*The Five Steps to Integrated Alarm Management:*

# Improving Clinical Decision Making and Patient Safety

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The paradigm shift to a more integrated approach for alarm management is occurring in health care today. The old method of inundating clinical staff with alarms from isolated medical equipment to a myriad of devices does not ensure that nurses can manage all their patients effectively. In fact, that very approach usually creates more problems than it solves. Conversely, turning off all alarms and hoping that the nurse is always able to hear or see alarms put everyone at risk.

Building an integrated alarm management system is simply a more proactive strategy. The more complex the delivery of care, the greater the challenge communication presents. Nurses, biomedical engineers, and technology managers are often tempted in planning committees to simply "buy more equipment" to fix the problems. With a JCAHO survey looming, signing a large-sum equipment purchase order without a full understanding of how the medical device connects to mobile nurses may not advance the cause.

Fortunately, a wealth of knowledge has been published about best practices that can guide health care organizations on principles that will contribute to effective standards in the nursing environment. Several early adopters of this new paradigm followed five basic steps to achieve integrated alarm management:

1) Alarm Harmonization
2) Alarm Clearinghouse
3) Alarm Filtering
4) Alarm Distribution
5) Evidence-Based Reports

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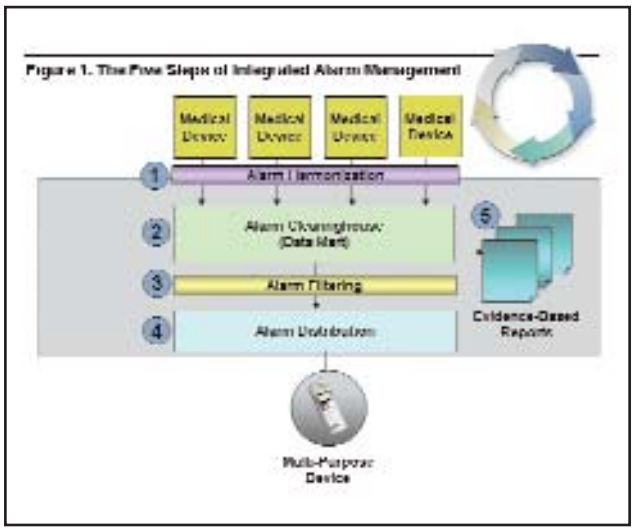


## Step One: Alarm Harmonization

One of the most challenging feats for health care organizations is to identify all of the clinical alarms currently being generated in the hospital, categorize them, and standardize the output based on alarm sensitivity. If you don't know an alarm exists or how it is being monitored and responded to, you are susceptible to missing it.

Each vendor has its own dialect, reluctant to move into a common language with other vendors. A number of standards-bearing groups have emerged but the lack of participation from medical equipment vendors makes it virtually impossible to harmonize best-in-class systems. Instead, alarm "harmonization" can be driven by a basic, rudimentary understanding of alarm sensitivities.

Alarm harmonization requires a common method of recognizing alarm conditions. There must be a set of alarm sensitivities that can be mapped across multiple systems, turning proprietary languages into a common format. There is much debate about the alarm sensitivities but some of the more common levels include:

emergency, critical, and non-critical. By establishing some element of common alarm sensitivities, care models can be optimized across an entire health care organization. Additionally, optimal staff levels can be supported based on the standard flow of information.

If health care organizations continue to add new technology to the current mix, things will only worsen for the nurses. The goal is to avoid desensitizing or overwhelming the nursing staff with too many alerts. As staff becomes overloaded, alarms inevitably fail to be acknowledged or are even shut off deliberately. Alarm harmonization helps to integrate the different dialects so that nurses can quickly and easily identify between critical and non-critical situations.

## Step Two: Alarm Clearinghouse

In step two, introduce a central data mart that brings all of the alarms and events into one centralized location. As a result, all alarms are stored to ensure they are meeting the standards defined in harmonization, and a holistic view of all alarms can be applied to understanding and affecting workflow, patient safety, and efficiency.

The clearinghouse can also serve as a "traffic cop" and manage the inflow and outflow of alarms. Alarm aggregation enables hospitals to monitor the total set of alarms to make smarter and faster clinical decisions. It provides specific measurements of all alarms received and distributed to the nursing staff, which ultimately helps nurse leaders make decisions about staff-to-patient ratios and staff level requirements.

Within the clearinghouse, a master association table seamlessly links patients, locations, staff, and devices to ensure the integrity of mapping the intelligent distribution of information. Many compliance organizations have emphasized the importance of creating an audit trail for acknowledgement, e.g. JCAHO's National Patient Safety Goals (NPSG).

Key alarming trends can be identified to improve workflow processes based on computer-based, statistical data versus anecdotal or random samplings. Monitoring the inflow of alarms can detect and provide constructive information. This can only be accomplished if there is a

thorough understanding of how each distinct alarm system interfaces with communication systems. For instance, it can determine that a monitoring technician is required because there are too many false positives that barrage and desensitize the nursing staff. Monitoring the outflow of alarms may detect that a nurse is receiving too many alerts during his or her shift. In this case, further alarm filtering and optimization would be recommended.

