Reducing the Safety Hazards of Monitor Alert and Alarm Fatigue

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Perspective

Alarm fatigue occurs when busy workers are exposed to numerous frequent safety alerts and as a result become desensitized to them. This desensitization can lead to longer response times or to missing important alarms. In a hospital setting, one of the most frequent devices that alarms is the physiological monitor.

The recent Joint Commission National Patient Safety Goal on clinical alarm safety highlighted the complexities of modern-day alarm management and the hazards of alarm fatigue.(1) Research has shown that 80%–99% of ECG monitor alarms are false or clinically insignificant.(2-5) Hospitals are struggling to address this problem effectively and efficiently, hoping for the proverbial magic bullet. However, the cause of overexuberant alerts and alarms is multifactorial and therefore difficult to address.

This article will discuss ways to reduce the effect of each one of the following contributors to alarm fatigue:

- Artifacts in the waveform
- Alarm settings, limits, and delays
- Setting alarms based on clinical population instead of individual patient
- Staff education
- Patient education

Artifacts in the Waveform

Waveform artifacts can be caused by poor lead preparation, as well as problems with adhesive placement and replacement. These artifacts can cause alarms highlighting system malfunctions (called technical alarms; an example is a "leads off" alarm). They can also lead to alarms when the monitor falsely perceives arrhythmias. To reduce the frequency of waveform artifacts, nurses should properly prepare the skin for lead placement and change the electrodes daily.(6) In addition, proper care and maintenance of lead wires and cables can improve signal-to-noise ratios. Hospitals should not only have a policy for electrode changes, but also for monitoring and replacing lead wires and cables on a regular basis.

Alarm Settings, Limits, and Delays

Most hospitals simply accept the factory-set defaults for their devices in areas such as maximum and minimum heart rate and SpO2. Importantly, these default settings may not meet workflow expectations when the baseline of your patient does not match the normal healthy adult population. For example, a patient with chronic obstructive pulmonary disease (COPD) may have a baseline SpO2 that is not within the normal range for healthy adult patients. In other cases, the default settings may not be appropriate for a given patient population, such as in pediatrics. A cross-disciplinary team should prioritize the alarm parameters and make decisions on what type of alarm (audio vs. visual, etc.) will take place for each alarm state. The team should also then decide if that alarm will be transmitted to a secondary device such as a pager or smartphone. These decisions should be based on the workflow and patient population for each individual unit. Techniques shown to decrease the number of alarms include changing the alarm default settings to match the patient population on the floor and further customizing alarms by individual patient.(6-11) Furthermore, combining alarm default changes with added delays between the alarm and the provider notification shows the greatest reduction in alarms.(11-12) One study showed that lowering SpO2 alarm limits to 88% with a 15-second delay reduced alarms by more than 80%.(11)

Setting Alarms Based on Clinical Population vs. Individual Patient

As mentioned above, some hospitals set default parameters by overall patient population—such as changing the settings for a cardiac step-down unit vs. a pulmonary care unit. Although this type of unit-based defaulting does reduce alarms, it is not as effective as adding in some consideration of individual patient characteristics.

Default settings are useful when patients first arrive on a unit; they can act as a safety net by detecting significant deviations from a "normal" population of patients. However, once enough data has been collected, it is recommended that alarms be configured specifically for each individual patient's own "normal" and be implemented at a level at which an action or intervention is required.(6,13) For example, for a patient with COPD whose normal baseline SpO2 is 88%, a clinician may decide to reduce her SpO2 low alarm to 80%, if at the level he will intervene to get the patient's SpO2 level back to her baseline. Because many hospitals prohibit this kind of change without a physician order or sign-off by two nurses, implementing this patient-specific change often takes significant coordination between clinicians and, sometimes, discussion at an appropriate hospital policy committee.

Staff Education

Staff education forms the bedrock of all change management efforts. We have previously discussed electrode placement and preparation, default alarm limits and delays, and basing alarm settings on individual patients. None of these interventions can be successful without proper staff education and training.

Research has shown that educational interventions that increase clinicians' understanding of and competencies with using the monitoring systems decrease alarms.(6,8) In addition, there is a growing movement to monitor only those patients who have clinical indications for monitoring.(6) Drew and colleagues (14) have created a practice standard for ECG monitoring in hospitals that should be evaluated and adopted. This standard provides recommendations with regard to indications, timeframes, and strategies to improve the diagnostic accuracy of cardiac arrhythmia, ischemia, and QT-interval monitoring.

While most educational interventions to date have focused on nurses, one hospital found that a team-based approach, combined with a formal alarm management committee structure and broad-based education, led to a 43% reduction in critical alarms.(15)

Patient Education

All previous interventions discussed have focused on how the care team can reduce the number of alarms and alerts. However, care teams represent only half of the picture.

Imagine yourself as a patient in a hospital, doing relatively well, and in one 24-hour period you hear or see 1000 beeps, dings, and interruptions—each (to your mind) potentially representing a problem, perhaps a serious one. It's easy to see that this is far from a healing environment; in fact, it is likely to be terribly anxiety provoking to patients or family members. Unsurprisingly, patients or their loved ones often find ways to silence or otherwise inhibit alarms from going off in their room. Of course, some alarms are truly appropriate, and silencing them indiscriminately can lead to a life-threatening situation.

Patients should be taught about the need for alarms, as well as the actions that should occur when an alarm goes off. This helps set expectations and allows patients to participate in their care. On rounds, it is good practice to discuss how alarms should be used and to inquire about the patient's experience with alarms, including how they may be interfering with sleep or rest. Discussion of alarm settings and changes to those settings should allow for patient feedback and include education for patients so that they understand the rationale for the adjustments and what is likely to happen. Such education will decrease the chances that patients will feel the need to change or disable alarms themselves.

Conclusion

As soon as technologies and monitors entered the world of clinical medicine, it seemed logical to build in alarms and alerts to let clinicians know when something is—or *might be*—wrong. Unfortunately, we have traded the hazards of not knowing about a potentially risky condition for a new hazard: that of alarm and alert fatigue. The widespread adoption of computerized order entry has only made things worse.

The purpose of an alarm or alert is to direct our attention to something of greater importance and away from something that is less important.(16) Recent suggestions to overcome alarm and alert fatigue have aimed to increase the value of the information of each alarm, rather than adding simply more alarms.(16) Increasing the value of the information requires a decrease in the number of false and clinically insignificant alarms. By reducing the number of waveform artifacts, one can decrease the number of false alarms. Increasing clinical significance of an alarm requires setting alarm defaults and delay using patient-centered techniques. Finally, successful changes require education of both staff and patients. The current research around alarm management highlights the difficulty in understanding and working in a complex adaptive system. This complexity must be identified and understood to create a safer hospital system.

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