Case Study

Continuous Monitoring of Patient Vital Signs to Reduce 'Failure-to-Rescue' Events

Phyllis J. Miller

The Johns Hopkins Hospital is a nonprofit academic medical center in Baltimore, MD, and part of the Johns Hopkins University. Founded in 1889, it is a large global health enterprise that operates six academic and community hospitals, four suburban healthcare and surgery centers, and 39 primary and specialty care outpatient sites. Zayed 11 East, the focal point of the initiative described here, is a 32-bed surgical unit that cares for patients with orthopedic/spine, trauma, general surgery, and neurological conditions and who receive opioids for pain management following surgical procedures.

Description of Issue

Initiatives by The Joint Commission[1] and Department of Health & Human Services[2] have brought increased attention to the topic of monitoring of patients on opioids and galvanized hospitals, including Johns Hopkins Hospital, to pursue continuous vital sign monitoring programs. The hospital's philosophy is that "failure-to-rescue" events (i.e., when a patient dies from a medical complication that was not recognized in a timely manner or treated appropriately) and in-hospital cardiac arrests should never occur.

In 2015, 40% of the sudden deaths at Johns Hopkins Hospital occurred on the Zayed 11 East unit. As a result, surveillance monitoring of vital signs was implemented for all patients on this unit. An earlier pilot that used a wired patient monitoring system received negative feedback, with patients expressing dissatisfaction with a system that they said was uncomfortable to wear. The device company from the first pilot did not offer an FDA-approved wireless product at the time of that selection, though it subsequently received FDA approval. This earlier system tethered them to the device with a cable, necessitating staff to to disconnect patients from monitoring when getting out of bed to go to the bathroom or for physical therapy. Patient complications were more likely to occur at that time but were not captured. For example, one patient experienced orthostatic hypertension when getting up for the first time postoperatively. Another patient experienced a burst of atrial fibrillation. In that case, it took some time to return the patient to bed, take vital signs, and reconnect them to the monitor to evaluate the rhythm.

A multidisciplinary team made up of clinical engineers, information technology (IT) staff, and medical as well as nursing clinicians guided the implementation of this initiative throughout both pilots. As the team looked to their second pilot, they chose a Food and Drug Administration (FDA)-approved wireless device (ViSi Mobile; Sotera Wireless, San Diego, CA). Then, the staff of Zayed 11 East implemented surveillance monitoring for all patients, which involved collecting patients' oxygenation level through pulse oximetry (SpO_2), continuous blood pressure, heart rate, respiratory rate, and temperature.

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The continuous nature of the monitoring provides an ongoing picture of the patient's condition rather than typical monitoring by a staff member, which measures only episodically without the ability to trend data. As a result, some early deterioration signals can be missed as they occur between the times that the staff measures the patient's vital signs. The nursing staff was accustomed to escalating data about compromised patients to their provider team members, who would determine the interventions needed for the patient's care. The new monitoring process added additional elements to the care environment and introduced a new paradigm of care. With surveillance monitoring, expectations changed—the rapid-response team was activated when needed to provide early intervention and stop the deterioration of the patient.

Challenges

As with any new initiative, the implementation team anticipated challenges with the development of new processes to support the initiative as well as initial resistance to the implementation of the new practices. They sought to educate the staff caring for the patients in as much detail as they could on the changing protocols for the surveillance monitoring of patients.

People

Of the 35 nursing staff of Zayed 11 East, 20 of them were new graduates in their first year of practice. These nurses were part of a nurse residency program and were included in the staffing mix for patients as this initiative was launched.

Developing critical thinking in new graduate nurses is especially profound, as during their first year of practice they are integrating academic lessons with the actual practice demands of caring for patients. Guided and intentional exchange of information along with discussions about the rationale for taking certain actions is critical to the development of the critical thinking skills needed for practice. Being able to ask questions about the rationale of the initiative also helped the new graduates assimilate the needed knowledge. The nurse residency program utilized the Casey-Fink Survey to measure the thoughts and feelings of new graduates about their practice.[3] For new graduates of Johns Hopkins Hospital, their top three concerns included a lack of confidence, fear of harming their patients, and an inability to handle the workload. This data was helpful as Sue Verrillo, MSN, RN, CRRN, nurse manager of the unit, developed specific strategies and resources to engage the new nurses in the monitoring process and address their concerns. In a conversation with Verrillo (May 2016), she stated that "this surveillance monitoring process is a new paradigm for them but it gives them continuous data regarding their patients. It gives them a starting point at the beginning of their shift and can then assist them to look at care needs of their patients for their shift."

As an example of developing critical thinking skills, a new nurse was assigned to a patient with a shoulder repair who had no cardiac history. A high heart rate alarm for 185 bpm sounded for the patient. The nurse recorded a radial pulse of 85 bpm and thought that the patient was fine. However, a vendor consultant questioned the nurse about the patient's clinical picture and asked if the nurse took an apical pulse. The nurse then determined from an apical pulse that the patient's heart rate actually was 185 bpm. The patient was transferred to the critical care unit and diagnosed with new onset spontaneous atrial fibrillation.