## Step Three: Alarm Filtering

With this step, you simply take the work you did in steps one and two to configure and annunciate your alarms (from clinical applications such as nurse call, patient monitoring, infusion pumps, and pulse oximeters, to name a few) to fit the new, harmonized model. As a result, all of the alerts will be set up to meet well thought out standards. You will know that alarms are being distributed and that the events can be seen and heard, and responded to in order to avoid the worst case scenario: a sentinel event.

With today's nursing shortage, the clinicians do not have the ability to respond to every possible alarm condition, so alarm filtering is required to avoid fatigue. Noise pollution levels rise and staff members become accustomed to or resentful of the alarms if they become overloaded.

Filtering various alarms and events can be tricky if not planned properly from the start. For example, in nurse call systems, call types are defined to help a nurse or nurse aide perform a given task for a patient. In some cases, call types can exceed over 100 variations making it difficult to manage. Conversely, in vital sign monitoring systems, alarms are segregated by some level of sensitivity, making the configuration more succinct.

In order to filter alarms, the alarms will need to be properly categorized so that the amount of alerts distributed to a primary caregiver can be monitored. If the amount of alerts distributed exceeds human vigilance, then the system can be reconfigured to avoid potential issues with patient safety. It is unlikely that a nurse manager will know exactly how many alarms will be distributed initially, so having the flexibility to add and remove alarm filters will be essential for creating an optimal nursing environment.

## Step Four: Alarm Distribution

A holistic understanding of alarms provides the visibility to plan how best to communicate alarms to caregivers. The result is more choices than the current approach, which says "make sure as many people as possible can hear and see the alarm." In contrast, alarm distribution allows caregivers to use the communication device best suited for them and their environment, and makes sure alarms are sent to and received by that device.

Today's distribution occurs in a variety of ways: overhead page, audible alert on medical equipment, dome light outside of a patient room, text message on a phone, or display on an LED sign. The method varies based on a nurse leaders' preference and staff feedback. Most hospitals are realizing the drawbacks of the often disruptive overhead page. Press Ganey's rating for "noise in and around the room" is one that has been proven to significantly impact patient satisfaction. Audible alerts are effective when nurses are nearby. However, in an increasingly mobile environment, alternate methods of secondary alarm notification are required to build the necessary safety nets to ensure that nurses are notified of critical conditions quickly and efficiently.

One of the most important aspects of alarm distribution is tracking an alarm condition to acknowledgement. Traditional paging does not store acknowledgements, so pages would often get lost due to bad coverage areas. Graphic pagers that display EKG snippets have not demonstrated enough reliability to be effective. This has forced communication device manufacturers to innovate.

Wireless telephones have emerged in nursing to offer voice communication and text messaging in a single, multi-purpose device. A new wireless telephone is emerging that will be able to display EKG snippets, making it the all-in-one "Swiss Army Knife" device so desperately desired in the nursing environment.

Before a device is chosen, a study of the current alarming conditions should be conducted to determine which communication device is the best fit for the nursing environment at hand. Too often, end-devices are chosen based on the desire for remote communications. More formal investigation would be recommended to determine if the end-device will have an impact on nurse productivity.

## Step Five: Evidence-Based Reports

With tools that help administrators analyze the data from centralized alarms in Step 2, hospitals can identify and fix bottlenecks in alarm responses. As a result, caregiver staffing and workflow can be more closely matched to patient safety and satisfaction requirements.

Evidence-based reports can trace nurse activity from

alarm condition to alarm silence, including the activity of distributing alarms through a communication network and ultimately to an end-device. Some end-devices have acknowledgement capabilities, so alarms can escalate to backup caregivers whenever an alarm is not received or acknowledged by a designated caregiver. The Catch-22 of added documentation is that it can sometimes show negligence, but lack of documentation can reduce the effectiveness of detecting omissions or medical errors. If health care organizations reward nurses who identify areas of needed improvement, documentation can play a profound role in patient safety.

Risk managers struggle to recreate events. When investigations occur, risk managers want a "flight recorder" that recreates a nurse response to a critical patient event. Without documentation, health care organizations will continue to lose battles in litigation because evidence-based reports are non-existent. Incident reports can provide quantitative data versus anecdotal or qualitative, random feedback.

## Conclusion

Today, health care organizations must think strategically about their approach to the nursing environment. The increasing isolation of medical equipment and devices will not solve the problem of keeping patients safe. Additionally, medical equipment alone will not significantly improve nurse productivity. Building a solid alarm management strategy that integrates multi-vendor clinical systems is required to reinvent processes and workflow patterns that would make a difference in a clinical setting.

An integrated alarm management strategy can help monitor real-time information and measure communications to determine the effectiveness of a quality system. By using evidence-based reports, health care organizations can optimize staff-to-patient ratios and measure performance against objectives. Instead of thinking about the next equipment upgrade, perhaps a facility should think about optimizing its clinical operations. ■