Becoming a High Reliability Organization: Operational Advice for Hospital Leaders

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Acknowledgements

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Appendixes and indexes are available on the AHRQ Web site:
http://www.ahrq.gov/qual/hroadvice.

Executive Summary

This document is written for hospital leaders at all levels who are interested in providing patients safer and higher quality care. It does not contain the views of researchers or theorists on how you can do better. Instead, it presents the thoughts, successes, and failures of hospital leaders who have used concepts of high reliability to make patient care better. It is a guidebook for leaders who want to do the same.

High reliability concepts are tools that a growing number of hospitals are using to help achieve their safety, quality, and efficiency goals. These concepts are not an improvement methodology such as Six Sigma® or Lean. Instead, they are insights into how to think about and change the vexing quality and safety issues you face. Hospitals do most things right, much of the time. But even very infrequent failures in critical processes can have terrible consequences for a patient. Creating a culture and processes that radically reduce system failures and effectively respond when failures do occur is the goal of high reliability thinking.

At the core of high reliability organizations (HROs) are five key concepts, which we believe are essential for any improvement initiative to succeed:

- **Sensitivity to operations.** Preserving constant awareness by leaders and staff of the state of the systems and processes that affect patient care. This awareness is key to noting risks and preventing them.

- **Reluctance to simplify.** Simple processes are good, but simplistic explanations for why things work or fail are risky. Avoiding overly simple explanations of failure (unqualified staff, inadequate training, communication failure, etc.) is essential in order to understand the true reasons patients are placed at risk.

- **Preoccupation with failure.** When near-misses occur, these are viewed as evidence of systems that should be improved to reduce potential harm to patients. Rather than viewing near-misses as proof that the system has effective safeguards, they are viewed as symptomatic of areas in need of more attention.

- **Deference to expertise.** If leaders and supervisors are not willing to listen and respond to the insights of staff who know how processes really work and the risks patients really face, you will not have a culture in which high reliability is possible.

- **Resilience.** Leaders and staff need to be trained and prepared to know how to respond when system failures do occur.

This document shows how hospital leaders have taken these basic concepts and used them to develop and implement initiatives that are key to enhanced reliability. The document shows how the concepts have been used to:

- Change and respond to the external and internal environment

- Plan and implement improvement initiatives

- Adjust how staff members do their work

- Implement improvement initiatives across a range of service types and clinical areas

- Spread improvements to other units and facilities

Summaries of applications in each of these areas are followed by more extended discussions of them drawn from a series of site visits and case studies of systems that participated in AHRQ's High Reliability Organization (HRO) Learning Network. Beyond the table of contents, there are two ways to easily locate the issues of most interest to you. One index allows you to locate particular clinical issues to which high reliability concepts have been applied while a second index allows you to locate discussions of particular high reliability concepts.

Applying high reliability concepts in your organization does not require a huge campaign or a major resource investment. It begins with leaders at all levels beginning to think about how the care they provide could become better. We hope this document will help you see what is possible and that it will help you begin the process of transforming your organization into one where safe, high-quality, and efficient care is received by each of your patients.

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Transforming Hospitals Into High Reliability Organizations

Introduction and Overview

The Institute of Medicine (IOM) and others have stressed the urgency of transforming hospitals into places where each patient receives the best quality care, every single time. This is a daunting challenge, and there are many reasons most hospital leaders would candidly admit that they are far from this goal. In conversations with leaders of hospitals with national reputations for their accomplishments in the areas of patient safety and quality, one recurring theme emerged: the need to change their systems and processes to achieve substantial increases in reliability over present levels. In their efforts to achieve these changes, innovators have looked outside the health care industry to identify examples of extremely high reliability organizations (HROs), which can, and do, achieve levels of reliability that are exceptionally high. Of course, commercial aviation, nuclear power, aircraft carriers, and other sectors known for high reliability differ from the health care system in critical ways. Concepts and approaches they have used cannot be directly duplicated in American hospitals. Instead, they needed to be applied and adapted to face hospitals' challenges.

In September 2005, the Agency for Healthcare Research and Quality (AHRQ) convened a group of leaders from 19 hospital systems who were committed to the application of high reliability concepts. While some of the systems had national reputations for quality, others were less advanced. All, however, wanted to learn from each other and from experts inside and outside of health care about how they could apply concepts of high reliability organizing in ways that would make their hospitals better for their patients.

This document brings together many of the lessons that have been learned working with these systems for the past 18 months. It is important to stress a few things this document is not. It is not:

- A cookbook for producing high reliability. All hospitals are different and have different challenges, resource levels, and cultures. Any cookbook that prescribed exactly what you should do to become a high reliability organization is bound to fail.

- An exhaustive summary of the latest literature and theories about high reliability. We understand that readers of this document are focused on providing high-quality care (and staying solvent)—not on becoming experts in high reliability. We explain the concepts, cite sources where you can learn more, and focus on applications and insights that have proven the most valuable to the leaders with whom AHRQ has been working.

- A description of a new methodology for quality improvement. Different members of the HRO Network use approaches such as Six Sigma®, Lean, Baldrige, and Total Quality Management (TQM). High reliability concepts help focus attention on the mindset and culture that is essential for any of these approaches to work. Although high reliability concepts are very useful, you should not view them as conflicting with strategies or vocabularies that you already may be using to promote quality and safety.

- A roadmap to help you arrive at a state of high reliability, in which your hospital has reached a permanent state of high reliability where patients always receive exactly the care they need and the care is provided in systems that have no inefficiencies or waste. High reliability organizing is an ongoing process that is never perfect, complete, or total. Commercial aviation is highly reliable in preventing crashes, but crashes still occur. And we may be willing to trust airlines to protect our lives but are much less confident that we can trust them with our bags. This document will help explain the processes that you can use to improve the reliability of your hospital and will help you understand why high reliability is a continuous action—not a program you can successfully implement and then move on to other things.

The purposes of this document are to:

- Define high reliability concepts and describe the importance of these concepts to hospitals such as yours. The first section of this document will give you a working understanding of the mindset needed for high reliability organizing and why this mindset is indispensable to efforts to improve patient safety and quality.

- Describe applications of high reliability concepts within the field of health care. The examples we describe in this section are drawn from the experiences of the systems who have participated in the AHRQ HRO Learning Network. These systems were able to invest considerable time and effort learning from other industries and experimenting with a range of high reliability applications in their hospitals. They have been eager to share what they have learned through this process with each other and with leaders from other hospital systems. We believe there is much to be gained from seeing how these hospitals dissected their problems and tried to fix them, as well as what they learned through this process about high reliability. These systems are among the first who have operationalized high reliability concepts within health care. Describing what they have done may help you identify your own opportunities to radically enhance the reliability of your own systems.

- Suggest applications of high reliability concepts that you may want to consider for your organization. This section is followed by an appendix that provides additional detail about the HRO Learning Network that AHRQ has sponsored.

Understanding High Reliability Organizations and Why They Matter

Challenges Calling for High Reliability

HROs are organizations with systems in place that are exceptionally consistent in accomplishing their goals and avoiding potentially catastrophic errors.[1] The industries first to embrace HRO concepts were those in which past failures had led to catastrophic consequences: airplane crashes, nuclear reactor meltdowns, and other such disasters. These industries found it essential to identify weak danger signals and to respond to these signals strongly so that system functioning could be maintained and disasters could be avoided.[2,3]

As the responses of these industries to risks were studied, a set of challenges was identified that all the organizations pursuing high reliability had in common.[4] Many of these characteristics exist in the average hospital as well.

- **Hypercomplexity.** HROs exist in complex environments that depend on multiteam systems that must coordinate for safety. The safety of a hospitalized patient depends on the effective coordination of physicians, nurses, pharmacists, medical technicians, technicians who maintain equipment, support staff who provide meals and maintain the physical environment, and many others. Hypercomplexity describes hospitals as well as it describes nuclear power plants.

- **Tight coupling.** HROs consist of tightly coupled teams in which the members depend on tasks performed across their team. A safe surgery depends on the ability of nurses, medical technicians, the surgery team, housekeeping, and transport to coordinate their efforts so that the patient arrives in surgery at the right time, with the right preparation, and with the right tools and supplies available for the operation to proceed smoothly. Every hospital leader recognizes that this coordination is critical but is often far from perfect.

- **Extreme hierarchical differentiation.** In HROs, roles are clearly differentiated and defined. Intensive coordination efforts are needed to keep members of the teams working cohesively. During times of crisis, however, decisionmaking is deferred to the most knowledgeable person on the team, regardless of their position in the organization.

- **Multiple decisionmakers in a complex communication network.** HROs consist of many decisionmakers working to make important, interconnected decisions. Like all hospitals, HROs must develop processes that allow these decisionmakers to communicate effectively with each other.