A debriefing reviewed the clinical reasons for the difference in radial and apical heart rates and the difference between what is perfused and not perfused because of the atrial fibrillation. During the debriefing, the new nurse was able to ask questions and gain a better understanding of the patient's clinical picture and to better analyze the care this patient would need. This process develops and advances the critical thinking skills of a nurse. In addition, the patient's early intervention enhanced support and credibility for the monitoring program. Some of the initial early resistance from the nursing staff abated. They began to see the potential of surveillance monitoring to save the lives of their patients.

Brad Winters, MD, the critical care anesthesiologist with overall responsibility for this quality improvement pilot, said in a

conversation (May 2016) that culture must be taken into account when implementing surveillance monitoring. Protocols now directed that certain provider actions would be taken when nurses escalated patient information to physicians. The system of nurse escalation still encountered barriers when physicians did not respond in a timely manner. Physicians also did not know when—or were unwilling—to call for assistance. "You have to address this cultural reality in the unit. You will realize only minimal change unless care is turned on its head," Winters said.

The staff noted an increase in alarms and initially expressed concern that a large number of them were not actionable. A two-step delay was built into the system—first a delay from the patient to the monitor and then a delay before the alarm was sent to the nurse's phone. That gives the patient every opportunity to self-correct prior to the notification of the nurse. As the delays in notification took effect and the alarm parameters were adjusted, the number of non–clinically actionable or "false" alarms decreased. That resulted in less staff resistance. A 20% to 25% false alarm rate for the pilot was viewed as acceptable on the unit because of the high failure-to-rescue rate with which the unit began. The unit hopes to decrease it over time as the initiative moves forward.

Processes

Zayed 11 East experienced some challenges with patient admissions following the introduction of the surveillance monitoring. When the unit began this initiative, providers confused the surveillance monitoring with cardiac monitoring, resulting in inappropriate, high-acuity admissions to the unit. Nursing leadership addressed this issue by formally and informally communicating to providers that the unit's acuity level, staffing ratio, and scope of care were unchanged. The only change was the addition of surveillance vital sign monitoring for all patients, in order to determine if it would help detect earlier, subtle signs of deterioration.

An additional challenge presented after patient discharge, when the patient room needed to be cleaned for the next patient. Environmental services staff often disposed of the cardiac cable, which was not a disposable item, after wiping down the monitoring unit. Reeducation failed to take hold due to a high turnover rate among environmental services staff. To prevent further loss of the cables, only staff members internal to the unit were permitted to clean them going forward.

The pilot anticipated that some patients might leave the hospital with their monitoring device after discharge. However, no units were lost during the pilot.

Infrastructure

The pilot faced several IT challenges. To be effective, common ground had to be found between the new wireless technology and the hospital's existing systems. IT staff had to resolve new security issues brought on by the technology, including the wireless transmission of PHI (protected health information). Wireless network bandwidth needed to be expanded and the interface with existing IT systems developed.

Middleware, which is a software that connects the original software to its applications, is responsible for notifying the nurse with potentially actionable data. IT staff had to evaluate whether or not the product worked with existing middleware and then develop an interface between the two so that alarm data could transmit to the nurses' phones.

Another consideration was how well patient data interfaced with the electronic health record (EHR), so that the monitoring data could be captured in the EHR. The hospital planned to implement a new EHR just months following the pilot. For this reason, they chose not to integrate monitoring data with the EHR for the pilot. This integration is planned with future initiatives once the new EHR is implemented.

Results

The results of the pilot were still being analyzed at the time of publication for true versus false alarm rates, whether an intervention was associated with an alarm, whether certain populations alarm more than others, the number of events, the number of rapid-response calls, and the number of transfers to the critical care areas. However, certain anecdotal outcomes are noted. The results of the pilot are forthcoming.

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During the 3-month pilot, surveillance monitoring identified:

- Three cases of patients with pulmonary emboli. Early intervention likely saved them from further deterioration and possible loss of life.
- Three cases of early-stage sepsis. Two of those patients were transferred to the critical care unit and one was able to be managed on the unit because of early intervention.
- Three postoperative myocardial infarctions. Two of the patients were transferred to critical care, while one remained on the unit for care.
- Two cases of atrial fibrillation. These were identified by the monitoring because of significant desaturation, and early intervention occurred.
- Two spinal cord–injured patients were identified with autonomic dysreflexia (considered a medical emergency) as a result of malignant hypertension and early intervention prevented further deterioration.

The patients said they felt safer with the monitoring and that they knew someone was watching them and would act if something went wrong. They reported less anxiety, which could also have implications for rest and the need for pain medications.

