Nurse perception of alarm fatigue impacts compliance with alarm management

Education can help nursing staff gain control and improve patient safety.

By Sharon H. Allan, DNP, ACNS-BC, CCRC

Someone with an outside perspective may be surprised by the noise and chaos of an intensive care unit (ICU), where alarms go off repeatedly. But nurses and others who work in that environment every day too often think the chaos is normal, when in fact it's creating distraction and jeopardizing patients.

Alarms have a long history of compromising patient safety, and recent studies demonstrate the negative consequences alarms have on families and nurses as well. To highlight the importance of this issue, for the fifth year in a row, reduction of clinical alarm harm is a Joint Commission National Patient Safety Goal.

To address this problem, a team of interdisciplinary professionals—including human factors engineers, clinical engineers, a unit-based nurse manager, a unit medical director, a unit-based clinical nurse specialist, a central nursing clinical nurse specialist, and expert bedside nurses—at a large academic medical institution launched a quality improvement (QI) project to look into the effects of alarm fatigue and strategies to reduce the number of nonactionable alarms.

Identifying the problem

ICUs are high-intensity environments that require clinical staff vigilance, but nonactionable nuisance alarms pull them away from high-priority tasks, creating staff dissatisfaction and a patient safety hazard. When the QI project team reviewed clinical alarm data, they discovered that alarm fatigue was institution-wide. During a patient safety meeting with ICU nurses, several of them indicated that one of the alerts being discussed was "message only." However, it was one of several auditory alarms that they heard several times a day. This is a prime example of how too much alarm noise created by nonactionable auditory alerts leads to alarm fatigue. Your brain isn't able to process all the sensory input, so sounds that aren't the result of a change in a patient's physiologic state aren't thoroughly processed, which can lead to missing an actionable alert.

The team conducted a literature review, which revealed that educational interventions targeting staff awareness of alarm fatigue may improve compliance with alarm management strategies.

Gathering data

The QI team wanted to measure nurse awareness and perception of alarm burden before and after an education intervention aimed at increasing nurse awareness. The team chose the National Clinical Alarm Survey, developed by the Healthcare Technology Foundation (HTF), to establish baseline perception and awareness. The HTF survey tool has been used to provide data on nurse awareness of alarm fatigue and the stress related to excessive clinical monitor alarms. The survey link was emailed to all of the nurses working in the ICU. The body of the email provided an overview of the project; when nurses opened the link to take the survey, they gave their consent to participate in the project.

Intervention through education

After completing the pre-intervention survey, nurses participated in intense education sessions for 8 weeks. The varied sessions included staff participation in developing education posters with weekly unit-specific alarm data, reading and discussing articles on the negative impact of

Survey says...

The group mean survey scores showed improvement after 8 weeks of education about alarm fatigue and management.

1 = Strongly agree   2 = Agree   3 = Neutral   4 = Disagree   5 = Strongly disagree

Nurse survey question	Preintervention group mean	Postintervention group mean	Percent improvement in score
Nuisance alarms occur frequently.	2.17	1.71	21.20%
Use of alarm profiles will decrease number of nonactionable alarms.	2.25	1.79	20.44%
There is no requirement in my institution to document that the alarms are set/appropriate for each patient.	1.96	1.71	12.76%
Nuisance/nonactionable alarms lead to staff dissatisfaction.	1.92	1.71	10.94%
Smart alarms would be effective in reducing false alarms.	2.00	1.79	10.50%
Patients admitted to the critical care unit are routinely set up in the default physiologic monitor alarm setting.	2.13	1.93	9.39%
Nuisance alarms disrupt patient care.	1.79	1.64	8.38%
Environmental background noise has interfered with alarm recognition.	3.33	3.07	7.81%
Over the course or my work week, I experience alarm fatigue.	3.17	3.43	7.58%

1 = Never   2 = Rarely   3 = Sometimes   4 = Always

I routinely customize alarms.	3.58	3.86	7.25%
I feel empowered to customize alarms.	3.38	3.93	2.54%
I feel confident to customize alarms.	3.88	3.93	1.27%

alarm fatigue, and exploring best practice alarm management strategies, such as alarm customization.

The posters were displayed in the staff team room. At weekly multidisciplinary comprehensive unit-based safety program meetings, an overview of the QI project was shared, along with education on the number of nonactionable alarms in the ICU and best practices to reduce alarm burden. Members of the QI team also conducted weekly one-on-one sessions with bedside nurses to measure real-time compliance with alarm customization.

