# Appendix F: Case Studies in High Reliability Applications: EICU and Sepsis Prevention at Christiana Care

# Overview

Health care organizations have become increasingly aware of the concepts of high reliability organizing. The aviation and nuclear power industries have already made strides toward applying high reliability concepts to quality and safety and serve as examples to other industries of how Weick and Sutcliffe's five principles of high reliability[4] can be applied toward operational improvements. Some organizations have gone a step further and used them to make tangible changes in their organizational behavior and culture. Christiana Care Hospital, a 1,100-bed hospital system in Wilmington, Delaware, applied high reliability concepts to create and sustain a Safety Mentor Program, Sepsis Alert campaign, and eCare system that provides remote support for intensive care unit (ICU) staff. This appendix shares Christiana's experience. It has three goals:

- Demonstrate how the implementation of several process changes improved overall patient care, with a focus on sepsis and ICU patients.

- Illustrate how high reliability concepts were used to develop and implement these innovations.

- Encourage leaders at every level within health care 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 (HRO) Learning Network sponsored by the Agency for Healthcare Research and Quality (AHRQ). Christiana allowed AHRQ and its contractor to visit Christiana Care Hospital in December 2006 to talk more extensively with the staff members who conceived of these innovations and helped to implement them.

# Explanation of the Innovations

## Safety Mentor Program

In large hospital systems, such as Christiana Care, it can be a challenge to effectively communicate across different medical units and hospital buildings. Staff members can be mindful of the patient safety events occurring in their own unit but may be unaware of events taking place in other units. This kind of "siloing" effect can prevent staff members from picking up patterns that occur across units.

To facilitate communication between different medical units, Christiana developed the "Patient Safety Mentor" Program. This hospitalwide program is composed of the Patient Safety Mentor Committee, which holds bimonthly meetings and is attended by representatives from every clinical area. Safety mentors currently represent virtually all areas of the organization, including, but not limited to, all disciplines of nursing, respiratory therapy, laboratory, home care services, environmental services, pharmacy, infection control, dialysis center, laundry materials, management maintenance, occupational safety, and employee health. Each designated mentor is

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[4] Weick KE and Sutcliffe KM. Managing the unexpected: assuring high performance in an age of complexity. San Francisco: Jossey-Bass; 2001.

responsible for measurement and reinforcement of safety practices and the National Patient Safety Goals for their department. They collect these measurements, provide peer-to-peer feedback, and bring the results to the meetings. The meeting agenda also includes:

- Discussing the results and best practices related to the Patient Safety Report Cards

- Sharing stories from recent patient safety events and suggesting strategies for improvement

If committee members believe that a patient safety issue needs to be communicated immediately to hospital staff, a one-page "Safety Alert" is posted to the hospital intranet to call all staff members' attention to the issue.

The "Patient Safety Mentor" program has been critical toward advancing Christiana's mission on improving patient care and safety by improving communication efforts among all disciplines.

## Sepsis Alert

Hospital staff at Christiana recognized the challenge of rapidly diagnosing and treating sepsis patients. Most patients with sepsis are unaware that they have the condition and enter the hospital exhibiting a range of symptoms. As a result, the sepsis is difficult to diagnose, and the patient fails to receive the rapid treatment that is needed.

Leaders and staff at Christiana recognized that their current process for treating sepsis was problematic because it was linked to admitting the patient to the ICU. Trained staff and appropriate antibiotics were available in the ICU, but because ICU beds were often full, septic patients sometimes failed to receive care as quickly as Christiana wanted. As a result, the sepsis mortality rate was slightly higher than the national average.

Christiana viewed this situation as an opportunity to improve the quality of care for sepsis patients. After discussions at a patient safety meeting, the hospital launched a "Surviving Sepsis" campaign. Its goal was to better facilitate the management and care of newly diagnosed sepsis patients, as well as decrease the hospital's sepsis mortality rate by 25 percent. They formed an interdisciplinary sepsis team to address three major areas of sepsis care: identification, resuscitation, and ICU management. The components of the "Sepsis Alert" system that they developed included:

- "Sepsis Alert" antibiotic packets and antibiotic guideline tables, which contained instructions on how to mix and administer sepsis antibiotics in a way that maximized their effectiveness

- Care management packets for emergency departments (EDs) and ICUs, which contained the sepsis protocol, recommended antibiotics for the suspected site of infection, and further recommended critical care therapy

- Outcome measures and processes for monitoring, including:

    - Prospective chart review and data collection
    - Monthly "Sepsis Alert" performance improvement meeting
    - Quarterly "Sepsis Alert" data meeting

- Educational programs to physicians, nurses, pharmacists, and other health care providers, which included grand rounds, educational videos, and inservice sessions

To expedite the process for treating sepsis patients, Christiana placed "rapid response carts" in central locations throughout the hospital. These carts contained sepsis antibiotic packets with an explanation of the sepsis algorithm to help remind nurses of the proper treatment steps. By placing sepsis medications in these strategic locations, Christiana could make sepsis treatments more portable and bring treatment to the patient instead of depending on ICU bed availability.

