Appendix E: Case Studies in High Reliability Applications: Medication Dispensing Machine Redesign and Executive Walkarounds at Sentara Leigh

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Overview

Health care organizations have paid increasing attention to the concepts of high reliability organizing. Examples from other industries such as aviation and nuclear power are well known within healthcare and many organizations publicly embrace Weick and Sutcliffe's five principles of high reliability.[1] Some organizations have gone well beyond awareness of these concepts and have used them to make concrete changes in both behaviors and in their cultures. Sentara Leigh Hospital, a 250 bed community hospital in Norfolk, VA, applied high reliability concepts to create and sustain several innovations designed to increase patient safety. These included implementing "no interruption zones" around their medication dispensing machines and improving communication within and between teams through "check-in meetings," "nurse huddles," and "executive walk-arounds." This document shares Sentara Leigh's experience. It has three goals:

- To document simple, but important innovations designed to reduce medication errors and increase staff communication
- To illustrate how high reliability concepts were used to develop and implement these innovations
- To encourage leaders at every level within healthcare organizations to apply high reliability concepts to make their systems safer and better for their patients

The information in this document was acquired as part of a high reliability organization learning network sponsored by the Agency for Healthcare Research and Quality (AHRQ). As one of the twenty participating healthcare systems, Sentara hosted a site visit for other participants in December 2006, where they discussed a number of applications of high reliability thinking to their operations. Sentara allowed AHRQ and its contractor to visit Sentara Leigh Hospital in January 2007 to talk more extensively with the administrators and staff members who conceived of these innovations and helped to implement them. AHRQ wants to express its deep appreciation to Sentara and its staff for their invaluable assistance in developing these resources.

Explanation of the Innovations

Medication Dispensing Machines

As is the case in many hospitals, the medication dispensing machines had become "watering holes," where nurses, respiratory therapists, and other staff often waited to draw medications for their patients. While waiting, conversations were routine and often involved the person drawing the medications. Because physicians, nurse supervisors and others knew that nurses could frequently be located at the medication dispensing machines, they often came to the area as well in order to ask nurses questions or share information with them.

[1] Weick, Karl E., and Kathleen M. Sutcliffe. *Managing the Unexpected: Assuring High Performance in an Age of Complexity*. San Francisco: Jossey-Bass, 2001.

Although conversation around the medication dispensing machines was often useful, it also created a significant distraction for staff using the machines, as well as for people who needed to stock them. These distractions sometimes contributed to medications being incorrectly stocked or restocked and sometimes resulted in nurses accidentally drawing the wrong medications, or failing to get all the medications they needed. Although no major medication error was known to have been caused by people interrupting users of the medication dispensing machines, nurses who used the machines most recognized that the interruptions were increasing the risk of medication errors and patient harm.

After discussions of this potential risk, the people who used these machines on several units decided to impose "no interruption zones" around the medication dispensing machines. When a staff member was inside the zone—either drawing medications or stocking the machine—they were not to be interrupted for any reason.

Because conversations around the medication dispensing machines were an engrained part of work life, staff leaders recognized that environmental changes would make it easier to enforce efforts to prevent interruptions. These included:

- Large signs above each medication dispensing machine reminding staff of the "no-interruption zones."
- When the flooring in units was replaced, a red tile border around the medication dispensing machines was installed to physically define the no-interruption zone.
- When space was available, the medication dispensing machines were distributed around the unit, rather than having all the machines in a central location. Because this change reduced the number of staff waiting in line to use the machines, it both improved efficiency and reduced the number of conversations around the machines.
- Whenever possible, the machines were relocated away from nursing stations and other areas where distractions and interruptions were more likely.

