More than 1,000 alarms per patient per stay. That’s what one unit at Johns Hopkins Hospital in Baltimore estimated nurses heard. It made for a noisy environment and one that was ripe for providers to become inured to the sound, potentially ignoring vital alarms because so many of them were false. Improving that kind of environment is exactly what The Joint Commission had in mind when the organization announced that alarm management would be a National Patient Safety Goal starting in January 2014.

Comments on proposed standards were still coming in at press time, and Anita Guintoli, RN, BSN, MJ, associate director of the office of quality monitoring at The Joint Commission says she can’t quantify or qualify the comments received until they have been analyzed.

The rationale for making this a focus is the proliferation of equipment and monitors in the past decade or so, says Patricia Adamski, RN, MS, MBA, FACHE, TJC’s director of standards interpretation for the division of healthcare improvement. “Vendors have added alarms to enhance value, but now there are so many that it’s difficult to prioritize them or even determine which alarm goes to what,” Adamski notes. “How do you know which to respond to first? Which is most critical and what is more of a nuisance that just needs to have a button pushed?”

A little under two years ago, TJC held a summit with the Association for the Advancement of Medical Instrumentation, the Food and Drug Administration (FDA) and ECRI. The group came up with a to-do list that was used in creating the proposed standards. (See the proposal at http://www.jointcommission.org/assets/1/6/Field_Review_NPSG_Alarms_20130109.pdf and list of resources related to alarm management in the box on page 40.)

Elements of the proposed standards include creating an inventory of alarms and their default settings, figuring out which ones are vital, which have parameters that can be changed, and which can be disabled completely. Hospitals will likely have to determine whether existing alarms are calibrated properly, who is allowed to change parameters, and whether the alarms can be heard and distinguished from the other ambient sound. They will have to educate staff about the policies and procedures related to alarms.

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With the thousands of alarms that go off on a unit in a given day, it’s no wonder that many front line staff start to ignore them. Indeed, some surveys have suggested that nurses believe the vast majority of alarms are nuisance alarms that don’t require any attention other than to turn them off. In 2006, Maria Cvach, MSN, CCRN, assistant director of nursing clinical standards at Johns Hopkins Hospital worked with an interdisciplinary team to address alarm fatigue. It included IT, nursing, physicians, and respiratory therapists. “Anyone with a vested interest in alarms had to be a part of it,” she says.

The first couple years were spent quantifying the problem. “We had to analyze the data from a bunch of different devices that don’t talk to each other, at least not yet.” So the data related to alarm is something you have to create, she says. “You can get raw numbers that says how many of what kind of alarm per day. But we want to know how they are sorted. How many are related to high or low heart rate, how many are VTAC.”

In the end, they had to get biomedical engineers to help retrieve and analyze the data they wanted and even installed a real-time surveillance system that integrated the data from all the devices at the bedside — cardiac, ventilator, and other monitors. Vendors were also helpful in retrieving data and understanding the alarm systems. Initially, there were more than two dozen data points Cvach looked at before cutting it down to six, including bed number, why the alarm sounded, its duration, and the kind of sound it made.

Cvach says they finally extracted data on alarms per bed day and how many of them were false. The numbers were staggering. One 12-day alarm system analysis registered 58,764 alarms, an average of 350 per patient per day. That rate was doubled on the noisiest unit. The pediatric intensive care unit (PICU) experienced 20,158 audible alarms in eight days for 17 beds, and analysis revealed a 90% false-positive rate among alarms for apnea in that unit.
Before making any changes, the team determined which were the most important alarms, and what proper parameters were for them going off. They made sure there were backup systems in place for the most critical alarms. Then they started doing rapid cycle testing of changes. Among the things they tried were sending pages and texts to provider cell phones when a critical alarm went off, changing electrodes for certain monitors daily, and altering default parameters. “None of the changes we made were earth-shattering,” she says. “They were modest.”

