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Sentara Princess Anne **Hospital**

Reducing alarm interruptions by 54% in neonatal intensive care

Results

- **54% reduction** in NICU secondary alerts within 30 days of new solution implementation
- **No adverse events reported** within 30 days of new solution implementation
- **62% increase** in NICU nurse satisfaction with alarm management solution
- **27% decrease** in ancillary, non-clinical alarm notifications to NICU nurses
- **63% decrease** in alarm fatigue reported by NICU nurses

> "The ultimate vision of the clinical leadership team was to reduce interruption fatigue among our staff by ensuring that nurses would not receive secondary notification of a patient monitor alarm if they were within proximity of that same patient monitor."
>
> – **Monique Lowery BSN, RNC-NIC**
> Clinical Manager,
> Sentara Princess Anne Hospital

Challenges

Sentara Princess Anne Hospital (SPAH) was built in 2011 in Southern Virginia Beach. The patient-centered hospital features a neonatal intensive care unit (NICU) with private and semi-private rooms. This new layout is a departure from the previous NICU design, which accommodated all patients in one large room. In the previous setting, nurses could see and hear all patient monitor and ventilator alarms at all times.

SPAH clinical leadership knew their new NICU layout would help reduce the spread of infectious diseases and provide more privacy to patients and families. Yet, it would also impose barriers that would make it harder for nurses to hear and see active patient monitor and ventilator alarms.

To ease interruption fatigue the team needed a better way to manage ancillary or secondary patient monitor alarms and ventilator notifications.

Although the original secondary alarm management solution worked as designed, it often sent alarms from patient monitors and ventilators to a nurse's phone even when they were standing right next to the sounding monitor or ventilator. The unnecessary noise was disruptive to nurses and overstimulated the infants.

"It was frustrating for our nurses to be in the patient room with alarms constantly sounding on their phones," explained Monique Lowery, BSN, RNC-NIC, Clinical Manager at SPAH. "The ancillary alarms interrupted patient care and would often create delays in patient assessments and feedings."

NICU nurses reported other frustrations. Routine care activities would cause nuisance alarms, which contributed to interruption fatigue. Often they occurred while a nurse was caring for a baby and unable to acknowledge the alarm, for example:

- Deliberately removing electrocardiogram (ECG) leads for bathing would generate a leads-off alarm
- While nurses had their hands full feeding and burping babies, patient monitors would alarm
- Alarms would trigger while nurses in sterile gloves completed central line dressing changes

Nursing staff explained that receiving patient monitor alarms on their phones when they were caring for patients and within close proximity of the monitor, contributed to interruption fatigue and long-term alarm desensitization. The incessant noise also stimulated neonatal patients for whom they were trying to reduce noxious stimulation.

Vocera Solution

Clinical leadership listened closely to staff feedback and quickly realized they needed to find a way to reduce the nuisance and non-actionable alarm notifications. The objective of the next generation solution was to send secondary patient monitor alarm notifications only when nurses were outside the visual and audible range of the primary patient monitor.

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>
> – **Greg Walkup**
> Director of IT
> Sentara Princess Anne Hospital

With a real-time location system (RTLS) already in place, a proposal was made to use the RTLS solution to establish a continuous signal for nurses' locations on the NICU and share that location information with the Vocera Engage intelligent workflow engine. Vocera Engage contains Engage Medical Device Alarm Notification (EMDAN), FDA 510(k)-cleared middleware, to deliver secondary alarm and event notifications. This process would allow secondary notifications of patient monitor alarms to be sent to nurses only when they were outside the patient's room. The clinical and technical teams worked closely with the RTLS vendor to precisely and consistently identify the location of nurses in relation to patient monitors with room-level accuracy. At the same time, the SPAH teams worked with Stryker to establish requirements for how and when to send patient monitor alarms via Vocera Engage's EMDAN based on the RTLS sourced location of a nurse.

"The ultimate vision of the clinical leadership team was to reduce interruption fatigue among our staff by ensuring that nurses would not receive secondary notification of a patient monitor alarm if they were within proximity of that same patient monitor," Lowery explained.

This advanced, rules-based secondary alerting solution was made possible because of the diligent partnership between the hospital's clinical and technical leadership teams, and their collaboration with Stryker and the RTLS vendor. The workflow design process took thoughtful planning accompanied by specific policies and procedures.

The teams took a methodical approach to identifying and addressing potential gaps or unacceptable delays in the RTLS system, including a test of every sensor, tag and room. It was critical to think through and document processes for nurses to confirm solution performance based on shift, availability and patient care scenario. Nursing leadership also needed to address the situation when there might be one nurse in a semi-private room with two monitors. From a maintenance perspective it was important to consider how to manage scheduled and unscheduled system outages. Solution design also needed a failsafe rule that would account for any sustained downtime.