While these environmental changes were helpful, they would not have made "no interruptions" the norm without an effective communication strategy. Sentara Leigh used a blend of strategies to create awareness of, and compliance with, the "no interruption zones," including:

- Announcements about the new behavioral practice in staff meetings and newsletters
- Introducing new staff to the "no interruption zones" in their orientation
- Reminders from supervisory staff to people observed interrupting others at the medication dispensing machines

Over time, stories became perhaps the most effective way of reinforcing the importance of avoiding interruptions around the medication dispensing machines. Stories were shared informally among staff and also more formally in staff meetings and newsletters. These included:

- Stories of supervisors apologizing to staff for interrupting them while drawing medications

- A story of the hospital CEO who questioned two staff members about a conversation he observed them having inside the "no interruption zone"
- Stories of supervisors supporting junior staff who objected to being interrupted by physicians and others while drawing medications

In less than three years, "no interruption zones" became an established part of Sentara Leigh's culture. The zones are known and respected by staff of all types and at all levels. Beyond the direct benefit of these zones to patient safety, the zones are also regarded as a source of pride by staff who see them as a visible way in which their hospital is unique in its commitment to the safety of its patients. Sentara's commitment to safety was recognized publicly in 2005 when it received the John M. Eisenberg Patient Safety and Quality award from the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) and the National Quality Forum.

Communication Improvements

A common challenge many hospitals face is an inability to assure effective communication. Because safe, high quality care requires coordination of many different staff types, effective communication within units, across different hospital departments, and between executives and clinical staff is essential. In addition to these challenges, shift changes and transitioning patients to different hospital units creates a need for effective communication to assure patient care is not compromised.

Sentara Leigh recognized the potential risks to patient safety associated with communication lapses between staff, administration, and work shifts. Administrators were at times unaware of patient care issues and the actions they could take to address them. Sometimes nurses and patient care staff experienced delays receiving necessary information at the beginning of their work shifts. And Sentara Leigh knew that communication problems were a frequently cited cause of medical errors. To respond to these concerns, they implemented three different practices to strengthen internal communication related to patient care. These included:

- Check-ins
- Nurse huddles
- Executive walk-arounds

Daily check-in meetings allow nurse managers, facility managers, physician staff, and hospital administration to coordinate on issues that affect each other. Sentara Leigh implemented these daily "check-ins" to assure that each group would be informed about issues affecting it and to provide a forum to raise questions and issues that could then be addressed by the appropriate person.

While the daily "check-ins" facilitate coordination between different staff types, Sentara also recognized the importance of improving transitions of care between the nursing staff who care for patients on different shifts. Shift changes create risks that important patient information will be lost or that issues that require close attention will be neglected because the incoming shift is unaware of them. To reduce this risk, in a number of units Sentara Leigh has implemented "nurse huddles"—five to seven minute long meetings at the beginning of each shift that allow

personnel on the outgoing and incoming shifts to exchange information and assure that there is no loss of situational awareness. With practice, nurses' abilities to provide concise updates has improved and key information can be exchanged quite efficiently.

Sentara Leigh also realized the need for hospital executives and leadership to directly observe and communicate with staff providing direct patient care. Such opportunities would allow leadership to identify issues they needed to address. But of equal importance was the need to reflect the importance they placed on direct patient care and on understanding and supporting the staff who provide it. To address this need they implemented "executive walk-arounds." Each day at 8:00 a group of hospital executives meets and walks through the hospital observing patient care and informally talking with staff along the way. Participants in these walk-arounds observe, ask questions, and note issues raised by staff which they address after the walk-around ends. Consistency, approachability, and responsiveness to concerns that staff raise have enabled Sentara Leigh to break down communication barriers between leadership and staff that exist in many other hospitals.

Each of the activities represented significant commitments to improving communication central to patient care. Although many hospitals may use one or more of these techniques, Sentara Leigh has been successful in using them to create a culture in which staff believe that their concerns are taken seriously and in which both staff and managers have better access to the information needed to perform their jobs successfully.