- **High degree of accountability.** HROs have a high degree of accountability when an error occurs that has severe consequences. In this respect, hospitals differ somewhat from many HROs, because medical errors tend to affect single patients rather than large groups of people at once. Moreover, despite flawless care, patients in hospitals do die, so distinguishing those whose deaths were inevitable from those the hospital could have averted is not easy.

- **Need for frequent, immediate feedback.** HROs exist in industries where team members must receive frequent feedback at all times. This feedback and the opportunity to make continuous adjustments based on it are essential to anticipate and avert problems before they become crises. Hospitals also are filled with equipment and personnel offering this type of feedback to staff. For them to function as HROs, they need systems and a mindset that will allow people to receive and respond to feedback, rather than being overwhelmed by information.

- **Compressed time constraints.** Time constraints are common to many industries, including health care. In HROs, the systems and culture allow people to identify when they lack time to reliably complete all needed tasks and obtain additional assistance. Hospital staff face the same challenge but do not always have staff with the resources and training needed to maintain high reliability when facing a significant time constraint.[3]

We suspect that the environmental challenges noted above describe your hospital, just as they describe the industries in which high reliability concepts were originally developed. From our conversations with health care leaders, we learned that two other challenges make high reliability in health care even more difficult—and important. These include:

- **Higher workforce mobility.** Hospitals tend to have a workforce that has higher turnover and less intact teams than many other industries. This makes training more critical (and expensive) and increases the importance of standardization of equipment and procedures.

- **Care of patients rather than machines.** Most of the industries emphasizing high reliability deal with machines and processes that are mechanical and whose design and condition are meticulously documented. At the heart of hospital care are patients, about which little is often known, and whose behavior (and whose families' behaviors) varies from others and can change over time. These factors create a degree of unpredictability that creates challenges for hospitals that other industries do not face.

High Reliability Organizing Concepts

Weick and Sutcliffe have identified five characteristics that need to guide the thinking of people in an HRO. We think it is important to emphasize that these are approaches to thinking about issues rather than behaviors, plans, checklists, etc. If a high reliability mindset does not exist among the people running an organization, no set of behaviors or rules will ever produce extreme high reliability.

Figure 1 illustrates the relationships between the five characteristics of mindfulness and the ultimate goal of health care organizations: exceptionally safe, consistently high-quality care. We regard these five characteristics as fundamental to successfully reengineering care processes to achieve exceptionally low levels of defects. Without a constant state of mindfulness, an organization cannot create or sustain highly reliable systems.

Figure 1. The five specific concepts that help create the state of mindfulness needed for reliability, which in turn is a prerequisite for safety

Specific Considerations	General Orientation	Impact on Processes	Ultimate Outcome
Sensitivity to Operations			
Preoccupation with Failure			
Deference to Expertise	State of Mindfulness	High Reliability	Exceptionally Safe, Consistently High Quality Care
Resilience			
Reluctance to Simplify			
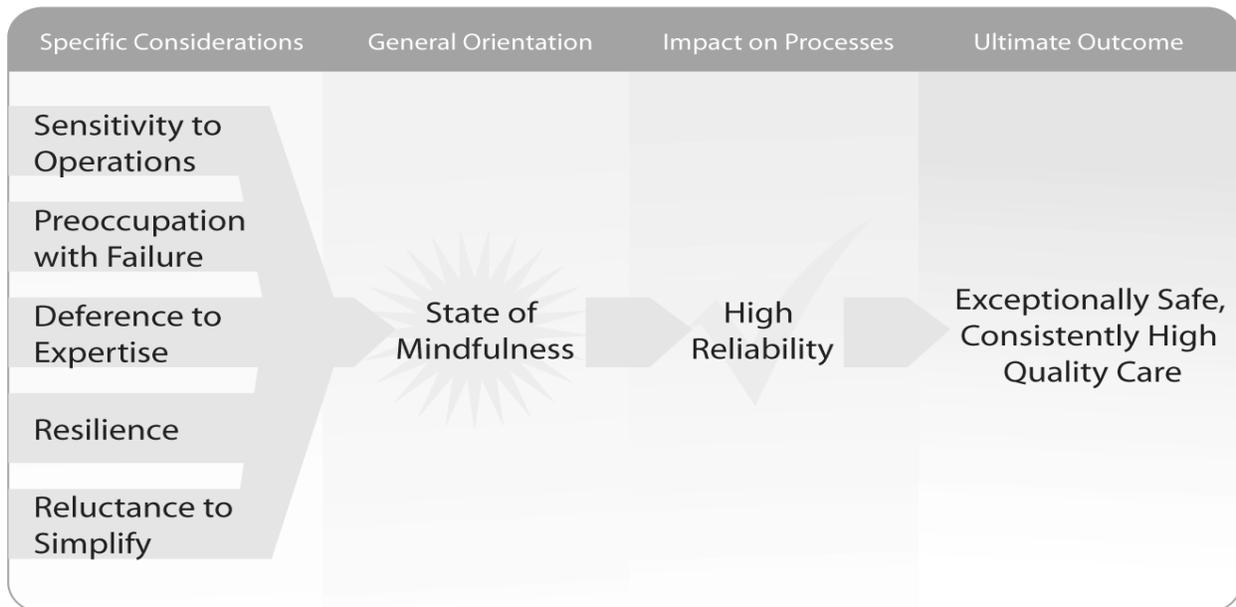
This section describes these five operational processes. A later section will apply them to health care operations more directly.

Sensitivity to operations. **.**HROs recognize that manuals and policies constantly change and are mindful of the complexity of the systems in which they work. HROs work quickly to identify anomalies and problems in their system to eliminate potential errors.[1] Maintaining "situational awareness" is important for staff at all levels because it is the only way anomalies, potential errors, and actual errors can be quickly identified and addressed (see Figure 2). Sensitivity to operations will both reduce the number of errors and allow errors to be quickly identified and fixed before their consequences become larger.

Figure 2. Sensitivity to operations

Sensitivity to operations encompasses more than checks of patient identity, vital signs, and medications. It includes awareness by staff, supervisors, and management of broader issues that can affect patient care, ranging from how long a person has been on duty, to the availability of needed supplies, to potential distractions.

Reluctance to simplify. HROs refuse to simplify or ignore the explanations for difficulties and problems that they face.[5] These organizations accept that their work is complex and do not accept simplistic solutions for challenges confronting complex and adaptive systems.[5] They understand that their systems can fail in ways that have never happened before and that they cannot identify all the ways in which their systems could fail in the future (see Figure 3).[5] This does not mean that HROs do not work to make processes as simple as possible. They do. It does mean that all staff members are encouraged to recognize the range of things that might go wrong and not assume that failures and potential failures are the result of a single, simple cause. HROs build diverse teams and use the experiences of team members who understand the complex nature of their field to continually refine their decisionmaking methods.[1]

Figure 3. Reluctance to simplify
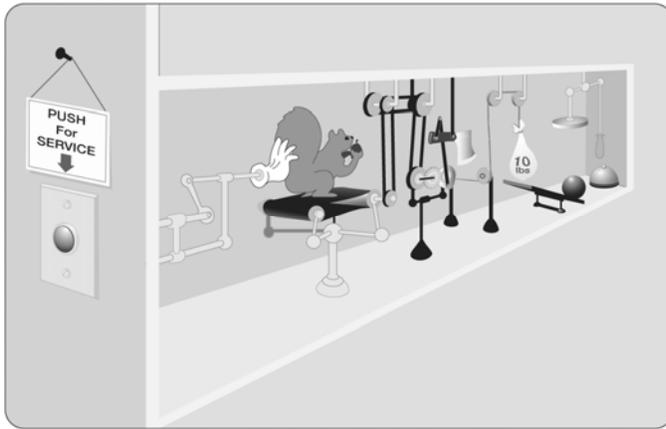
Oversimplifying explanations for how things work risks developing unworkable solutions and failing to understand all the ways in which a system may fail, placing a patient at risk.

Preoccupation with failure. HROs are focused on predicting and eliminating catastrophes rather than reacting to them.[5] These organizations constantly entertain the thought that they may have missed something that places patients at risk. "Near misses" are viewed as opportunities to improve current systems by examining strengths, determining weaknesses, and devoting resources to improve and address them.[1,5] Near misses are not viewed as proof that the system has enough checks in it to prevent errors, because that approach encourages complacency rather than reliability (see Figure 4). Instead, near misses are viewed as opportunities to better understand what went wrong in earlier stages that could be prevented in the future through improved processes.