Perception vs. reality

Pre- and postintervention nurse awareness survey results were compared to see if staff compliance and confidence with customized alarm settings improved. The goal was to achieve a 20% improvement in survey results specific to questions that measure nurse awareness and perception of alarm fatigue. A total of 38% (n=23)

of the nursing staff participated in the preintervention survey and 21% of the nurses (n=13) volunteered to participate in the postintervention survey. Descriptive statistics were run to compare pre- and postintervention group means and determine if improved scores were clinically significant. (See *Survey says....*) Nurse knowledge of alarm fatigue, customization of alarm settings, and awareness of nuisance alarms improved. The practice change showed improvement in all areas of the survey.

The preintervention survey data reflected the nurses' perception that they were knowledgeable about alarm fatigue and alarm customization, and that they demonstrated high compliance with alarm management strategies aimed at reducing alarm burden. However, during education sessions, the QI team found that many of the nurses didn't have the knowledge or confidence to customize alarms, and that they weren't able to define or describe alarm fatigue.

What we learned

This QI project resulted in overall clinical improvement in nurse awareness and knowledge of alarm fatigue and improvement in compliance with best practice changes to reduce alarm burden. The small sample size, time constraints, and length of the survey limited the number of nurses who could participate.

Improving staff compliance with strategies to reduce alarm burden may benefit from preintervention one-on-one sessions to evaluate nurses' baseline practical skills on the use of best practice alarm-reduction strategies. The intervention also might benefit from a tool that assesses nurses' personal awareness and perception and compares those results with their actual knowledge and understanding.

The QI team will disseminate the nursing implications of this project as recommendations for future standards of care to help improve nursing practice and alarm management.

Take control

When you're in the thick of a busy, noisy ICU, you might not realize the impact of multiple alarms vying for your attention. Education about the ramifications of nurse fatigue and the benefits of alarm-reduction strategies may help you and your colleagues gain control of the situation, improve your work environment, and ensure patient safety. ★

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What about big data and nursing?

Statistics, computer science, and nursing work together to analyze data and inform patient care.

By Melinda Higgins, PhD; Roy L. Simpson, DNP, RN, FAAN, DPNAP, FACMI; William Gregory Johnson

You've probably been hearing a lot in the news lately about big data. But what is it? And what does it mean for nurses? How does it affect our lives and our patients' lives? How can it help us develop new knowledge for our profession?

All the devices we use professionally and personally have one thing in common—they produce data that can be mined; in other words, "big data." Most of us didn't encounter big data in our nursing curriculum, but we need to know about it now. We can use big data to advance knowledge through technology and innovation, and it can have a significant impact on our practice.

This article reviews the interdisciplinary team required for big data analytics, along with some processes and suggestions for using big data in your practice.

Big data = better patient care

In their landmark 2015 article, Brennan and Bakken aptly stated, "Nursing needs big data and big data needs nursing." The authors noted that big data arises out of scholarly inquiry, which can occur through everyday observations using tools such as computer watches with physical fitness programs, cardiac devices like ECGs, and Twitter and Facebook accounts. When the information in these devices and programs are mined, it can be analyzed to help create new knowledge and improve patient care.

To make all of this happen, we need centers that advance big data science, such as the one housed at Emory University's Nell Hodgson Woodruff School of Nursing. Emory's center established three components of big data for advancing nursing science: a data dictionary of research and activities related to research and its funding, an educational database of over 1 million patients seen at Emory University Healthcare, and detailed biological measurements for advancing precision healthcare and nursing research.

Data success

The success of the center depends on team members from three disciplines: statistics, computer science, and professional nursing. Each is prepared at the doctoral level.

Statistician

The statistician aligns correct statistical analysis approaches to address each research question, defines proper statistical methods, and coordinates with the computer scientist and RN to understand the data structure and format. Then the interdisciplinary team works to understand the underlying system that generates the data (for example, the electronic health record [EHR]) and accu-

rately identifies the outcomes of interest (for example, readmissions within 30 days) that need to be estimated and evaluated.

When working with big data, you may encounter issues related to software and computing resources, data formatting, and data choice. Many statistical software packages run into problems when the organization's computer system memory isn't large enough to handle the software. However, rapid developments in this area have advanced new methods to manage these situations. The statistician must work closely with the team to ensure that the computing resources are adequate to handle all of the data sources for storage, preprocessing, cleaning.

