmManagement_Cardiac.pdf?la=en&hash=036C8FC4B0DF00D0AA823F6FBB50C081BA6BA7F7). Published April 2016. Accessed May 8, 2018.
7. Sandau KE, Funk M, Auerbach A, et al; American Heart Association Council on Cardiovascular and Stroke Nursing; Council on Clinical Cardiology; Council on Cardiovascular Disease in the Young. Update to practice standards for electrocardiographic monitoring in hospital settings: A scientific statement from the American Heart Association. The American Heart Association website. <https://doi.org/10.1161/CIR.0000000000000527>. Published October 3, 2017. Accessed February 6, 2018.
8. Walsh J, Topol EJ, Steinhilb SR. Novel wireless devices for cardiac monitoring. *Circulation*. 2014;130(7):573-581. [doi.org/10.1161/CIRCULATIONAHA.114.009024](https://doi.org/10.1161/CIRCULATIONAHA.114.009024).
9. Graham M. Quant HC tries to predict cardiac arrest with an algorithm. *Chicago Tribune* website. <http://www.chicagotribune.com/bluesky/originals/chi-quant-hc-ecart-cardiac-arrest-bsi-story.html>. Published March 30, 2015. Accessed May 15, 2018.
10. Parmley CI, Neeley R. Acute altered mental status, mental status changes, depressed mental status, lethargic, obtunded, altered level of consciousness. Clinical Advisor.com website. <https://www.clinicaladvisor.com/critical-care-medicine/acute-altered-mental-status-mental-status-changes-depressed-mental-status-lethargic-obtunded-altered-level-of-consciousness/article/585624/>. Accessed February 23, 2018.
11. Whelan L, Stanton MP. Updating telemetry practices to improve the culture of safety. *Nurs Manage*. 2013;44(3):12-4. doi: 10.1097/01.NUMA.0000427192.74586.45.
12. Sendelbach S, Funk M. Alarm fatigue: A patient safety concern. *AACN Adv Crit Care*. 2013;24(4):378-86.

## Additional Vizient PSO resources

The Vizient PSO offers the following resources on cardiac monitoring; these documents include leading practices, outcomes and recommendations:

- [Systemwide management of clinical alarms](#)
- [Clinical alarm management: Cardiac and physiologic monitoring](#)

## Appendix A. Expert advisory team

Cardiac alarm best practice recommendations were developed by a Vizient PSO multidisciplinary member task force.

<b>Kenneth Catchpole, PhD, BSc, MErgS</b> SmartState Endowed Chair in Clinical Practice and Human Factors Medical University of South Carolina	<b>Jeannie Mollohan, MSN(R), APRN, NNP-BC, NEA-BC</b> Nursing Practice and Clinical Effectiveness SSM Health
<b>Dana Peres Edelson, MD, MS</b> Department of Internal Medicine University of Chicago	<b>Linda M. Robertson, MSN, RN, ANP, CHCQM</b> System Director of Accreditation Wellstar
<b>Ellen Flynn, MBA, RN, JD, CPPS</b> Associate Vice President Vizient	<b>Jessica Schoenthal, MSN, RN, CPPS</b> Collaborative Advisor Vizient
<b>Susan Heimsoth, MHA, RN, CCRN, CNRN</b> Director, Clinical Informatics University of Missouri Health Care	<b>Vinaya Sebastian, RN, MS, CPHQ, CSSBB, HACF</b> Quality Improvement Coordinator Santa Clara Valley Medical Center
<b>Lisa Hutchinson, MSN, RN, MS</b> Cardiovascular Quality Lead Mercy Quality and Safety Center	<b>Jo M. Tabler, MSN, RN, AGCNS-BC, CEN, CFRN</b> Clinical Nurse Specialist Adult ICU/PCU/ED IU Health North Hospital
<b>Jackie Lamendola, MHA, RN</b> Senior Quality Manager, Patient Safety The Ohio State University Wexner Medical Center	<b>Chele Wells, BSN, RN</b> Coordinator, Patient Safety Liaisons, Critical Care RN Northwestern Medicine, Delnor Hospital
<b>Ryan Minnix, MSN, RN, ANP, CHCQM</b> Nurse Manager Wake Forest	<b>Tammy Williams, MSN, RN, CPPS</b> Collaborative Advisor Vizient