For instance, there were a lot of false alarms related to a VT greater than 2. “We had a VTAC alarm, so why did we even need two?” There are some 200 parameters for most cardiac alarms, and Cvach worked with the monitor company to make alterations. Some alarms were changed from audible to messages. Other non-critical alarms were altered so that they waited to sound for a minute to see if the condition persisted or if it was related to a patient moving — rolling over, getting up to brush her teeth. Staff were educated, and the committee found a champion on every unit who knew about the alarms, their purpose, and parameters and could act as a guide to other staff.

Reductions were 24%-75% depending on the unit. “If you start with 771 alarms per day and you cut that by half, staff will notice,” she says. Along with the reduction in alarms, Cvach says there was a reduction in the duration of time they sounded because when they did, nurses knew it wasn’t as likely to be false and so they acted quickly.

While they haven’t researched the relationship between outcomes and alarm changes, it is something Cvach is interested in. “We are trying to get funding for a multi-site randomized controlled study on that,” she says. Meanwhile, from a look at the cardiac arrest and rapid response team data, she doesn’t think there has been any negative correlation between alarm changes and outcomes.

The dream of the future

Cvach says she dreams of a day when alarms don’t sound because nurses and other frontline staff have information on trends for patient vitals that can predict future problems. While that may be a while away, there are trials under way to create devices that are better at talking to each other and can ascertain whether a particular metric points to a patient crisis or, when taken in conjunction with other metrics, is just a blip that doesn’t merit attention.

Ross Koppel, PhD, FACMI, a professor at the University of Pennsylvania School of Medicine, is working on just such a project at the university’s hospitals as part of a multi-hospital project funded by the National Science Foundation. They are two years into a four-year project that is supposed to create a smart alarm. “If a nurse on a typical shift hears up to 1,800 alarms, how many of them are real? If you have an upper limit parameter of 130 for blood pressure, someone in pain just after surgery may have 135, but that’s not a problem. So the nurse just hits the three minute silence button over and over during a 12-hour shift.”

Or the blood pressure could be fine, the oxygen saturation looks good, and respiration is great. But the patient rolled over and the cardiac lead fell off, so there is no heartbeat. “There’s a good indication that the patient is fine, and a good, experienced nurse will realize that and give it lower priority. But the alarm will still ring. But if you had alarms that talked to each other, no alarm would sound,” Koppel says. “We are trying to create that kind of intuitive alarm that looks at data in combination so that there are fewer alarms that are more meaningful when they sound.”

Right now, creating that kind of system that talks to each other is a time-consuming feat for IT staff, who are creating dongles to link systems

Further resources on alarm management

• Association for the Advancement of Medical Technology: http://www.aamij.org/meetings/summits/alarms3.html
• ECRI top 10 Hazards: https://www.ecri.org/Forms/Pages/ECRI-Institute-2013-Top-10-Hazards.aspx
• The Johns Hopkins project: http://ajcc.aacnjournals.org/content/19/1/28fullpdf.html?sid=353507c8-bbc5-418a-9a0a-35677c0b836a
• Johns Hopkins white paper: http://www.hopkinsmedicine.org/dev/_test_ben/The%20Johns%20Hopkins%20Hospital-Using%20Data%20to%20Drive%20Alarm%20Improvement%20Efforts%202012.pdf
together. “There is no coherent protocol that allows devices to talk to each other,” he says. But they are working to create programs — some may even work on cell phones — that will process all the data. The key is to create something that isn’t overly restricting the alarms. “You can’t err on the side of a program not sending a critical alarm.” The IT wizards are also working on a program to analyze the vast quantities of information that comes out of a neuro-ICU unit to predict cerebral events, and what combination of data could predict sepsis.

Like Cvach, the IT guys are realizing that there are a ton of monitors with a ton of information. “There are up to 117 devices in a typical ICU, and it’s insane that they don’t talk to each other,” Koppel says. Further, vendors aren’t always helpful in providing the proprietary code necessary to extract the data.

Getting to the part where they test some new alarm program will take more time, he adds. Meanwhile, there are steps you can take to reduce the burden. “Demand from your vendors that any device you use gives you data that is accessible not just through the vendor server. Ask for a common data protocol that will enable your own people to use data from devices connected to their patients. No one should have to spend time building dongles.”

REFERENCE

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