Figure 4. Preoccupation with failure
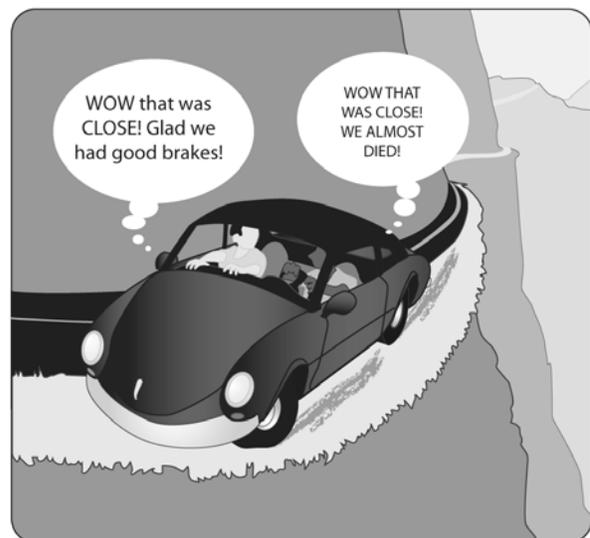
A preoccupation with failure means that near misses are viewed as invitations to improve rather than as proof that a system has enough checks to prevent a catastrophic failure.

Deference to expertise. HROs cultivate a culture in which team members and organizational leaders defer to the person with the most knowledge relevant to the issue they are confronting. The most experienced person or the person highest in the organizational hierarchy does not necessarily have the information most critical to responding to a crisis.[1] A high reliability culture requires staff at every level to be comfortable sharing information and concerns with others— and to be commended when they do so (see Figure 5). A deemphasis on hierarchy is essential for organizations to prevent and respond to problems most effectively.[5]

Figure 5. Deference to expertise
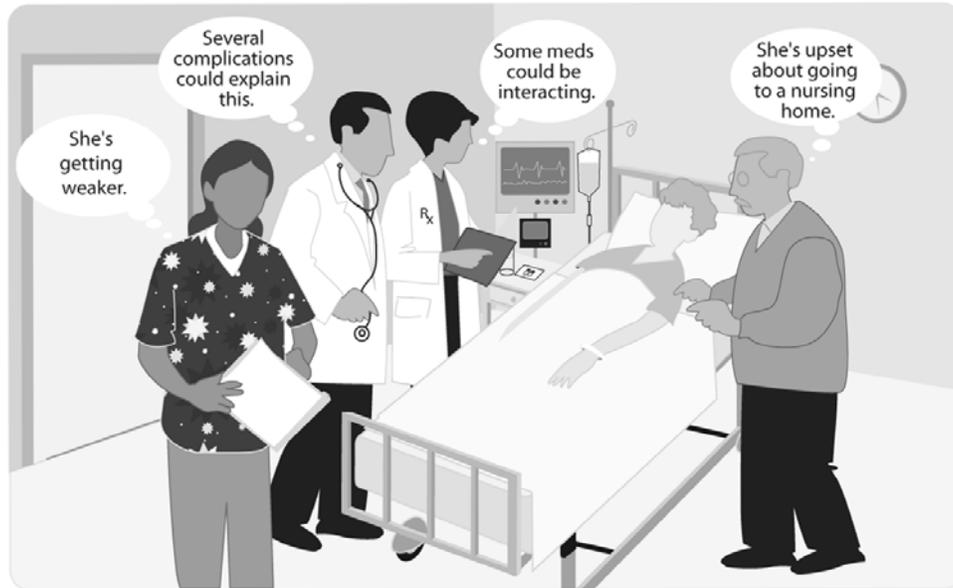
In many situations, different staff members as well as the patient and family may have information essential to providing ideal care. Deference to expertise entails recognizing the knowledge available from each person and deferring to whoever's expertise is most relevant to the choices being made.

Resilience. HROs pay close attention to their ability to quickly contain errors and improvise when difficulties occur. Thus, systems can function despite setbacks.[1,5] An HRO assumes that, despite considerable safeguards, the system may fail in unanticipated ways. They prepare for these failures by training staff to perform quick situational assessments, working effectively as a team that defers to expertise, and practicing responses to system failures (see Figure 6).[5]

Figure 6. Resilience

A good boater never leaves the dock without preparing for many situations that are unlikely but possible. Oars, pump, lifejacket, and fire extinguisher ensure that the boater can quickly respond to unexpected system failures.

Use of High Reliability Concepts in Hospitals

Organizations have explicitly pursued high reliability concepts for more than 20 years, but these concepts have a shorter history within health care.[3] Reasons for interest are numerous. Lack of reliability contributes to medical errors, inconsistent quality, and inefficiencies. With scrutiny from a growing number of external stakeholders, hospitals must become more reliable to compete and to provide care that meets their patients' needs. Three specific trends in the overall environment have contributed to a growing emphasis on high reliability concepts:

- **Public awareness of medical errors and quality.** Never before have patients, their families, and other stakeholders known as much about the quality and existence of errors in hospitals. The IOM report made hospital errors a part of the public consciousness. Public reporting by the Centers for Medicare and Medicaid Services (CMS) and a growing number of States allows consumers to see and ask questions regarding care quality. Hospitals and the boards that govern them are using these data to compete in the marketplace, or these data are being used against them. Public advertising campaigns encourage consumers to request information from their providers.

- **Health information technology (HIT).** HIT has allowed some hospitals to more precisely monitor their systems of care, the dispensing of medications to patients, and the amount of system waste. These data have focused attention on the frequency with which ideal care is not provided to patients. HIT has also affected hospitals in another way. Hospitals embracing HIT have found that automating flawed systems can make their operations less efficient rather than more. Therefore, making systems reliable before they are automated has become a priority.

- **Emergence of quality improvement methodologies.** A wide range of specific improvement methods have been embraced within health care, ranging from total quality management and continuous quality improvement, to ISO and Six Sigma®, to Lean Thinking and Baldrige. Each of these methods has a distinct vocabulary, philosophy, and method, but they all emphasize the need to make all aspects of care better and more reliable than they currently are.

Applying High Reliability Concepts to Hospitals

Applying high reliability concepts in hospitals is not easy—or easy to explain. Although practitioners want concrete steps to take, the challenge of becoming a high reliability organization is more complex. In fact, this transformation must occur over a period of time and take into account various factors, including general environmental issues; training and oversight of staff; processes for planning, implementing, and measuring new initiatives; and specific work processes occurring on units. A high reliability mindset views each of these levels as important and as a source of opportunities and threats to achieving exceptionally high-quality patient care.

Discussing and enhancing applications of high reliability concepts was the focus of the AHRQ HRO Learning Network. This section is based on a series of site visits and case studies drawn from hospital systems participating in the Network. These documents are included in their entirety as appendixes. This section synthesizes themes from these documents so that you can understand how a high reliability mindset affects the following areas:

- Changing and responding to the external and internal environment

- Planning and implementing improvement initiatives

- Approaches to doing work

- Approaches to measuring progress

- Specific improvement initiatives

- Spreading improvements to other units and facilities

Figure 7. Hospital leaders must juggle many environmental factors that affect their facilities

The table of contents and index will allow you to locate topics of interest easily across the appendixes attached to this document.

Changing and Responding to the Hospital's Environments

Hospitals and their staff operate within an external environment shaped by government regulations, characteristics of their patient populations, the job market for health care professionals, and the extent of competition from other sources of care. Hospital workers also confront an internal environment shaped by leadership priorities, resources available for training and improvement initiatives, and policies regarding responses to medical errors and quality defects (see Figure 7). This section summarizes how a high reliability mindset affects responses to these environmental issues.

External Environment

Leaders of hospitals and hospital systems are the people most aware of the environmental factors that affect their facilities and are the ones most capable of attempting to change this environment. In Minnesota, a set of these leaders began to meet informally to discuss issues of mutual concern. Each knew that their facilities had safety and quality concerns, but they recognized that these issues had causes that were more complex than simplified explanations such as inadequate staff training, poor communication, or failure to follow defined policies. This reluctance to simplify was combined with an awareness of operational failures, which hospital leaders sometimes lack. These informal discussions gradually led them to recognize and collaborate on environmental issues that had previously undermined their efforts to become more reliable and safe. Their collaboration allowed them to:

- **Address environmental barriers more effectively.** Collaborating on community-level barriers to improve safety and reliability through collaboration was more likely to succeed than individual organizations' attempts to address the same barriers. These collaborations made it easier to work with legislative groups and occupational oversight boards to change policies needed for a culture of high reliability. Broad-based support was also critical to efforts to develop an innovative and successful system for reporting near misses and errors.

- **Achieve cross-hospital standardization.** Sharing a workforce among hospitals, including nurses and specialists, was a great motivation for standardizing forms and processes across all institutions. This strategy reduced variations in work patterns as well as the potential for errors and unnecessary rework. The collaboration also created opportunities to standardize the measuring and reporting of quality issues. This approach made it easier to more accurately set priorities, develop consistent requirements, and evaluate progress.

