



Clinical Update

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Alarm Fatigue: Impact on Nursing Care

Alarms are essential in today's high-tech environment of care. The proliferation of alarms raises the question: Is it too much of a good thing?¹ The Joint Commission made improving alarm effectiveness a national patient safety goal in 2004; it is now incorporated in accreditation requirements.²

We'll look at challenges in managing bedside alarms as well as the potential for alarm systems to alert clinicians to life-threatening conditions such as tension pneumothorax and cardiac tamponade.

Beeps, Chimes, Tones and Flashes

We've all had the experience of hearing a warning down the hall. Depending on the unit, you may be able to differentiate the IV pump alarm from the pulse oximetry alarm by the tone or pitch of the sound, but it can be a challenge to differentiate alarms by sound alone. Visual alerts in critical care areas can help identify key alerts at a glance.

Too Sensitive — Not Specific?

When talking about alarms, sensitivity refers to how much of a problem it takes to sound an alarm. Specificity refers to whether an alarm is clinically valid — that is, does it sound for a true deviation that requires action at the bedside? A recently published study found that alarms sound, on average, every 10 minutes in intensive care.³ Are the alarms accurate in detecting some sort of problem? Yes, 94% to 97% of the time.^{2,3,4} They sound when a sensor falls off, or a patient coughs or when monitored parameters fall outside the limits of the alarm. While technically these soundings are accurate, they commonly refer to an issue with the equipment, not with the patient.

Two studies found clinically relevant alarms that resulted in an appropriate adjustment by the caregiver occurred between 15% to 25% of the time.^{3,4} Alarms for systolic and mean arterial pressure were most often clinically valid while those for oxygen saturation and respiratory rate were most commonly "false". In addition, only 4% of heart rate threshold alarms were clinically significant.³ These indicators, designed to enhance patient safety, can actually endanger it when clinicians don't believe or trust alarms to give them valuable warnings about the patients they care for.

Nurses' Concerns

Research has examined concerns of nurses and other bedside caregivers. Key themes recur:^{2,4,5}

- Nurses are frustrated by false alarms.
- False alarms are a nuisance and disrupt patient care.
- Caregivers ignore frequent alarms, react more slowly, and/or turn sound down.
- Chronic inadequate staffing limits ability to respond to alarms.

- Alarms are seen as another "to do" task instead of a helpful patient management tool.

In recent years, with the increasing focus on safety, more organizations are developing policies and procedures about alarms in general. At the most basic, they can specify who should respond to an alarm by defining what constitutes an appropriate response. If an "acceptable" response is making the noise go away, anyone can figure that out, and family members often do. It's the age-old nursing challenge: convincing others that the psychomotor tasks we perform are actually carefully integrated with high-level cognitive knowledge, assessment and analysis that can't be seen or easily replaced by non-licensed assistants.

Causes of Alarm Adverse Events

A number of studies have looked for common threads in adverse events related to alarms in which patients were harmed or there was a near miss.^{2,3,4,5}

- Improper configuration in which limits are not customized to the patient
- Defeated alarms; situations where alarms were turned off rather than being placed on delay or the device was not set up according to manufacturer's instructions in order to stop alarms from sounding
- Inconsistency between devices: one action may delay on one device, turn off on another
- Alarms may not be heard when doors are closed

Addressing Alarm Issues

There are two broad categories of fixes for alarm problems: (1) the technology itself and (2) how we use it.^{2,6} (See [On the Web](#) for links.) Immediate actions include verifying and documenting alarms as part of shift change reports and setting alarms at the "action required" point to reduce risk for false alarms. Research shows that education on "buttonology" is not an issue, but review of pathophysiology is critical, particularly in simulation labs so clinicians can recognize key patterns of changes in monitored parameters that provide early signs of deterioration.

And it is essential that clinicians are involved in product evaluation and choice of monitoring systems. They should have the opportunity to try out monitors in the clinical setting to test manufacturer claims and evaluate the monitors' effectiveness in their particular unit.

Looking to the Future

There is no shortage of recommendations for improving alarm use but the challenge is the implementation.^{1,2,5} Improvement requires commitment from many stakeholders to enhance ease-of-use, devote more resources to alarm management and develop smart alarms.

In The Literature

What is an Emergency?

The current issue of *MedSurg Nursing* contains an article with a terrific review of one hospital's experience with implementing a rapid response system that responded to family activation. The authors provide a literature review and multiple algorithms that allow readers to replicate their system. Case studies and examples of follow up help others learn from their valuable experience.