"The solution was a vision articulated by our clinical leadership and facilitated by members of the technical leadership teams working closely with our vendor partners," said Greg Walkup, Director of IT at SPAH. "The collaboration was exemplary and the reason that such a sophisticated and impactful solution could be successfully implemented."

Results*

The clinical and technical leadership teams at SPAH listened to the voice of their nurses to understand workflows and the need for a better alarm management solution. To measure the success of the project, the hospital compared ancillary alarm notifications before and after implementing the Vocera Engage solution. Data showed a 54% reduction in secondary NICU alarms within 30 days of integrating the alarm management technology with the RTLS system.

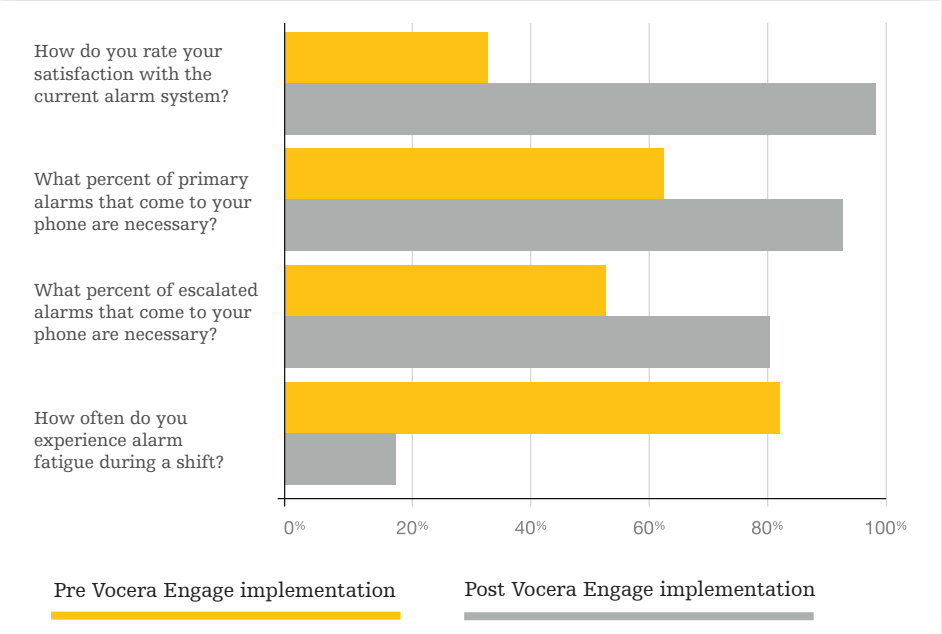
Results of a satisfaction survey completed by NICU nurses before and after implementation also underscore the new solution's success. Prior to integrating the Vocera system with the RTLS, NICU nurses said they experienced alarm fatigue 95% of the time while on shift. After implementation, this same nurse population said they experienced alarm fatigue less than 16% of the time during their shift. Only 34% of NICU nurses said they were satisfied with the previous alarm management system. After the Vocera solution was implemented, 96% said they were satisfied with the alarm management solution.

The pre-implementation survey also revealed that 81% of NICU nurses experienced alarm

Pre Vocera solution March 2016	**Post Vocera solution** May 2016
8,117 events occurred	5,072 events occurred
16,450 of these resulted in alarm notifications	9,827 of these resulted in alarm notifications
Slowest day = 82 events 115 notifications	Slowest day = 52 events 99 notifications
Busiest day = 786 events 1,468 notifications	Busiest day = 286 events 597 notifications

fatigue always or frequently during their shift. That number significantly decreased after the new technology integration, with only 18% of these nurses reporting alarm fatigue always or frequently during a shift in the NICU. The significant decrease in unnecessary alarms being sent to nurses' phones because of the new rules-based solution likely contributed to improvements in nurse wellbeing. In addition to reducing alarm and interruption fatigue for nurses, the neonates also benefited from having a quieter, more healing environment.

Staff survey*



Looking forward

Secondary, or ancillary, alarm notification solutions provide clinicians with the flexibility to move throughout the unit, beyond the visual and/or audible range of the patient monitors. However, what has been absent from previous design and implementation of these solutions is specificity. The value of a secondary notification solution with high specificity helps reduce interruption fatigue, helps improve staff responsiveness and helps increase staff and patient experience. In addition, reducing noxious stimuli creates a more healing environment for neonates in the NICU.

"The staff is excited about implementing intelligent secondary notifications to improve workflows and reduce interruption fatigue in other patient care areas," Walkup said. "The technical leadership team is planning to roll out Vocera Engage in other units throughout the Sentara Healthcare enterprise."

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