As leaders of these hospitals reflected on these efforts to collaborate, they identified a number of tangible recommendations for ways to make as much progress as possible. These included:

- **Do not compete on patient safety.** It is essential to agree at the beginning of any collaboration that the organizations involved will not compete on patient safety initiatives such as preventing wrong site surgery and medication abbreviation errors. Competing on patient safety will both derail collaborative efforts toward improvement and cause misalignments between individual system focuses and established priorities. Even in areas where hospitals do compete, there still may be grounds for collaborating with each other. In Minnesota, even though there is competition related to performance on quality measures, hospitals have worked collaboratively to develop common quality metrics that can be used to measure comparative performance.

- **Do not underestimate the value of incremental muddling.** Many of the successful collaborations began with informal conversations between relevant leaders about issues of potential interest. While some of these discussions did not progress, others evolved into more focused discussions and formal agreements to work together to achieve important goals. This approach to planning allowed ideas to be explored without major commitments of time or resources and reduced the likelihood of a major investment in an idea that lacked widespread support.

- **Local community collaborations can be more powerful than national collaborations.** Geography is an important factor in collaboration because the people involved have a common understanding of the local conditions, such as the market, transportation, and money. National collaborations are sometimes scoped too broadly to apply to local health care systems and practitioners. Collaboration at the local level can be very effective for this reason.

- **Expect building community collaborations to take time.** One criticism of collaboration is that there are so many possible focuses of work. Rather than attempting to involve all of the organizations and their leaders in all initiatives at the same time, Minnesota has been successful by developing collaborations one at a time and including only the relevant groups for specific initiatives. Trying to do too many things too quickly is always in tension with trying to make sure particular initiatives have enough traction to succeed. Building a coalition over time and bringing in different stakeholders with different needs at the appropriate time makes collaborative work more feasible.

Working together, the organizations in Minnesota have made substantial progress shaping external environmental factors. Three examples reflect the range of what is possible:

- **Changing perceptions of medical errors.** Working together was necessary to educate legislators, regulators, and members of the media on the importance of a nonpunitive approach to medical errors. It is better to focus on understanding and fixing system failures than singling out individuals for blame. Punitive cultures discourage the open communication needed to respond quickly so that small errors do not become large ones. Working together, leaders of these organizations were more successful in educating those in oversight positions as well as media members regarding best approaches to diagnosing and fixing errors and addressing quality issues.

- **Standardizing aspects of care communitywide.** Leaders recognized that workforce members often worked in multiple facilities in which "correct" ways of doing work were inconsistent. They also understood that efforts by one facility to insist that physicians comply with policies regarding surgical markings or medication abbreviations would be compromised if the physician could simply practice elsewhere in a place that was more accommodating. By working together, the leaders created communitywide standards for medication concentrations, surgical site markings, and use of appropriate abbreviations for medications. Creating and implementing these standards together allowed these leaders to reduce threats to reliability in each of their hospitals.

- **Standardizing approaches to measuring and reporting results.** Hospital leaders also worked together to develop and implement common measures and approaches for reporting on quality. This approach enabled them and other stakeholders to have more accurate data regarding their facilities' comparative performance and made it easier to meet the reporting requirements of payers and regulators.

More details on how this community collaboration worked to modify the external environment so that their systems could be more reliable are provided in the Fairview and Allina Site Visit Appendix.

Internal Environment

Hospital staff operate within an internal environment shaped by executive leaders, financial constraints, and human resource policies. Creating an internal environment that supports an HRO mindset is essential to achieve the goals of safety and quality. Four key elements in a supportive internal environment are:

- **Executive leadership support.** Exempla Chief Executive Officer (CEO) Jeff Selberg discussed the importance of supportive executive leadership in achieving high reliability. His observations on what leaders must do reflect many of the HRO principles described above, including:

  - *Culture is the foundation for vision and strategy.* A culture characterized by fear and self-protection will not lend itself to openness, learning, and improvement.
  - *Transparency is the key to change the culture.* An unwillingness to face and share the hard facts is an indicator of denial, and denial is not compatible with a safe environment.
  - *Safety must be the overarching strategy.* Safety should be the root cause of achieving efficiency and effectiveness. If the inverse of this relationship exists, the likelihood of having unsafe yet highly efficient processes increases. Only if safety is the starting point can the correlation among safety, efficiency, and effectiveness remain positive.
  - *Leaders must take ownership for setting the climate and focusing the work.* Generating clarity, setting the example, and demonstrating confidence will help to transform organizational culture. However, without outright acceptance of ultimate accountability for setting organizational direction, a leader's vision will not be legitimized in the eyes of his or her followers.

- **Alignment with your business case.** Hospitals can be highly reliable producers of adequate profit margins at the expense of highly reliable safe and quality care. The only way to ensure that the pursuit of reliability encompasses both is to work to align the business case with the case for quality. This is not easy, but Scott Hamlin, the chief financial officer (CFO) of Cincinnati Children's Hospital, offered his perspective on how this goal can be achieved. He noted that:

  - *Getting the CFO on board is critical.* To the extent that the CFO influences resource allocation decisions, interacts with the board, and shapes compensation strategies for

organizational leaders, organizational transformation is unlikely without the full support of the CFO.

- ■ ***Getting the CFO on board is a gradual process.*** The CFO needs to be tactfully and patiently educated about issues related to quality and safety, as well as how these issues affect the hospital's financial performance. In Mr. Hamlin's case, it took several years for him to evolve from a skeptic about issues related to quality to a champion for quality's role in the hospital's business case. CFOs are trained to be skeptical and focused on financial issues, so it is unrealistic to think that a single presentation, workshop, or set of data will lead to a dramatic change in their outlook. More time and patience will be required.

- ■ ***Giving CFOs data and tools that they can use to convince themselves of the business case for quality is essential.*** Cincinnati Children's helped to train the CFO's staff to perform analyses required to convince the CFO of the business case for quality. Analyses performed by quality staff would have been suspect, but once the financial analysts could evaluate data independently to draw financial conclusions, the results were credible to the CFO. The approach used at Cincinnati Children's involved providing the CFO with the data and tools that he and his staff could use to convince themselves of the business case for quality.

- • **Linkage of staff behavior with desired outcomes.** Sentara is highly reflective about creating and reinforcing these links, because they recognize that their staff will probably do things they are rewarded for doing. If they want staff to be sensitive to operations and preoccupied with failure, they need to ensure that these behaviors are rewarded. Recommendations based on their experiences include:

  - ■ ***Don't introduce interventions unless they are fully linked with policies and aligned with incentives for performance.*** Several systems expect all new initiatives to be linked to dashboards reviewed by executives or the board before the initiative can begin. Sentara and other systems also incentivize improvements in areas where they are looking to improve. For example, employee bonuses linked to improvements on behavior-based expectations (BBEs) for error prevention amounted to the equivalent of two weeks' pay. Effective alignment helps new initiatives get running quickly and effectively.

  - ■ ***Make sure there are clearly identified owners for all actions that are key to a successful implementation.*** Systems reported substantial improvements in performance when actions were assigned to specific owners. When an action is owned by a team rather than an individual, it is less likely to happen.

  - ■ ***Make sure that safety and quality issues are carefully linked to operational issues.*** When quality improvement (QI) staff attempt to develop an intervention without close coordination with operational leadership, the project is unlikely to work. If operational and improvement planners work together to link their goals and processes, the project is more likely to have a successful start.

- **A just culture.** A just culture is one where people can report mistakes, errors, or waste without reprisal or personal risk. This does not mean that individuals are not held accountable for their actions, but it does mean that people are not held responsible for flawed systems in which dedicated and trained people can still make mistakes. All staff must feel empowered to identify errors, defects, and system failures that could lead to an unsafe environment for patients.

  - Christiana Care actively promotes a just culture in their innovative electronic intensive care unit (EICU). A major key to making the EICU successful was to allay concerns that EICU staff were judging the quality of the work performed by staff providing direct patient care in the ICU. The wall of their EICU is covered with fish—each fish represents a good catch of a problem that protected a patient from potential harm. Rather than covering up near misses or threats to patients, Christiana actively acknowledges that these threats exist and celebrates, rather than hides, the fact that they are detected and prevented. It is an approach that reinforces a nonpunitive view of errors and one that encourages preoccupation with failure.

  - Cincinnati Children's has worked with units to increase reliability and celebrate successes. When a near-miss event takes place and a staff member accurately records the event, that staff member is acknowledged for reporting the event. Similar approaches are used in many of the other hospitals.

