



# Mitigating alarm fatigue and improving clinical productivity – the role of intelligent middleware in delivering efficient care

*Much has been written about the danger of alarm (or alert) fatigue as it relates to patient safety. Often overlooked, however, is the extent to which productivity is negatively impacted when caregivers are overwhelmed by unending alarms, many of which are nuisance or non-actionable events.*

*This paper looks at the ways in which alarm fatigue impedes efficient care. It also offers a solution in the form of intelligent middleware—easily integrated software that can overcome those challenges and promote optimal caregiver productivity.*

*At John Hopkins Hospital, one 12-day alarm system analysis registered 58,764 alarms, an average of 350 per patient per day!*

## **When technology gets in the way**

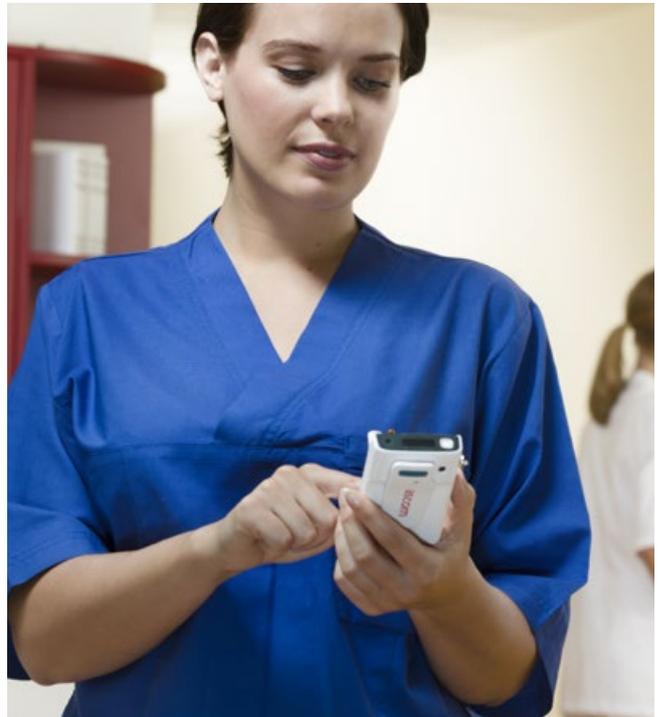
Patient care has been transformed by advanced technology that can record and report almost any patient event. From monitors to pulse oximeters to infusion pumps, these devices send alerts that demand caregivers' attention.

While such technology has improved patient care through more immediate response to patient events, the sheer number of alarms has actually created roadblocks for caregivers. Faced with a barrage of work interruptions and competing priorities, clinicians are forced to become increasingly more reactive in delivering care and often frustrated by unnecessary calls to action.

## **Common interruptions with enormous impact**

When a caregiver is repeatedly interrupted during his or her routine, the individual's efficiency obviously suffers. Take a simple task: a nurse redressing a surgical wound. In approaching that task, the nurse will perform hand hygiene according to facility protocol and put on protective equipment or clothing required for that procedure. If a patient monitor alarm sounds from another room, the nurse, who may not know the priority level of the alert, may decide to err on the side of safety by stopping the redressing procedure and checking in with the other patient. This interruption thus would necessitate repeating the hygiene and protective-clothing procedure process, which, of course, is extremely inefficient.

This simple interruption reveals the magnitude of potential productivity loss.



*Consider if a hospital has 100 nurses and each of those nurses encounters just three five-minute work interruptions per day, it adds up to a staggering 9,125 hours of lost productivity per year—the equivalent to more than four staff positions.*

Given a number of related issues, including the shortage of nurses, potential for burnout and negative effects on job satisfaction, it is critical that alert fatigue be addressed operationally to meet the needs of personnel and to promote organizational viability.



### Competing priorities and workflow bottlenecks

Even during normal patient-related routines, caregivers must constantly set and reset priorities in response to patient alarms. Balancing priorities is even more complex when caregivers are flooded with low-priority events. This scenario typically occurs when medical device alarm parameters are not customized to a particular patient. In study after study, we find that lack of parameter customization remains one of the leading causes of alarm fatigue<sup>2</sup>.