Application and Illustration of High Reliability Concepts

At one level, these innovations at Sentara Leigh might appear simple, obvious, and easy to replicate. But as anyone with experience in quality improvement will know, simple changes are never easy to make and are even harder to sustain. Why did these innovations emerge at Sentara Leigh rather than elsewhere? Why did hospital management take time out of their overbooked schedules to meet with clinical staff and why did they think this was integral to improving patient safety? Why did staff and leadership expend considerable energy to create "no interruption zones" when they had no proof that interruptions had ever seriously harmed a patient? And why was Sentara Leigh able to rapidly implement and sustain a change that has not even been made yet at some of the other hospitals in Sentara's highly regarded system? Weick and Sutcliffe's five principles of high reliability organizing help answer these questions and also provide ideas for increasing the reliability and safety of other systems in hospitals.[2]

Preoccupation with Failure

High reliability organizations require people at all levels to be constantly thinking about ways in which their systems may fail. This includes both attentiveness to major failures and an awareness of small breakdowns in the systems that increase the risk of larger failures. Weick and Sutcliffe describe this aspect of mindfulness as "preoccupation with failure."

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[2] Keller, Paul. *Managing the Unexpected in Prescribed Fire and Fire Use Operations: a Workshop on the High Reliability Organization*. USDA Forest Service. Oct 2004.

As part of Sentara's overall emphasis on patient safety, it developed a set of five behavioral-based expectations for all staff members, one of which was to have a constantly questioning attitude about their work and how it could be done better. Staff members with this mindset were reviewing applications of high reliability in the commercial aviation industry and were exposed to the notion of the "sterile cockpit." Because a plane is at greatest risk during takeoffs and landings, conversation in the cockpit during these periods is limited to the tasks required for the takeoff or landing to be successful.[3] Other conversation or interruptions are explicitly prohibited.

While people from many healthcare organizations were familiar with the sterile cockpit concept, the questioning attitude at Sentara Leigh may have contributed to their willingness to take the concept and consider what aspects of their work were placed at risk due to interruptions and poor communication. As staff discussed potential applications, the area around the medication dispensing machines came up repeatedly as one where interruptions were common and posed risks to patient safety. The most obvious risk was that an interruption could cause a nurse or respiratory therapist to draw an incorrect medication for a patient. But as they discussed the issue, additional risks emerged, including:

- The potential for neglecting to draw a drug needed by a patient, leading to either additional work or the failure of a patient to receive an ordered drug
- The potential for accidentally drawing the wrong drug, realizing it had been drawn in error, and returning it to the wrong location in the machine
- The potential for the pharmacy tech to stock drugs in the wrong location due to interruptions, increasing the potential for a medication error

Because Sentara's culture emphasizes communication across staff types, an issue that began as one only relevant to nurses became one of importance to pharmacy and respiratory therapy. This created a stronger consensus that interruptions at the medication dispensing machines increased the risk that medication errors would occur. Use of the team "check-ins" and "nurse huddles" quickly diagnosed the problem before negative outcomes were noticed, and Sentara Leigh's preoccupation with failure was shared amongst all staff members, to share stories, and prevent further problems from occurring elsewhere.

Preoccupation with failure also impacted how staff and leadership at Sentara Leigh responded once they became aware of the risks the interruptions were creating. Three important differences distinguished Sentara Leigh from many other organizations less preoccupied with potential breakdowns in their systems:

- They proactively addressed the risks, rather than waiting to respond until a patient had experienced serious harm. Many hospitals can tie their emphasis on patient safety to a tragic event, where a system breakdown led to a patient injury or death. In many organizations, a patient must experience serious harm before efforts to reduce risks are

[3] Note: On August 26, 2006 a commuter plane crashed in Louisville, KY, killing 49 of the 50 people on board. Cockpit conversations that violated the sterile cockpit rule have been identified as a potentially significant factor for why the plane took off on the wrong runway.

made a priority. Sentara Leigh's culture emphasizes mindfulness that encourages staff to reduce risks even before those risks are known to have caused a patient harm.