  - Christiana Care and Sentara staff both relayed the importance of stories in fostering a just culture. When stories are told by staff about being validated rather than criticized by leaders for reporting mistakes, these stories become part of a culture in which potential risks can be discussed and reduced rather than concealed and allowed to continue.

Planning and Implementing Improvement Initiatives

Improving quality and safety requires both knowing what to do and how to do it. Many initiatives are excellent ideas but still fail because the approach to implementation is poorly designed. A high reliability mindset must be applied to how your organization plans and implements improvements. If you don't understand the pressures and challenges facing the people key to your implementation, you probably won't succeed. You also will not succeed if you oversimplify your implementation strategy, fail to listen to people with the most expertise about what success requires, or fail to constantly consider what can go wrong and work to avoid those challenges.

Systems in the Network offered considerable practical advice about how to apply high reliability concepts to their planning and implementation activities. This advice falls into three general categories:

- Processes
- People
- Resources

Process Applications

Success requires introducing innovations into systems that are prepared to respond to them. Systems in the Network have learned much from their successes and failures in rolling out new initiatives. Preconditions for success that they have identified include:

- **If an improvement cannot be integrated into an ongoing initiative or process, do not try it.** Until it is integrated it will not be successful. A key to high reliability is simplifying systems and processes so that they can be performed consistently. The more separate initiatives or processes that exist, the less reliable the overall system will be.

- **Negotiate in advance where savings from an innovation will go.** This will ensure that resources that are freed up can support top priorities and will increase motivation by key people needed to make the innovation successful. Because not all innovations result in cost savings, it is even more important to agree on where savings from those that do are allocated.

Rollouts also work better if they are sequenced or staged in ways that make them more palatable to staff. Key observations related to success include:

- **Christiana Care embeds initiatives into the training that they provide to new staff.** This creates the expectation that the initiatives are essential and avoids having to retrain staff after they begin work.

- **Start by simplifying policies and procedures to make it possible for staff to comply.** Shortly after Sentara introduced BBEs, they began to simplify processes so that people could see that changes would not be a net increase to their workload. Gaining buy-in and appreciation for making jobs easier before adding new procedures or processes helps employees to avoid seeing the new things as an extra burden.

- **Roll initiatives out incrementally and begin with ones that are nonpunitive.** For example, Sentara introduced and educated staff regarding the BBEs first before implementing Red Rules. They did this because they wanted people to believe that they had the training and clarity required to be successful before Sentara introduced Red Rules, which focused on actions that should always be prevented. Without a culture that supports disclosure and questioning, introducing Red Rules could be counterproductive.

- **Exempla uses Lean thinking approaches to rolling out initiatives.** By drawing together key people and allowing them to spend an extended period of time working together to map out the process and then redesign it, they reduce the likelihood of redesign efforts that are likely to fail. Even then, Exempla has learned that further adjustments should be expected once the process redesign is extended to other units or work shifts.

People Applications

Although the importance of people is obvious, many initiatives in hospitals still fail because key perspectives are overlooked, physicians are not included (or do not want to be included), or improvement staff are different from operational staff. Anticipating the people problems that can prevent your improvements from succeeding is a key dimension of preoccupation with failure. Observations from Network members related to people include:

- **To involve physicians, avoid systems or procedures that decrease their efficiency.** Physicians do not mind changes in how they practice medicine if those changes make them more efficient (or at least do not decrease their efficiency). Involving them in the planning process is crucial toward preventing the implementation of changes that they will perceive as making them less efficient.

- **Provide resources and expertise that allow physicians to help lead improvement efforts.** Cincinnati Children's works extensively to provide resources and expertise that will allow its physicians to help lead improvement efforts. Each Clinical System Improvement Integrating Team is led by a physician and a nonphysician. In this capacity, physicians work collaboratively to help develop and lead initiatives that improve systems and processes. The net effect of this effort is a growing number of physician leaders who can provide valuable perspectives and ideas required to drive the transformational goals that have been established.

- **Include people from multiple shifts and work units.** Each site visit involved at least one story of an implementation that was developed by one set of people and resisted by another because they were not involved in planning. Christiana Care found that their EICU initiative benefited greatly from involving staff from the ICU in planning and having them spend time in the EICU to understand how it works. Exempla found that their pharmacy redesign was resisted by night shift staff who were not involved in its planning. Every system reported that initiatives developed in particular units or hospitals were not as well received in others. Including as broad a set of people who will be affected by the initiative is critical.

- **Encompass multiple staff types in planning.** Sentara's medication dispensing machine system redesign succeeded in part because they included nurses, pharmacists, supervisors, and other staff in the planning process.

- **Avoid having quality improvement staff design initiatives without input from operational staff.** The role of quality improvement staff at Cincinnati Children's is to serve the teams working on the improvement rather than function as the leads responsible for achieving the change. This consultative role ensures that ownership of the improvement efforts remains with the units and teams that provide patient care. This approach increases staff buy-in as well as the sustainability of improvement efforts.

Resource Applications

Having adequate resources is critical for many initiatives to succeed, and the most important resource is sufficient time for key leaders to focus on the effort. Systems have used a variety of strategies to ensure that sufficient resources are available. These include the following:

- Exempla provides replacement staff for people participating in the Lean Change Process Efforts. It is unreasonable to expect staff to focus on these planning efforts while still attempting to do their normal jobs.

- Cincinnati Children's budgets a substantial amount to support personnel on high-profile initiatives. Particularly for physicians, this support is essential to ensure their participation.

- Resources and labor are always in short supply, so many systems actively monitor the number of priorities to ensure that there are not too many to support. Cincinnati Children's stresses keeping a short priority list. The only way something goes onto this list is if something on the list is completed or removed. This plan ensures the focus new projects require. At the microsystem level, several systems use strategies that require managers to list all the things they are trying to do and then to classify these things based on whether they can or cannot do them. Management then must respond to these lists by setting priorities and making decisions about more resources. This task is very difficult for managers but helps avoid starting new things that personnel feel cannot be done.

Doing the Work

HRO concepts emphasize a different way of thinking about and performing work at every level. If tasks are too complex it becomes impossible to distinguish doing the work right from doing it wrong. If there are no opportunities to talk about issues with other staff, there is little chance that people will be exposed to other views or information and little opportunity to discuss near misses. If leaders aren't routinely observing and talking with staff providing direct patient care, they will not understand the operations for which they are responsible.

The Sentara site visit and subsequent case study at Sentara focused attention on a range of strategies that they (and other systems) are using to encourage high reliability thinking as people do their work. These strategies include:

- **Simplifying work process.** If you cannot reduce what you want staff to do into a limited set of clearly defined behaviors, your system will not be reliable. As noted above, Sentara has created a set of behavioral-based expectations (BBEs) for their staff. These BBEs were associated with a substantial reduction in sentinel and other serious events and substantially reduced insurance claims over a 3-year period.

- **Daily check-ins.** These short, focused meetings of leaders and staff on a unit follow a set agenda and occur at the same time each day. The meetings allow staff to raise questions, give them information that may affect their work, and provide a forum for raising issues, which are delegated and handled outside the meeting.

- **Executive rounds.** Executive rounds enable hospital leaders to retain an awareness of operations that is needed for good decisionmaking. These rounds also create an opportunity for staff to raise issues with leaders and for leaders to model the behaviors they want staff to exhibit, including following up on issues that are raised. They are key to supporting a culture that defers to expertise and encourages staff to speak out about safety and quality concerns. In order for executive rounding to be most effective, however, hospital leadership must follow up on the concerns voiced by staff members in order to ensure receiving continual feedback.

- **Safety huddles.** Sentara uses these huddles in units every 12 hours, which ensures that the unit is thinking specifically about safety issues at least twice a day as a team. The huddles are very short but allow people to comment on any safety issues they observed or were concerned about. They also allow people to comment on their own condition so that people can receive extra assistance on days when they may need it.

- **Performance management.** Many systems in the HRO Network have very rigorous processes for managing performance and rewarding individual and team accomplishment. These approaches often include behavioral observation of staff by trained supervisors and substantial bonuses linked to fulfilling the BBEs. Performance management is key to ensuring that staff are rewarded for desired behavior and discouraged from other actions.

Measuring Progress

It is impossible to be preoccupied with failure or to respond to system breakdowns if information is not available to measure system performance. A general theme across repeated discussions of measurement with HRO Network systems is that measuring is essential but often does not work as planned. Missing baseline information makes progress hard to assess; excess complexity makes results difficult to understand or use; and measures that are too labor intensive are unsustainable over time.

This section identifies several general insights about effective measurement shared by systems in the Network. It also addresses issues related to several specific areas where measurement is important.