Although these environmental and process changes were vital to achieving the "Surviving Sepsis" campaign's goals, Christiana wanted to ensure that staff members would practice the new sepsis patient care guidelines in the long term. Christiana leadership knew that one singular attempt at sepsis education would not be adequate to sustain long-term improvements. Therefore, they instituted ongoing educational efforts throughout the hospital system. Different examples of these educational efforts included:

- Posters featuring the "Sepsis Alert" treatment protocol
- Focus articles on treatment of septic shock
- Creation of pocket cards for staff use that explained the "Sepsis Alert" treatment protocol

Since the implementation of this "Sepsis Alert" system, the original goal of 25 percent mortality rate reduction was achieved. In total, there has been a 46 percent reduction in mortality and a 22.3 percent reduction in the average ICU length of stay, which has resulted in a savings of almost $200,000 for the hospital system. Other outcomes include a 197.2 percent increase in patients discharged to home, an important indicator of functional improvement; a 66.2 percent decrease in the incidence of acute respiratory distress syndrome; and a 22.5 percent decrease in acute renal failure.

In addition to financial gains, the hospital system has experienced a shift in culture with regard to the hospital's approach to sepsis care. Because health care providers were educated on the importance of early, aggressive management of sepsis, sepsis is now viewed as an acute condition. Staff understand that it needs to be treated as soon and as aggressively as possible to ensure the highest level of patient care. Sepsis patients are now identified earlier and treated with the right medications in a more timely fashion.

# eCare

The ICU can be one of the most demanding units in the hospital. ICU patients often require ventilators and complex medications and must be constantly monitored to ensure that changes in their condition are quickly addressed. When the ICU is full, nursing staff are stretched, or one patient has a significant problem, the risk increases that this vulnerable patient population will not receive the best possible care.

Christiana Care realized the demands they were placing on their ICU staff and the challenges they faced in ensuring that they received optimal care. After substantial investigation of options, they implemented "eCare"—an electronic monitoring and video surveillance system for individual ICU rooms. This allowed onsite patient care to be remotely monitored by an offsite team of physicians and nurses. It also created an additional resource to investigate issues such as potential medication interactions when the ICU staff were busy. The EICU was installed as a means to support ICU physicians and nurses by:

- Monitoring IV medications and infusion rates

- Tracking patient vital signs and medical records

- Providing 24-hour surveillance using camera and audio interaction between patients and eCare nurses and physicians

eCare increased Christiana's ability to provide ICU patients with the constant monitoring and attention their medical conditions demanded. While onsite staff still have full responsibility and control of their patients, they receive collaborative support from the offsite eCare nurses and intensivists to enhance their ability to provide the best possible patient care.

At first, physicians and nurses were skeptical of an innovation that they feared would be used to monitor their behavior and punish them for any observed mistakes. Christiana proactively addressed this concern, assuring ICU staff that eCare existed to support patient care and to provide an additional resource to them. Christiana allowed ICU staff to visit, and, in some cases, to work for a period of time in the remote eCare location so that they could more clearly understand how the process worked and develop relationships with the staff who worked there. Over time, nurses found it reassuring that the vital signs of all their patients were being constantly monitored, something they could not do themselves when caring for six or more patients. Physicians also began to view eCare as an integral member of the care team that contributed to efforts to ensure patient safety. Additionally, many patients and families were reassured that they were being constantly monitored and that they could speak with a member of the e-Care team whenever they had a question or concern.

While these three innovations reflect only some of Christiana Care's safety and quality initiatives, they clearly have resulted in noticeable improvements in patient outcomes and in the creation of a culture that emphasizes quality and safety. Christiana received the 2007 HealthGrades Distinguished Hospital Award for Clinical Excellence and was the top ranked hospital in Delaware for Overall Critical Care Services in 2006 and 2007.

# Application and Illustration of High Reliability Concepts

Christiana Care's innovations for improving patient safety, while appearing straightforward and simple, are driven by their attention to operationalizing high reliability concepts. This section describes how Christiana applied the five concepts of high reliability to the three interventions described above.

## Preoccupation With Failure

High reliability organizing requires staff at all levels to be constantly thinking of ways their systems could fail. This includes both attentiveness to major failures and awareness of small breakdowns in the system that increase the risk of larger failures. Weick and Sutcliffe describe this aspect of mindfulness as "preoccupation with failure."