The pilot measured the levels of nursing and patient satisfaction with this initiative. Patient surveys were distributed on the day of discharge and showed a 98% satisfaction rate with the program. The patients said they felt safer with the monitoring and that they knew someone was watching them and would act if something went wrong. They reported less anxiety, which could also have implications for rest and the need for pain medications. One patient said in the survey, "I think that Johns Hopkins is on the right track to lead in surveillance monitoring because it is the right thing to do for the patient." Another response demonstrates the technological savvy of patients. "I want you to work on a way to sync this data to my FitBit," said one patient in the survey. Although the suggestion may not be practical, it clearly indicates the patient expectations for technological solutions in today's care environment.

Nursing staff recorded a 70% to 75% satisfaction rate with the initiative. The reasons for this rating may include an increased workload for the nursing staff. The initiative requires a paradigm shift in the nurse's practice routine. Previously, technicians manually took vital signs every 4 hours, and the results were only reviewed by the nurse. With the pilot, nurses were responsible for reviewing more vital signs data, managing the monitoring, switching out the monitors when necessary, dealing with electrodes/leads that would be dislodged, as well as responding to alarms, so the workload appreciably increased. Nurses experienced a heightened practice expectation, as they were required to correlate the alarm and monitor data with the patient's physical assessment, and then look back to trend the monitor data to see any changes. Examples of such changes could include desaturation of the oxygen level with activity, an episode of orthostatic hypertension, uncontrolled pain that was leading to hypertension, or more serious events, such as beginning sepsis or determining that a workup was needed to rule out a pulmonary embolism.

The implementation team was happy with both the patient and the nurse satisfaction rates for the pilot. For the nursing results, they were particularly happy since the nursing staff is the group that experiences the most change to their practice with this initiative.

Next Steps

The next step for this initiative is to broaden its use into other nursing units. The medicine, neurology, and obstetrics units are among the first targets for future implementation. Surveillance monitoring data is intended to integrate with the EHR once the new EHR system is in place. Parameters for the frequency of uploading the data into the EHR will need to be determined so that meaningful data is captured and the system is not overloaded.

Staff are also developing a framework intended to eventually identify the data most useful to predict the deterioration of patients with certain conditions and suggest the needed interventions for them. Future plans include developing a standard of care for surveillance monitoring of patients. Such a

standard of care is currently unavailable due to the novelty of this practice.

Lessons Learned

In looking at the results from their two pilot studies, both Winters and Verillo said they agree that a surveillance monitoring initiative is one that is feasible for hospitals to undertake and that the resulting alarm rates experienced in this project can be managed to an acceptable rate. With effective adaptive approaches, the necessary culture changes can be made to integrate the process into a unit's workflow. An example included sending programmed, regularly scheduled alerts to the nurses' phones. The alerts instructed nurses to change the batteries for the monitoring equipment at a preset time, as well as to check the patients' chest leads.

Education efforts showed staff step by step how the surveillance monitoring program affected their patients' conditions and prevented potentially life-threatening events. Examples included picking up on a pulmonary embolus prior to patient death, and catching autonomic dysreflexia prior to the patient suffering a stroke. Staff became convinced of the positive effect of the monitoring initiative once they could see the value of the early intervention for their patients. They now believe that this approach may eliminate or dramatically reduce failure-to-rescue events.

Having both clinical and executive leadership support and buy-in for the initiative, along with the clinical support of providers and the nursing staff, is essential to make such an initiative a reality. Continued and persistent support for the program by the implementation team, as well as responding to the necessary changes, was essential for bringing about the change in practice and solidifying it into the unit culture.

In addition to that support, the implementation team must maintain an integrated and cooperative structure, so all members are in sync with the initiative. This requires a considerable time investment in communication, the Johns Hopkins team said, but this is essential to the success of the project. Along the way to implementation, each decision must be vetted; nothing should be taken for granted because each decision carries implications for other processes. A commitment to team unity is important to ensuring that everyone stays on the same page as its composition changes due to turnover and different stages of the process.

Conclusion

Utilization of surveillance monitoring is one opportunity to improve patient care and demonstrate compliance with the National Patient Safety Goal for alarm management. It gives hospital staff an opportunity to fulfill commitment to improve patient outcomes by changing their organization's processes and policies. To be successful, the initiative must be multidisciplinary and have executive leadership support. Through the continuous quality improvement process, care for patients can be improved. ■

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References

1. **The Joint Commission**. 2016 Hospital National Patient Safety Goals. Available at: www.jointcommission.org/assets/1/6/2016_NPSG_HAP_ER.pdf. Accessed Nov. 26, 2016.
2. **Department of Health & Human Services**. The U.S. Opioid Epidemic. Available at: www.hhs.gov/opioids/about-the-epidemic. Accessed Nov. 26, 2016.
3. **UCHealth.** Casey-Fink Survey Instruments. Available at: www.uchealth.org/professionals/pages/casey-fink-survey-instruments.aspx. Accessed Nov. 1, 2016.