Measurement Insights

- **Measure fewer things better.** Multiple systems in the Network noted the common problem of having too much data. Too much information can make it harder to be truly sensitive to operations and to noticing important failures that occur within key systems. Cincinnati Children's uses a series of basic questions to ensure that it is measuring the right things, but not too many things:

  - What do we want to know?
  - How are we going to collect that information in the clinical process?
  - What are we trying to show at the end of the data collection?

These questions reduce the tendency to measure everything that is measurable, which in systems with strong technology infrastructure can be much more than is meaningful or usable.

- **Stories count and simplify.** We heard as many examples of improvements stemming from a story about a problem than we did about initiatives based on data. Both are very important, but leaders noted that sometimes problems are well known and the need to collect data regarding them is irrelevant and slows the process. If there is agreement related to a problem and a way to fix it, then resources should focus on the fix, not documenting the obvious. Over time, measures become more crucial and their accuracy must be refined, but in many cases, stories are the starting place.

- **Couple measures with high performance standards.** Data can desensitize people to system failures. If a certain failure rate is the norm, then trending data that show no change in that failure rate can contribute to complacency. Each system we visited placed very high importance on establishing goals that were well above current levels of performance on key indicators. This approach reduces complacency and contributes to a culture in which continuous improvement is essential.

Specific Measurement Areas

Many of the specific initiatives described below include descriptions of how progress was measured over time. The three examples shown here illustrate important measurement concepts: Anything can be measured and measures can be quite simple, but sometimes multiple measures are essential to track system performance.

- **Measuring leadership.** Jeff Selberg's discussion of leadership's role in creating a high performance culture posed several important questions useful for assessing leadership performance.

  - *Are you committed to your own growth as you grow your organization?* Your organization's ability to transform and improve is directly correlated to your ability as a leader to transform and improve.

  - *Are you creating the environment so that the right and, most of the time, the wicked questions are asked?* It is not your role to have an answer for all of the questions, but rather to create an environment where the right questions are asked and greater personal and organizational awareness are achieved. Asking these types of questions may feel risky, but the result will be greater organizational tolerance for diversity of thought.

  - *Are you engaging in patient-centered versus ego-centered conversations?* You must take yourself out of the center of your strategy and replace yourself with the patient to ensure that you are protecting your patients first and foremost. A great deal of self-awareness is required to know where you are in every conversation.

- *Are you embracing challenges that stretch your capacity as a leader?* Your approach must be that every situation, no matter how challenging, is the perfect opportunity to learn, grow, and meet long-term objectives.

  While these questions are basic and the answers subjective, they reinforce the importance of assessment of all aspects of an organization's behavior, including the actions of its leaders. If they are unwilling to assess themselves, they will find it hard to create a culture where assessment is the norm.

- **Measuring chemotherapy orders.** Exempla made changes designed to reduce risks and improve efficiency of chemotherapy orders. The safety metrics they developed (number of abbreviations, use of standardized order sets, illegibility, etc.) were all quite simple and easy for staff to measure before and after the initiative was introduced. But these measures were combined with assessments of nurse's satisfaction with the process and changes. Exempla realized two important things. If they could not make changes that were easy to assess and that were supported by staff, the changes would not be sustainable. In other words, Exempla wanted to ensure that the processes implemented for measuring chemotherapy orders were working effectively for the staff members actually measuring the medications. Tracking both dimensions was simple but also vital to knowing whether they were achieving their goals.

- **Measuring errors and near misses.** Measuring safety events is quite complex. Some systems reported experiencing increases in reported events as they worked to make their cultures more transparent and attuned to safety issues. Other systems reported instances where a large percentage of some kinds of errors (e.g., medication) were not reported. There was general agreement about several issues relating to measuring errors:

  - *Measure both minor and major events so that both can be trended.* In a punitive culture, both will be underreported. In a just culture, both will be reported more frequently, but major events should decline more substantially than minor ones.

  - *Look for alignment between these measures and other indicators of safety.* Sentara became more confident in their measures because their improvements on event measures corresponded to reduced insurance claims.

  - *Consider measures that examine the ratio of major to minor safety events.* Such measures may encourage reporting of small errors and allow hospitals to see whether the ratio of major to minor errors is declining over time.

While measuring too much can be unhelpful, systems have recognized that for issues such as safety, no single metric will provide a clear sense of how they are actually doing. This reluctance to simplify safety into a single indicator prevents measurements that can be useless or potentially even dangerous to patients.

Implementing Specific Improvement Initiatives

Applying HRO concepts to specific improvement initiatives is what truly matters. If the concepts cannot be used to make specific aspects of hospital care safer, higher in quality, or more efficient, then they are of no value to hospital leaders. This section highlights the breadth of applications of HRO concepts to improvement initiatives, all of which are described in more detail in the site visit summaries and case studies. Those sections reflect an important aspect of HRO thinking: that changes are often driven by several or all of the HRO concepts.

- Christiana Care applied concepts of resilience and preoccupation with failure to successfully create an EICU that provides an additional level of support to staff caring for their sickest, highest risk patients.

- Sentara's preoccupation with failure led them to notice and reduce the number of interruptions experienced by people at the medication dispensing machines. This resulted in lowering the risk of drawing the wrong medications and reducing the time lost for staff associated with required rework when medications were forgotten.

- Exempla applied Lean concepts to the challenge of improving chemotherapy orders. In a relatively short time they raised staff satisfaction with the process and reduced problems in orders that increased the risk of medication errors.

- Cincinnati Children's identified flaws in their discharge planning process that kept patients hospitalized longer than necessary and limited bed space for patients scheduled for surgery. Their initiative substantially raised the percentage of patients leaving the hospital within 4 hours of meeting their discharge goals.

- Cincinnati Children's applied a range of strategies to substantially reduce ventilator-acquired pneumonia cases among their patients. The reduction reduced patients' length of stay and freed hospital beds to care for additional patients, which also generated more revenue for the hospital.

- Working together, hospitals in the Minneapolis area agreed to standardize medication concentrations to reduce errors that could occur by staff working in facilities that used different concentrations.

- Exempla redesigned their processes for stocking and using their medication dispensing machines. The changes they made reduced inventory costs, the number of medications that the pharmacy had to send to the ICU, and the number of unused medications in the medication dispensing machine.

- Christiana Care applied the HRO concept of sensitivity to operations to prevent and more quickly detect and treat sepsis. These changes substantially lowered the impact of sepsis in their facility.

- Cincinnati Children's applied the concepts of sensitivity to operations and preoccupation with failure to recognize the need to reduce codes occurring outside the ICU. These efforts have made codes outside the ICU exceptionally rare events.

- Several systems in the Network have computerized physician order entry (CPOE) systems in place. While these systems have much promise, they sometimes have no, or

even negative effects on patient safety. Cincinnati Children's deferred to the expertise of the users of the system when designing and implementing it. They rejected overly simplistic understandings of the potential risks and rolled out a system that substantially reduced the number of calls required to clarify orders and cut delivery time of the medications to the unit by over 50 percent.

- Exempla redesigned their specimen processing workstation to improve efficiency and reduce the potential for errors and rework. This process created more workspace and reduced both retesting and the need for redraws of patient specimens.

- Sentara and other systems implemented safety huddles and other processes designed to improve patient handoffs within and between units. These processes allow staff to be more sensitive to operations, understand and attend to risks confronting particular patients, and defer to the expertise of the providers who have been caring for the patient most recently.

These and the other examples described in the appendixes should provide you with a broader understanding of the potential applications of HRO concepts to the challenges you face. It is important to remember that even the most detailed explanations of these changes might omit key details, and your facility will need to adapt what others have done to make it work for you. But these examples should demonstrate that a culture built on a high reliability mindset is one that will lead to safer, better, and more efficient care for your patients.

Spreading Improvements to Other Units and Facilities

No system participating in the HRO Learning Network was satisfied that their innovations and improvements had been embraced by all the units and facilities in their systems that could benefit from them. Although it would be wonderful to feature a system that has mastered the process of rapidly spreading improvements, it is unsurprising that this challenge remains unsolved. Often people fear change because it is unknown, can disrupt work patterns, and can take more time to implement. Change does not occur overnight but takes time, and these initiatives are new, so it can be difficult to implement them.

Much of this challenge relates to the need to establish and sustain a culture built on high reliability concepts. Without leadership and a culture that encourages constant reflection about system risks and opportunities for improvement, initiatives that worked elsewhere may fail. As a result, spreading improvements across a system is part of an even broader challenge: the challenge of spreading a high reliability culture across a system. Cultures change slowly, but systems in the Network identified a number of suggestions for facilitating this process across units, to physicians, and across systems.

Between-Unit Spread

- Aggregating data and sharing it across the hospital has been used by several of the systems to raise awareness of key issues and to motivate other units to improve to a standard being set in other units. Some hospitals post unit performance data in public places to communicate the norm of transparency and accountability.