In addition to software and computing resource issues, data may be unstructured (not always numeric and not in a rectangular "spreadsheet" format) and messy (missing data, outliers, mixed data types). This is where the RN aligns the nomenclatures and taxonomies of practice to the data, building on the work of the American Nurses Association (ANA) database committee, which identified nursing vocabulary in the late 1980s and early 1990s. The team works to help with all preprocessing steps to understand data quality and limitation issues that affect the final analyses, modeling, and subsequent inferences to be drawn.

Keep in mind that not all data should be included in the analyses. Instead, data sources and amounts should be purposefully sampled with as much care and consideration as enrolling a sample from a larger population of interest for a clinical trial.

Computer scientist

All of the data from the hundreds of devices that nurses use enables the transformation of information into actionable knowledge at the bedside. However, health data flows into EHR repositories with various characteristics, which can overwhelm a computer.

A computer scientist focused on data science has the skills and understanding to calm the volume and veracity issues (bias, noise, uncertainty) of information into quality assets that help nurses deliver targeted care. Advances in computer processors and algorithms also enable mining of data generated from health devices worn by patients. Data from these devices are transmitted over the internet so nurses can interpret the information to create actionable outcomes.

RN

The team informatics RN understands the foundations of nursing, has patient care knowledge, and uses data to inform nursing practice. In addition, the RN understands practice theory and how to implement it at the bedside within the workflow and context of the organization through the lens of a nurse. He or she also understands the independent and dependent variables of the practice; the alignment of legal, ethical, and regulatory requirements (for example, privacy regulations and institutional board review requirements); and the criteria for research versus quality and safety analytics.

In addition to identifying and interpreting important data sources through the lens of a clinician, the RN understands the science behind the nursing process, how
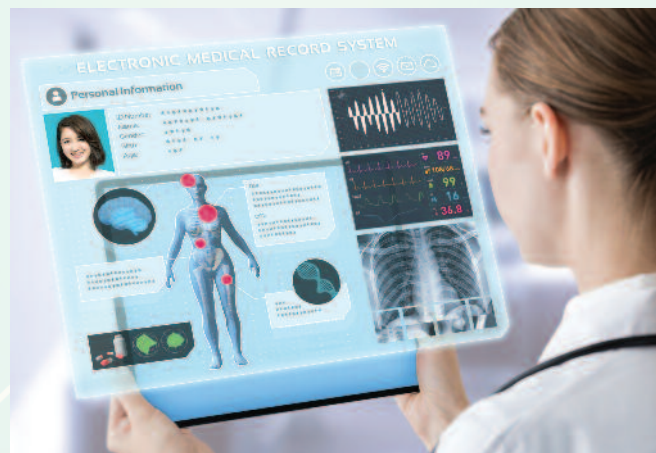
the life cycle of data affects nursing practice, and how feedback loops for quality and practice can be developed based on evidence. The RN evaluates the unintended and intended biases of the process and helps integrate the ANA *Code of Ethics for Nurses with Inter-*

pretive Statements and the patient's bill of rights into the context of the information age.

From data to knowledge

Big data lets us analyze gazillions of data elements. For example, when all of the data in the EHR are processed, they're cleaned so that missing values are identified, unrealistic or meaningless data points are extracted, and redundant and conflicting data are eliminated. This is where computer scientists and statisticians come in.

To process the data and transform it into a format for meaningful analysis, it needs to be smoothed, aggregated, normalized, and discretized. It also requires clustering and binning, histograms analysis, and hierarchy evaluation. In other words, we need knowledge from disciplines outside of nursing. Don't let anyone tell you that creating an Excel spreadsheet is big data. Similarly, manipulation of a spreadsheet isn't even close to the requirements needed to interpret big data. It requires computer coding and statistical programming skills.

After processing, we begin mining the data for new knowledge, so we can illuminate nursing phenomena. We want to shine a light on what we do and how we make a difference in patients' lives. For example, in the 1980s, ANA made what was an audacious statement for the times: Every patient needs a nurse. Aikens' research showing the impact of RN staffing on patient morbidity and mortality followed. Her work illuminated the need

for nursing practice at a professional level of advanced knowledge to avoid costly complications or even death. Our work matters, and to show that it matters and advance the profession, we need big data.　★

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