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EDITORIALS

Crying Wolf: False Alarms and Patient Safety

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Despite 15 years of national and local investment in improving the safety of hospital care, patient safety remains a leading problem in both adult and pediatric hospitals. A 2010 study found that 180,000 Medicare beneficiaries likely die each year due to harm suffered as a result of medical care,[1] a death toll surpassed only by deaths due to cardiovascular disease and cancer. Even though initial efforts in the field have shown great promise for stemming the tide of healthcare-associated infections,[2] surgical errors,[3] handoff failures,[4] and errors in the care of adults hospitalized for myocardial infarction and congestive heart failure,[5] much work remains to be done.[6] The root causes of many adverse events are poorly understood and unaddressed. Resultant tragedies remain all too common.

In the current issue of the *Journal of Hospital Medicine*, Bonafide and colleagues report the results of an innovative observational pilot study designed to assess the role of an inadequately addressed root cause of serious errors: alarm fatigue.[7] Alarm fatigue is the phenomenon of desensitization to alarms, particularly in the context of excessive false alarms. In a videotaped observational assessment of nurse response times to 5070 alarms on a pediatric ward and intensive care unit (ICU), the authors found that nurses responded significantly more slowly as the number of nonactionable alarms in the preceding 2 hours increased. Although a substantial majority of these alarms were technically valid (ie, representing true deviations of vital signs outside of the normal range rather than sensor or equipment problems), the vast majority required no action to be taken—approximately 7 out of 8 in the ICU and an astonishing 99 out of 100 on the ward.

As any hospitalist, intensivist, or nurse knows well, alarms are rampant throughout hospitals. It is impossible to walk down any hallway on a busy hospital ward—never mind an ICU—without seeing a flashing light or 2 above a doorway, and hearing the incessant beeping of oxygen saturation and cardiovascular/respiratory monitors, a thousand bits of technology forever crying wolf. The problem, of course, is that sometimes there really is a wolf, but it is hard to take the risk seriously when the false alarms happen not just twice before a true threat materializes, as in Aesop's fable, but 7 times in the ICU, or worse, 99 times in the setting where most hospitalists practice. Moreover, even when the threat is real, in most cases it is caught in time one way or another, and no lasting harm results.

So why not simply shut off the unremitting noise? In 1987, outside of Baltimore, Amtrak experienced what at the time was the deadliest rail crash in its history after 1 of its passenger trains collided with a Conrail freight train. A major root cause of the crash was that the crew on the freight train had placed duct tape over an annoying automated signal alarm.[8,9] Tragically, on this particular day, the suppressed alarm was all too relevant. Identifying the real alarm, however, can be nearly impossible when it sounds the same as 100 irritating sounds constantly emanating from the environment. It is the challenge of identifying the needle in the haystack, after you have developed an allergy to the hay.

What then to do? More research like that conducted by Bonafide and colleagues is needed to better understand how healthcare providers respond to the onslaught of alarms they encounter, and to inform refinement of these systems. Understanding how alarm fatigue plays out in the context of different clinical settings, with different workloads, varying levels of distraction, and different rates of true and false-positive alarms will be critical. Furthermore, understanding how individuals' physiologic fatigue, circadian misalignment, mood, stress, and cognitive state may play into alarm response is likewise essential, if we are to design appropriate alarm systems that function effectively in the busy 24-hour environment of healthcare. Ongoing work suggests that smart alarms, using algorithms that integrate data from multiple vital sign readings over time, may reduce the frequency of false alarms and better identify clinically significant events.[10] Replacing existing range-limit monitors with these types of smart alarms has the potential to greatly improve both the sensitivity and specificity of hospital alarms, but further work in this area is needed.

Ultimately, if we can better separate out the signal, we will be better poised to respond to the true emergencies that arise that are currently obscured by the

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ever-present noise. Better trust in the alarm systems we have would help all of us focus our energies on the problems that matter most. Doing so, we could better care for our patients, and better identify the system failures that cause them harm in our hospitals.

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