- They viewed small breakdowns in their processes for drawing medications and transitioning patients as signs of danger rather than as proof that the overall system was safe. Many staff could tell stories of how they had found a medication stocked in the wrong location and had put it back where it belonged. It was common for nurses to be interrupted when leaving their shift and to realize later that they had neglected to mention something about a patient to their counterpart on the incoming shift. In many organizations, these kinds of stories would be viewed as proof that the system was safe, since in each case the mistake was caught before the patient was harmed. But in a system that is preoccupied with failure, these small breakdowns were correctly recognized as small events that ought to be addressed because they increased the likelihood of a major medication error.
- They promptly acted based on the information they had rather than attempting to collect data to establish the exact magnitude of the problem. Certainly organizations need data in order to set priorities and justify major investments. But in this case, the solutions did not require significant resources or justify waiting until a way of quantifying the risk could be developed and implemented. Staff were convinced that interruptions and poor communication were creating risks for their patients and that small changes in how they drew medications or communicated with each other could reduce those risks. This proactive approach to identifying and eliminating small risks is characteristic of cultures that are preoccupied with failure.

Sensitivity to Operations

More highly reliable organizations pay very close attention to operations and organize themselves to create and maintain situational awareness. There is an emphasis on having the best information about the situation and using this information as the basis for making decisions.

Sentara Leigh has made sensitivity to operations a major emphasis. Through daily "check-ins" involving the hospitals senior staff and "executive walk-arounds," the hospital leaders made a concerted effort to understand and address the concrete issues that are affecting the care patients receive. Currently, nursing leadership is working with nurses to answer a simple, but very important care question: Who is the sickest patient on your unit? Knowing who the sickest patients are (as opposed to those who may be the most challenging families or be the most vocal or noncompliant) increases the likelihood that the sickest patients will be receive the monitoring and care that their condition warrants.

Both staff and leaders also recognized that interruptions were creating a loss of situational awareness for staff members engaging in important activities. If interruptions caused a pharmacy technician to lose track of which medications have already been stocked or a nurse to forget to share information about a patient to their replacement at the end of a shift, situational awareness has been lost and the risk of error has been increased. Moreover, if executive leaders are not consistently out in the hospital interacting with staff and observing the provision of care, they will never have the situational awareness required for them to make effective management decisions.

Because staff and leaders at Sentara Leigh recognized that losing situational awareness while performing critical tasks was problematic, they did not need to wait for a patient to be harmed in order to address the issue. "No interruption zones," executive walk-arounds, and daily check-in meetings all increased situational awareness. That was sufficient reason for them to be implemented.

Resilience

Resilience is a characteristic of systems that can experience one or more failures but still avoid a major failure. When unexpected events occur, resilient systems have the capacity to improvise and quickly develop new plans to respond to then unanticipated.

Responding quickly to situations is integral to resilience. Sentara Leigh's efforts to communicate more effectively have provided them with an ability to quickly and effectively collaborate to respond to unexpected potential threats. "Executive walk-arounds" and daily "check-in" meetings have created forums in which staff work together to address problems; they also lay the groundwork for more effective responses when other unexpected events occur.

Even though processes that hospitals use for ordering, drawing, and administering medications have many checks built into them, Sentara Leigh correctly recognized that interruptions of staff while working at the medication dispensing machines reduced the resilience of their system by compromising checks that the system ought to include. Rather than assuming that other checks would prevent distractions from causing a patient harm, they actively worked to reduce factors that compromised the resilience within their system.

Deference to Expertise

Deference to expertise is a mindset that accepts the insights and recommendations from the person or people most knowledgeable about a situation—even if those people have less seniority, organizational prestige, or are lower in the organizational hierarchy. This mentality is illustrated in Sentara Leigh's "check-ins," "nurse huddles," and "executive walk-arounds," where staff members meet as equals to address concerns and problems. Those who have relevant information about a threat to safety or quality have the opportunity to express their concerns, regardless of their position within the hospital. Traditionally hospitals have been highly hierarchical on multiple dimensions (i.e. physicians-nurses-non clinical staff; administrators, managers, care providers). By implementing executive walk-arounds and daily check in meetings in which different staff listen to and defer to each other, Sentara is working to overcome a difficult cultural challenge.