In conversations with members of the Trauma Department, Christiana staff noticed how effective rapid resuscitation was for treating cardiac shock patients and felt that this method of care could be applied to the care they provided to sepsis patients. Even though their outcomes for sepsis were not much worse than average, Christiana recognized that there were opportunities for them to be better. In the interdisciplinary team Christiana assembled to discuss the problem, there was general agreement on three areas where sepsis patient care was less than ideal. These included:

- Identifying septic patients in the Emergency Room

- Obtaining and administering the proper antibiotics in a timely fashion

- Allowing septic patients to "slip through the cracks" and be transferred to an inpatient unit

Identifying the specific failures that could affect the care of sepsis patients allowed staff at Christiana to develop solutions that addressed each of these problems. The solutions encompassed:

- Educating health care providers on early, more subtle, and varied presentations of sepsis and the importance of timely, aggressive management so that sepsis could be identified in the ER as well as in hospital units.

- Creating and distributing antibiotic kits throughout the ED and other hospital departments. These kits allowed clinicians to more rapidly administer antibiotics to sepsis patients since they didn't need to order them from the pharmacy.

Christiana's preoccupation with failure also led them to focus on safety concerns before a patient was seriously harmed. Both the eCare initiative and the patient safety mentor program featured efforts to create awareness of risks that had been prevented by attentive staff.

- Inside of the eCare workspace the ICU staff has created a "catch of the day" wall. This wall is filled with cut-out fish that have stories of near misses written on them. These fish serve as a visual reminder to staff members of the unit's commitment to recognize and

build awareness of patient safety. Instead of hiding these near misses, Christiana seizes the opportunity to openly display its near misses so that everyone can become more aware of potential vulnerabilities and sensitive to other risks patients may encounter.

- Members of the Patient Safety Mentor Program attribute its success to recognizing the individuals who are able to find "near misses" and "good catches" from events that never reach a patient. Recognition occurs by identifying the staff member who prevented an event and awarding them a "recognition diamond."  The Patient Safety Committee e-mails the individual's immediate manager and each person up the senior chain of command so that senior leaders know about staff members who prevent errors.

Beyond the direct impact of these activities, the positive recognition that accompanies calling attention to near misses and other patient risks is an integral part of building a culture in which staff at all levels are comfortable disclosing risks without fear of punishment.

## Sensitivity to Operations

More highly reliable organizations also 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.

Christiana has made sensitivity to operations a major priority. The implementation of the Patient Safety Mentor Program and the EICU have allowed staff members to maintain a strong understanding of patient needs and conditions.

To keep all staff members informed of patient safety issues, Christiana elects a "Patient Safety Mentor" from each medical unit who is responsible for attending bimonthly meetings. During these meetings, mentors report on their unit's measurement of the national patient safety goals and communicate back to their individual units the issues discussed at the meeting. Committee members have the opportunity to share stories of recent patient safety events and hear strategies for improvement from other members. To ensure that all the information discussed at the meetings gets communicated to each member's medical unit, all the meeting information is placed in a public system. These meetings serve as a way for staff members from different medical units to build awareness of the kinds of patient safety issues occurring throughout the hospital. The meetings also help to detect patterns in events related to patient safety.

eCare is another example of Christiana's application of sensitivity to operations. The eCare system is designed to support greater awareness by clinicians of the condition of some of the most sensitive patients. To support this effort, they developed a coding system that allows staff members to adjust the amount of attention they give to patients based on the patient's risk status (red, yellow, green). These measures have allowed Christiana staff to maintain the highest amount of situational awareness for their most critical patients.

# Resilience

Resilience is a concept that HROs exhibit when paying close and constant attention to their ability to quickly contain errors and improvise when difficulties occur. Hospitals exhibit resilience when they identify and respond to smaller system failures quickly before problems mushroom into more significant events. To accomplish this goal, they must be prepared to improvise quickly and to respond rapidly to unplanned events.

Christiana Care's resilience is reflected in the design and use of their eCare unit. ICU patients can experience unexpected complications, dislodge medical equipment, and place themselves at risk of falling. The remote staff in the eCare unit provide greater capacity to respond to any of these unplanned events. Christiana Care realized the potential for eCare to help them respond quickly to challenges, including:

- Inadvertent misdiagnosis of patient status and prescription of incorrect medication amount

- Receipt of incorrect treatment and medication instructions by nurses due to inefficiencies in written and verbal orders

- Failures to update medical records, especially during shift changes and transitions in staff

To increase the resiliency of ICU patient care, Christiana Care used the eCare system to help double-check medication and treatment orders. eCare staff also provided 24-hour situational assessment on physician medication and treatment orders, so that if there was a breakdown in the system, it could be quickly detected and fixed before larger medical failures occurred.