*Cincinnati Children’s Hospital Medical Center recently conducted an assessment of cardiac monitor alarms in the facility’s bone marrow trans-plantation unit. The research revealed an average of 5,300 alarms daily, of which 95 percent were false alarms. Common errors reported were: monitors that weren’t set with age-appropriate parameters, electrodes that were placed incorrectly and replaced too infrequently, and lack of standard processes for ordering patient-specific parameters<sup>3</sup>.*

This is compounded by the reduction in length of stay for patients, as frequent patient churn makes it more challenging to effectively customize parameters.<sup>4</sup>

The commonsense conclusion is that excessive alarms are distracting and impede the ability of caregivers to effectively deliver care. Thus the filtering of alarm events—another function of middleware—must be part of an overall solution to reducing alarm fatigue.

### Assuring awareness of actionable alarms

One of the most fundamental aspects of alarm management is ensuring that caregivers are aware of all actionable alarms.

Here, middleware plays a vital role by directing secondary alarm notifications to a caregiver’s mobile device. Middleware becomes the intermediary between clinical alarm systems



and mobile devices, controlling centrally the distribution and display of alarm notifications, sending only actionable alerts to an assigned caregiver for appropriate and timely response. To accomplish this, intelligent filtering of alarm notifications is required.

Such filtering also can greatly limit the time a caregiver spends in “flood” mode, a condition that arises when a caregiver receives more alarm notifications than can possibly be handled. Flood mode not only exacerbates alarm fatigue, but it also puts the caregiver in a constant state of reaction. Controlling the number of events being sent to a caregiver’s mobile device is a crucial element in reducing alarm fatigue.

*According to one study on alert response, if an alarm is accurate 90 percent of the time, individuals will respond to the alarm 90 percent of the time. Conversely, if the alarm is accurate 10 percent of the time, individuals will respond only 10 percent of the time. This, the study concluded, demonstrates that workers will modify their response rate to the alarm system’s reliability<sup>5</sup>*

In addition to alarm filtering, which significantly reduces nuisance alarm notifications, middleware also relays the appropriate alarm priority. This can include differentiated audible alerts and color-coded alert messages to help caregivers quickly identify high-priority events.

Most middleware systems also provide staff assignment and rules-based escalation to ensure alarm notifications get to the assigned caregiver or a designated backup.

The system can also trigger a team-based response for specific events when appropriate.



In short, today's best middleware platforms link mission-critical systems with mobile staff, providing intelligent integration with two-way interactive communications to get the right message to the right person at the right time. They deliver not just alerts, but interactive information that can be escalated, while prioritizing and filtering alert messages to reduce alarm fatigue and minimize workflow interruptions.

### Conclusion

The challenges of alarm fatigue in today's healthcare environment necessitate advanced tools. Intelligent middleware products will play an increasingly important role as part of an overall alarm management solution. Reducing alarm fatigue and enhancing caregiver productivity will enable a more efficient care environment, saving time, money and resources.

### Middleware systems increase productivity for caregivers:

- Mobile notification of patient alarm events
- Intelligent alarm filtering to reduce nuisance alarm notifications
- Alarm prioritization to more easily distinguish important patient events
- Staff assignment routine to help ensure caregivers have clear patient responsibilities
- Formal, rules-based escalation process when primary caregiver cannot respond
- Reporting tools for auditing and improving clinical workflow



1. News Article, Actionable Alarm Or Crying Wolf? Johns Hopkins Safety Team Honored For Reducing Clinical Alarms, John Hopkins Medicine, October 15, 2012
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3. Combating Alarm Fatigue, American Journal of Nursing, Maria Nix, 115(2):16, February 2015
4. Avalere Health analysis of American Hospital Association Annual Survey data, 2013, Average Length of Stay in Community Hospitals, 1993–2013, accessed at <http://www.aha.org/research/reports/tw/chartbook/2015/chart3-5.pdf>.
5. Alarm Fatigue: The Human-System Interface, Clinical Nurse Specialist, The Journal for Advanced Nursing Practice, June 2014, accessed at [http://www.nursingcenter.com/JournalArticle?Article\\_ID=2433261](http://www.nursingcenter.com/JournalArticle?Article_ID=2433261)

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