- Stories were regarded as key to spreading ideas. Specific ideas related to sharing stories effectively included:
  - Capture people doing good things and share those stories. These stories reinforce a culture where doing good gets as much attention as avoiding bad.
  - Talking openly about mistakes and near mistakes reinforces the message that they can occur everywhere and that they should be acknowledged when they occur. This was regarded as essential to creating a high reliability culture across the whole organization.
  - Sharing stories from and about all types of staff and from patients helps reinforce the principle of equality and teamwork.

Spread to Physicians

Every system present agreed that developing and implementing HRO concepts for staff other than physicians was much easier than doing the same thing with physicians. Although difficult, ideas for supporting spread to physicians include:

- Frame changes in ways that appeal to physicians' needs. When physicians view a change as something that will make them more efficient, they are much more likely to support it.

- Don't even try to implement changes focused on physicians without very strong executive and physician leadership. The few success stories that were shared involving physicians all occurred where strong leadership support existed.

- Begin by making successful changes that involve other staff. These successes increase the willingness of physicians to try them. One hospital in Sentara's system is introducing Red Rules for physicians, but this is still a work in progress.

- Allow physicians to violate some rules based on their clinical judgment—but only if they document the reason for the exception. Some systems felt that allowing these types of exceptions also encouraged mindfulness required to be an HRO.

Spread Across Systems

- Sharing data systemwide can be effective in creating awareness of performance differences between hospitals. If improvements are substantive and effectively measured, demand may increase for these improvements so that other hospitals can achieve similar improvements.

- Creating informal and even formal settings for peers from different facilities to network and share ideas with each other can help spread good ideas. A number of improvements that have spread in Sentara have occurred because of informal discussions between peers.

- Some systems have tried formal rollouts from one hospital to others in the system. It was not clear whether these efforts worked better than spread that occurred informally.

- Seeing where spread may be occurring informally and then supporting those efforts with well-trained staff appeared to work well. This strategy ensures that the interest in change already exists and maximizes the impact of trained staff.

Using This Information

The preceding section reflects a very broad range of applications of high reliability concepts to the practical challenges faced by hospitals and their leaders. While the appendixes provide more detail about many of the concepts, there are no step-by-step detailed descriptions of exactly how to implement any of the interventions that we describe. What worked for these hospitals will not work exactly the same way for you. You and others in your facility will need to develop strategies for planning, implementing, and measuring your initiatives that match your environment and culture and adapt to your unique challenges and opportunities.

If you have read through the preceding section, we hope you now:

- **Understand high reliability concepts more clearly.** Although the concepts are simple, they can also be threatening. Really embracing them will require that you openly acknowledge and respond to risks your patients face and that you reject a hierarchical approach to decisionmaking in favor of one that defers to the expertise of others—even when they are less senior in the organization or from professions different from your own. To become a high reliability organization, you will need to both understand these concepts and support a culture that makes their application possible.

- **Learn from examples of how these concepts have been applied in hospitals.** We hope you were intrigued and excited by the range of improvements that are described in this document. Some represent small and rapid changes that are likely to produce modest improvements while others are major initiatives that require extended periods of planning and considerable resources. Hospitals in the HRO Network are certainly not the only ones experimenting with ways to make their patients safer and their quality better. But the breadth of their efforts means that the examples offer something of value to every hospital leader.

- **Apply HRO concepts to the most pressing needs you face.** Many people who work in hospitals—even those who are leaders—sometimes feel that they lack the organizational support needed to make substantive improvements. It's clear that executive- and even board-level support are enormously valuable in becoming a high reliability organization, but it's also clear that each person has opportunities to make improvements. We suggest you consider starting with smaller initiatives that don't necessarily require extensive support from others. As you begin to model and use the HRO concepts described in this document you'll learn a great deal. You can also achieve some small successes that can lay the groundwork for bigger initiatives. Each system in the HRO Network made progress slowly and incrementally.

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Appendixes and indexes are available on the AHRQ Web site:
http://www.ahrq.gov/qual/hroadvice.

Appendix A: High Reliability Organization Learning Network Operational Advice from the Sentara Network Site Visit

Overview

This appendix summarizes practical suggestions for becoming a high reliability organization that were suggested by representatives of Sentara and other health care systems attending the site visit. All the suggestions reflect ideas that have been tried—some successfully and others not so successfully. The focus of the site visit was on two of Weick and Sutcliffe's aspects of a high reliability organization (HRO):

- How can health care systems become more sensitive to operations?

- How can health care systems develop a preoccupation with failure that reduces the likelihood that failures will occur?

Detailed slides that cover the topics Sentara discussed as well as other handouts from systems in attendance are available from Margie Shofer at AHRQ (Marjorie.Shofer@ahrq.hhs.gov).

This document organizes the topics discussed into answers to three important categories:

- **Rolling out improvements:** Many good ideas never are implemented—even in systems that want to improve. This section provides practical suggestions on how to overcome these barriers to rolling out high reliability initiatives.

- **Working out improvements**: Sometimes the difference between success and failure is in the details of the initiative. This section discusses how to create and measure high reliability system changes that will work.

- **Spreading out improvements:** Innovations often are tried first in a single hospital within a system or even within a single hospital unit. This section summarizes practical ideas for helping to spread effective ideas across systems and units.

Rolling Out Improvements

Many specific and general ideas about what makes rollouts more successful were shared. Although some of these seem obvious, systems shared multiple examples of projects that failed or were slowed because they failed to do these things—or succeeded because they did do them. These ideas are divided into the following categories:

- **Preparing for a successful rollout:** making sure the system is ready for the initiative

- **Planning a successful rollout:** making sure you're solving the right problems with the right people

- **Sequencing and staging:** making sure the right things are done in the right order

- **Educating and communicating:** making sure the initiative is effectively introduced to staff

Preparing for Successful Rollouts

- Don't introduce interventions unless they are fully linked with policies and aligned with incentives for performance. Several systems expect all new initiatives to be linked to dashboards reviewed by executives or the board before the initiative can begin. Sentara and other systems also incentivize improvements in areas where they are looking to improve. For example, employee bonuses linked to improvements on behavior-based expectations (BBEs) for error prevention amounted to the equivalent of 2 weeks' pay. Effective alignment helps new initiatives get running quickly and effectively.

- Make sure there are clearly identified owners for all actions that are key to a successful implementation. Systems reported substantial improvements in performance when actions were assigned to specific owners. When an action is owned by a team rather than an individual, it is less likely to happen. Ownership occurs at two levels. For important actions, a problem owner is the operational staff person responsible for making something happen. There also should be an executive sponsor who can help overcome barriers that the problem owner can't resolve.

- Make sure that safety and quality issues are carefully linked to the operational issues. When quality improvement (QI) staff attempt to develop an intervention without close coordination with operational leadership, the project is unlikely to work. If operational and improvement planners work together to link their goals and processes, the project is more likely to have a successful start.

- If an improvement cannot be integrated into an ongoing initiative or process, do not try it. Until it is integrated it will not succeed. A key to high reliability is simplifying systems and processes so that they can be performed consistently. The more separate initiatives or processes that exist, the less reliable the overall system will be. Sentara and others avoid introducing new things until they've developed an effective way to integrate them into ongoing processes. For example, if administrators already are rounding to assess the patient experience, add safety assessment to this rounding so that both occur together. This approach also communicates the message that patient satisfaction and safety are equally important concerns.

- Negotiate in advance where savings from an innovation will go. This will ensure that resources that are freed up can support top priorities and will increase motivation by key people needed to make the innovation successful.

- Avoid having too many priorities. Cincinnati Children's stresses keeping a short priority list. The only way something goes onto this list is if something on the list is completed or removed. This plan ensures the focus new projects require. At the microsystem level, several systems use strategies that require managers to list all the things they are trying to do and then to classify these things based on what they can or cannot do. Management then must respond to these lists by setting priorities and making decisions about more resources. This is very difficult for managers but helps avoid starting new things that personnel think cannot be done (like many other things they already believe they cannot do).

- When planning new initiatives, make sure both time and people are built into the budget. When the dollars are there but key people lack the time to work on the project, it creates frustration and reduces success.

Planning a Successful Rollout

Solving the Right Problems

- Make sure the root causes of problems are fully understood. Bad root cause analyses in the past led Sentara to frequently have a twofold solution to whatever the problem was—reeducate the staff and develop a new policy, but neither had long-lasting effects. Better understanding of causes led them to identify the systemic issues that were the real reason for the mistake, which in turn led to better solutions that prevented recurrences.