Beyond these efforts, Sentara has emphasized the importance of a questioning attitude for all staff members and has been very deliberate in sharing stories that encourage staff to challenge inappropriate behaviors—even when the people engaging in them are higher in the hierarchy. These include stories about physicians being reminded to wash their hands by nurses, administrators being corrected by non-clinical staff for violating established rules on their units, and administrators strongly backing junior staff who appropriately corrected a more senior

person who was violating one of the established Red Rules (rules that specify actions that must never or always occur). While Sentara Leigh still regards this type of questioning mindset as an aspect of their culture that needs considerable improvement, the development and implementation of the "no interruption zones" would have been much more difficult in an organization that had never emphasized a questioning mindset before.

Because of a willingness to defer to expertise, Sentara has a history of empowering staff to examine issues and propose changes. Rather than limiting discussions about high reliability to senior leadership of the healthcare system or the hospitals, a range of staff members are included in improvement efforts. It is unlikely that senior staff were even aware of the interruptions frequently experienced by staff drawing medications, but once the issue was raised by the staff who used the machines, senior leaders were willing to defer to this expertise and support their recommendations for how to prevent interruptions. In a top-down organization where priorities are set by senior leaders, it is unlikely that unit staff would have felt empowered to recommend changes and even less likely they would have received organizational support.

Reluctance to Simplify

The final process that supports organizational mindfulness is a reluctance to simplify. This concept is often misunderstood or challenged by people who view simplifying work processes as critical to becoming more efficient and reliable. But while simplifying work processes is highly desirable, it is risky to oversimplify <u>explanations</u> or <u>interpretations</u> of what has happened or what might happen in the future. Examples of oversimplifications related to medication dispensing errors that Sentara avoided include:

- Past mistakes when stocking or withdrawing medications from the machines have always been noticed and fixed before harming the patient. Therefore, we can assume that future mistakes will always be noticed and fixed before causing harm.
- We know all of the things that can go wrong when withdrawing medications from the machines, so we are sure we have checks to prevent those problems from harming the patient.

At a broader level, Sentara also could have easily oversimplified key explanations for how processes worked in ways that made them insensitive to risks as well as how to address operational inefficiencies in the hospital. For example, they could have believed that communication problems were all the same and could be easily corrected by improved email, or staff announcements or some other overly simplistic solution. Instead, they recognized that communication problems included:

- Lack of communication within hospital units
- Communication problems between different departments and administration
- Insufficient information about the current status of patients
- Lack of communication between work shifts and information being lost during transition times of patient care teams

By refusing to oversimplify the communication problems that were placing patients at risk, Sentara Leigh was able to implement a range of activities designed to reduce these problems.

A third example of a reluctance to simplify relates to Sentara Leigh's approach to reducing distractions at the medication dispensing machines. They resisted the temptation to assume that the problem was a simple one that could be fixed by imposing a rule forbidding people to distract staff withdrawing medications. Instead, they employed a set of strategies including:

- Clearly communicating the new work practice—something they did through announcements in staff meetings and newsletters.
- Creating environmental reminders of the new work practice. These reminders included large signs located above each medication dispensing machine, red tile borders around the machines, and, where possible, relocating the machines to areas where interruptions would be less likely.
- Having supervisors remind staff of the work practice and reprimand people who failed to comply with it. Without the other strategies and a culture that supported safety-based changes, enforcement by supervisors probably would have been insufficient to produce lasting change. But supervisor reminders did play an important role in the early stages of implementing the "no interruption zones."
- Using reinforcers to sustain the work practice over time. Reinforcers included:

    - Staff recognition of the immediate benefits of the "no interruption zones." When staff saw that the zones were allowing them to do their work more rapidly and accurately, they became advocates for, and enforcers of, the new work practice.
    - Retaining environmental cues reminding staff of the work practice
    - Senior staff apologizing when they realized they were violating the zones
    - Circulating stories that reinforced the importance of the "no interruption zones" and legitimated staff's ability to refuse to be interrupted
    - Including a discussion of the work practice in the orientation of new employees

It would have been overly simplistic to assume that any one (or two) of these activities would produce lasting adherence to the "no interruption zones." Sentara avoided viewing the implementation of a new work practice as "easy" or a "quick fix." Instead, they embraced a range of activities that were successful in producing their goal.