Resilience is also a key characteristic of Christiana Care's "Surviving Sepsis" campaign. Rather than assuming that sepsis will always be detected when a patient is admitted and will always be treated in the ICU, Christiana trained staff to be alert for sepsis throughout the hospital. Moreover, by making treatment kits with needed antibiotics available throughout the hospital, Christiana Care created a system that could respond to patient needs even when a bed in the ICU was unavailable.

# Deference to Expertise

Hospitals that exhibit deference to expertise are systems that have developed a culture where organizational leaders listen to and support the judgments of the person with the most knowledge of the issue being discussed. Traditionally, the roles of administrators, physicians, nurses, and other staff are clearly defined and each group is reluctant to listen to the concerns or perspectives of other groups. Nonphysicians are socialized to defer to the views of physicians, even when they are concerned that the physician is incorrect or unaware of an important piece of information.

Christiana Care sought to eliminate the communication barriers that made deference to expertise more difficult. During the Patient Safety Mentor Meetings, Christiana Care follows a shared governance model. All staff members are equally involved in patient safety discussions and actions to prevent similar risks to patients from occurring in the future. They do this because

they value perspectives from all levels of staff and realize that a safety practice is only effective if all relevant people are involved and concerns are addressed.

Deference to expertise is also integral to the eCare innovation in Christiana Care's ICU departments. Physicians and nurses have established a culture where they are encouraged to ask questions and double-check instructions. Onsite and eCare staff have developed a collaborative relationship where questions and expressions of concern are viewed as desirable. This has enabled eCare nurses or physicians to correct ICU staff, even if they are not the ones who are with the patient. Because eCare staff are not judgmental and do not provide evaluations of the patient's care quality, they can openly raise concerns about medical errors or risks to patient safety without challenging the role of onsite staff in providing patient care. The ability of each member of the nursing and physician staff in the ICU and eCare sites to work together to double-check each other's actions without worry of penalty or punitive action is central to this initiative's success.

## Reluctance To Simplify

A final characteristic of high reliability hospitals is a reluctance to simplify. In a complex setting, there is always a desire to simplify the situation and solution, so that it can easily be applied and used across all departments of the hospital. This can be perceived as the most efficient way to solve a patient safety problem. But efficiency is not always the best way to maximize patient outcomes. Each unit and patient has different resources and needs from one another. An HRO is perceptive of such situations and never oversimplifies solutions to operational challenges.

Christiana Care refused to simplify patient safety issues. When analyzing a particular patient safety problem, the Patient Safety Mentor Team could have simply blamed a physician or nurse for an incorrect order or practice and determined that an individual's error caused the problem. Instead, Christiana Care looked beyond the person directly involved in the error to examine the care processes and systems within which the error occurred.

A reluctance to simplify has contributed to the success of each of their initiatives. By assembling an interdisciplinary team to explore septic shock, Christiana was able to identify multiple factors that contributed to poorer sepsis outcomes. When Christiana examined the safety of patients in their ICUs, they recognized that the solution was not merely a technical one. An electronic system for monitoring patients in the ICU was only part of what was necessary to enhance patient safety. Of equal importance was the need to introduce this technology and the staff who would support it in a way that addressed legitimate staff concerns about how eCare would be used and whether they should avoid it or integrate it into the care of their patients.

# Conclusion

There are many lessons to be learned from Christiana Care's patient safety innovations. Implementation of the Patient Safety Mentors, eCare, and Surviving Sepsis Campaign can give insights relevant to many other hospital quality and improvement efforts:

- Complete hospital staff buy-in is essential for implementing a new system, including nurses, physicians, and administrators. When all levels of staff are involved in the development of new innovations and realize that they are integral to the success of such an endeavor, the initiative is much more likely to succeed.

- Along with an effective systematic innovation, there needs to be a change in the staff culture. All people need to own a new patient safety initiative and be personally invested in its success. There needs to be a cultural change in addition to change in the operational system. Staff members need to be willing to change and provide a supportive and questioning environment for the benefit of patient safety.

- Education and awareness are integral to changing patient safety culture. Staff members should be constantly aware of hospital operations and constantly reminded of patient safety goals and objectives.

- Patient safety improvements should be an ongoing process. They need constant and continuous attention from staff members. Christiana Care's initiatives continue to evolve in response to the changing needs of their patients and a greater understanding of how those needs can be addressed. HRO is not a final state; it is a goal toward which the organization should be continuously moving.

Every person working in a health care organization has the potential to identify and make changes that benefit patients. Christiana Care's initiatives are compelling examples of how HRO concepts can lead to tangible actions that make patient care safer and of higher quality. 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 toward that end.