Source: Bogert S, Ferrell C, Rutledge DN: Experience with family activation of rapid response teams. *MEDSURG Nursing* 2010;19(4):215-222.

Evidence-Based Unit Design

A terrific brief on use of evidence-based design is in the current issue of *Nursing Economic\$*. The author describes the three phases of their construction plan to increase the number of ICU beds from 4 to 10. Her team reviewed the literature on design features such as private rooms and sink locations, asked staff for wants and needs, and analyzed cost and quality benefits. If a remodel or new construction is in your future, be sure to check this out.

Source: Spikes T, Aduddell K: Utilizing evidence-based design in a community hospital ICU. *Nursing Economic\$* 2010;28(4):279-283.

Alarm Fatigue: Impact on Nursing Care continued

Key to identifying conditions such as tension pneumothorax and cardiac tamponade is the monitor's ability to use artificial intelligence to synthesize data. This multi-parameter approach can also reduce false alarms. When skilled clinicians respond to an alarm, they do not look at one parameter in isolation. They instinctively check other parameters to confirm the patient's condition and eliminate artifact as an alarm trigger. Computers can do this; key is for clinicians to demand integrated monitoring with more sophisticated algorithms to overcome the very real safety issues and often, uselessness, of single-parameter alarms.^{1,3} A tension pneumothorax warning would combine falling SpO₂, increasing heart rate and high pressure on the ventilator. A cardiac tamponade alarm would sound when cardiac output and blood pressure drops and right heart pressure increases rapidly. Multiple changing parameters are more likely to confirm a clinically relevant, potentially critical event that would require immediate attention¹.

As is so often the case, nurses are their own best advocates. We need to educate administrators and purchasers about the complex interaction between expert clinicians and technology at the bedside and demand technology that supports professional nursing practice for optimal patient outcomes.

Sources

1. Blum JM, Tremper KK: Alarms in the intensive care unit: too much of a good thing is dangerous: is it time to add some intelligence to alarms? *Critical Care Medicine* 2010;38(2):702-703 [PubMed Citation](#)
2. Korniewicz DM, Clark T, David Y: A national online survey on the effectiveness of clinical alarms. *American Journal of Critical Care* 2008;17(1):36-43. [PubMed Citation](#)
3. Siebig S, Kuhls S, et al.: Intensive care unit alarms — how many do we need? *Critical Care Medicine* 2010;38(2):451-456. [PubMed Citation](#)
4. Chambrin MC, Ravoux P, et al.: Multicentric study of monitoring alarms in the adult intensive care unit (ICU): a descriptive analysis. *Intensive Care Medicine* 1999;25:1360-1366. [PubMed Citation](#)
5. Wyckoff M: Improving how we use and respond to clinical alarms. *American Nurse Today* 2009;4(9):37-39.
6. Cvach M, Dang D, et al.: Clinical alarms and the impact on patient safety. *Initiatives in Safe Patient Care* 2009. Available online at: <http://www.initiatives-patientsafety.org/Initiatives2%20.pdf>

On the World Wide Web



Standards for ECG Monitoring

The American Heart Association has established evidence-based standards for electrocardiographic monitoring that were published in the journal *Circulation*. Of special note are the recommendations on which patients should be monitored. They are available online for free at: <http://circ.ahajournals.org/cgi/content/full/110/17/2721>

Learning Why Alarms Fail

The Pennsylvania Patient Safety Authority has published a white paper *Alarm Interventions During Medical Telemetry Monitoring*. The group performed a failure mode and effects analysis on reported events or near misses and developed a comprehensive set of recommendations for risk reduction that can be implemented in any care setting.

<http://tinyurl.com/3a7wsge>

More Ways to Improve Clinical Alarms

The American College of Clinical Engineering Healthcare Technology Foundation assembled a task force in response to the Joint Commission's patient safety goal regarding clinical alarms. Their report, *Impact of Clinical Alarms on Patient Safety*, analyzes the FDA device database and ECRI's Problem Report System, determines causes of adverse events and makes recommendations for improvements in both clinical practice and device design.

<http://www.thehtf.org/White%20Paper.pdf>

Monitors in Perfect Harmony

Boston researchers are examining whether music can translate changes in patient parameters more effectively than monitor beeps. A harsh-sounding note would signal a problem. Listen to the report (including the sound of a healthy cell) and read the transcript here:

<http://www.wbur.org/2010/03/04/surgical-symphony>

Be sure to visit Atrium University, a free, online resource filled with educational materials about chest drainage. From basic to advanced, the University provides learning opportunities in written, Web-based training and video formats.