A final example of reluctance to simplify is Sentara's recognition that other people are only one source of distractions when withdrawing medications. These included:

- Environmental distractions. Nearby nursing stations and other high traffic areas represent distractions to people at the medication dispensing machines. Sentara is working to relocate machines away from each other, away from nursing stations, and in some cases, into rooms where distractions will be minimal.
- Communication devices: Pagers and cell phones can interrupt a person drawing medications as easily as another person can. Sentara is working to remind staff of the distraction risk these devices pose and to encourage them to avoid talking on cell phones while in the no-interrupt zone.

It is possible for a patient safety initiative such as this to create a sense of complacency among staff who focus on how much safer the system now is and neglect to consider all the additional ways in which the system could still improve. Rather than this, Sentara has used their “no interruption zones” to encourage further thought about other aspects of patient care where interruptions and distractions may place patients at risk. New areas they are beginning to look at include:

- How to reduce distractions during patient charting, which can lead to errors and omissions. Sentara is using what they have learned in their “no interruption zone” effort to generate ideas for reducing interruptions while charting patients.
- How to decrease distractions and interruptions during patient handoffs. Various units at Sentara Leigh are experimenting with:

    - Doing handoffs during windows of time when neither person is responsible for patient care.
    - Trying to do handoffs in areas removed from lots of distractions like nurses stations.
    - Delegating responsibility for handling calls/pages to another person so the handoff is not interrupted.

In a culture that works to avoid oversimplification, each improvement in patient care creates an awareness of new risks and a means for addressing them. Sentara’s initiative illustrates this process and highlights the importance of constantly looking for information that may challenge current beliefs that systems are safe and reliable.

Conclusion

Much can be learned about how “no interruption zones” and relatively simple communication interventions have made Sentara Leigh a safer place for its patients. But there are several broader implications that emerge from this initiative. These include:

- Organizational culture plays a key role in making it possible for an organization to quickly and successfully implement changes. At Sentara Leigh, each successful change reinforces the organization’s willingness to make other changes. When organizations lack a culture and history supportive of improvement, change will be much harder. But once leaders begin to move towards high reliability, they gradually can create a culture and momentum for change that will make future efforts easier.
- Each aspect of mindfulness reinforces the other aspects. There is considerable overlap between the five processes and an organization cannot be appropriately alert unless it embraces all of them. So while there is value in considering all five of these processes, it may not be good strategy to focus on any one or two of the processes, to the neglect of the others.
- The organizational goal should be an ongoing process of high reliability organizing rather than to become a high reliability organization. The latter goal implies that high reliability is an end point that can be reached in which all risks are known and all processes are

optimized to prevent these risks. But this view represents the exact sort of oversimplification a state of mindfulness is designed to prevent. As Sentara Leigh has improved its systems, it has become aware of more—not fewer—ways in which other systems can be improved. As a result, improvements are a continuous activity—not a phase that at some point will come to an end.

- Not all efforts to improve safety require a large investment of time and money. Many hospitals are weighing high-tech, high-cost safety initiatives such as electronic medical records, electronic intensive care units or computerized physician order entry systems. Even for hospitals that lack the resources to pursue these initiatives, there are opportunities for changing processes and systems to enhance patient safety. We believe that hospitals who have successfully implemented smaller and less complex system changes will be better prepared to succeed in larger ones. Conversely, hospitals lacking the state of mindfulness required for high reliability organizing are unlikely to successfully implement complex improvements, regardless of the resources they possess.

Every person working in a health care organization has the potential to identify and make changes that benefit their patients. Sentara Leigh's implementation of "no interruption zones" and strategies for enhancing communication are compelling examples of such initiatives. Our hope is that this discussion of their example and the high reliability processes on which it was based will encourage you to reflect on your opportunities to make care safer and to successfully work towards that end.