- Assess the problem type or failure mode type (human error, organization and process, management systems, work environment, human factors, or equipment and medical device) before deciding on appropriate diagnostics and measurements. If you know a system is completely broken, analyzing root causes or developing performance measures is likely to be a burdensome waste of time. Focus energy on making the system reasonably reliable and then you can profitably measure it or assess the causes of problems that do occur.

Including the Right People

- The key to involving physicians is to avoid systems or procedures that make them more inefficient. Physicians do not mind changes in how they practice medicine if those changes make them more efficient (or at least do not make them less efficient). Involving them in the planning process is key to avoiding changes that they will perceive as making them less efficient.

- Involve all key players in developing solutions to problems or improvement interventions. This increases their buy-in and reduces the likelihood that important factors are overlooked.

Sequencing and Staging

- Start by simplifying policies and procedures to make it possible for staff to comply. Shortly after Sentara introduced BBEs, they began to simplify processes so that people could see that changes would not create a net increase in their workload. Gaining buy-in and appreciation for making jobs easier before adding new procedures or processes helps employees to not regard the new things as an extra burden.

- Roll out initiatives incrementally. For example, Sentara introduced and educated staff regarding the BBEs first before implementing Red Rules. To avoid the perception that Red Rules are a punitive activity, Sentara needed grounding in behavior accountability for error prevention.

- Introduce nonpunitive changes before changes that could be punitive. Sentara introduced BBEs before introducing Red Rules, because they wanted people to believe they could do

what they were supposed to before Red Rules were introduced. Without a culture that supports disclosure and questioning, introducing Red Rules could be counterproductive.

- Fix the processes before you try to automate them. Several systems observed that electronic medical records (EMRs) can be counterproductive if they simply automate processes that are not safe. So they have focused on making the processes safer (and simpler), which means that EMRs can be easier and more successful.

Educating and Communicating

- Focus communication strategies to address vertical alignment of specific and concrete behaviors with the overall organizational mission rather than on general themes. For example, messages to "be safer" are too abstract to produce needed behavioral changes while specific messages, such as, "Never disturb someone at the medication dispensing machine (medication distribution station)," are actionable.

- Build a culture that is supportive of improvements in safety and quality by developing stories and themes that resonate with staff. Because of its proximity to naval bases and nuclear power plants, Sentara staff relate well to the concept of "having a wingman" and to Red Rules and other techniques linked to the nuclear power industry. When new initiatives are linked to these common themes, buy-in is quicker.

- Since behavior change leads to culture change, make education as hands-on and nontraditional as possible. Unless training lets people model and act out desired behaviors (e.g., having a questioning attitude), it is unlikely to change behavior. Sentara has shifted their training approach to include a large hands-on learning component rather than just didactic content, which they are finding works better in achieving the changed behaviors required to become more reliable.

- Train people together as teams when introducing new processes or initiatives. This approach reinforces the need for them to operate as teams, allows for valuable role playing, and reinforces messages of equality and empowerment.

Working Out Improvements

Sentara provided a set of PowerPoint® slides that addressed their efforts in the following areas:

- How to transform themselves into a high reliability organization

- How to become more sensitive to operations

- How to become more preoccupied with failures and their future avoidance

Rather than duplicating these slides, which are available on the HRO Learning Network extranet and from AHRQ and Delmarva, this section highlights observations and challenges in these areas that came out of the discussion between system representatives.

Observations About Sentara's Transformation

- By looking outside health care to other industries such as nuclear power, Sentara was able to gain insight into a different approach to accelerating organizational improvement. They also acquired ideas and operational insights that have been essential to the improvements they are making.

- Rather than making the focus specific behaviors and processes, Sentara views both behaviors and outcomes as the product of shared values and beliefs (i.e., their culture). But Sentara has concluded that the way to create the right culture heavily depends on accountability for performing safe behaviors by all levels of staff.

- Different types of assessment tools have different functions. While common cause analyses of past events can help you understand past performance by looking for common themes, human factor analyses shed light on current performance. Cultural assessments provide the best insights into future performance by the system. Understanding the different roles these assessment types can play will help determine which are most appropriate to use in a specific situation.

- Sentara's assessment of past safety events led them to identify poor communication, inadequate attention to detail (especially on repetitive tasks), noncompliance with policies and procedures, and failure to recognize risk and use error prevention techniques as the primary causes. Other systems agreed that these factors were instrumental in safety events in their hospitals as well.

- If you can't reduce what you want staff to do into a limited set of clearly defined behaviors, your system will not be reliable. Sentara has created a set of BBEs for staff that are summarized on slides 11 and 12. For each expected behavior, there is a specific tool or technique to carry out error prevention.

- The process of building accountability around performance of BBEs in Sentara hospitals was associated with a substantial reduction in sentinel and other serious events. An important message to chief executive officers (CEOs) is that implementing BBEs was also associated with a substantial reduction in insurance claims linked to hospital errors. Sentara has sustained a reduction in claims from 25 million to between 10 and 15 million over a 3-year period.

- Measuring sentinel and other safety events is quite complex. Some systems reported experiencing an increase in reported events as they worked to make their cultures more transparent and attuned to safety issues. Other systems reported instances where a large percentage of some kinds of errors (e.g., medication) were not reported. There was general agreement about several issues related to measuring errors:

  - Measure both minor and major events so that both can be trended. In a punitive culture, both will be underreported. In a just culture, both will be reported more frequently, but major events should decline more substantially than minor ones.

  - Look for alignment between these measures and other indicators of safety. Sentara is more confident in their measures because their improvements on event measures correspond to reduced insurance claims.

- Consider measures that examine the ratio of major to minor safety events. Such measures may encourage reporting of small errors and allow hospitals to see whether the ratio of major to minor errors is declining over time.

- Recognize that measurements and results, such as those Sentara is reporting, don't just help to monitor progress toward safety. They are key to reinforcing a culture that values safety and is proud of efforts to improve it.

- Efforts to prevent errors become most powerful when the behaviors become habits that don't require extra work or thought. By converting these behaviors to habits, Sentara hopes to see an 80 percent reduction in safety events after a 2-year period in which they worked to make safe behaviors habits.

- While Red Rules are an extremely valuable part of a safety culture, there were several keys to using them effectively:

  - Precede the introduction of Red Rules with the rollout of BBEs. That will prevent Red Rules from becoming punitive.

  - Keep the number of Red Rules quite small. At Sentara each unit has two or three, although one initially proposed 29 Red Rules.

  - Focus on decision-based behaviors rather than skill-based behaviors. Things such as hand washing are important but aren't the best match for Red Rules.

  - Do not overuse Red Rules. Without caution, overreliance on Red Rules risks making people less attentive to detail. Stressing the continued need for professional judgment and introducing other rule types that require conscious decisions may help prevent this problem.

  - Introduce Red Rules to nonphysician staff first. A few systems reported trying Red Rules with physicians, but this requires substantial discipline and support from executive and physician leadership.

  - Recognize that much of the value of Red Rules comes from the staff discussion about what these rules should be. This forces staff to discuss potential threats to safety that exist in their unit and to identify which of those threats most require Red Rules to prevent them.

Sensitivity to Operations

High reliability systems pay close attention to operations. Weick proposes that by maintaining a high level of situational awareness, a system will be able to deploy resources at the appropriate time, understand the implications of a situation, and use this information to predict events that may occur in the future. Only by focusing on these issues will a system be able to reduce the number of errors likely to occur in the future. This section captures ideas shared by the systems on how to become more sensitive to operations.

- Making people more sensitive to operations requires making them more sensitive to relationships with other people. Because humans play major roles in the operations, they must be attended to in a highly reliable system.

- Daily check-in meetings are an effective way to maintain sensitivity to operations. Here are concrete steps to making them effective:

    - Be extremely consistent. At Sentara the meetings are never canceled and the time is never changed.

    - Make it a stand-up meeting. This will allow meetings to stay very short and focused.

    - Have a standing agenda. One hospital has a check-in package that consists of the nursing supervisor's report, the census report, and the operating room (OR) schedule. The agenda consists of:
        o Issues in the past 12 hours
        o Any pressing problems at present
        o Any anticipated problems coming up
        o Staffing issues
        o Flow issues
        o Facility issues

      For each hospital, the agenda would be different, but a standard agenda makes the meetings more efficient.

    - Make sure others know about the meeting so that they can show up and announce or raise issues or ask or answer questions.

    - Do not try to solve all problems raised at the meeting. Just acknowledge them and determine who will address them later.

    - Pick the right time for a meeting. One system has 3 a.m. bed analysis meetings to help plan for transports; other meetings occur at the start of each shift.

- Rounding by supervisors and administrators can strengthen sensitivity to operations. Suggestions for maximizing the value of rounding include:

    - Link it to the check-in meeting. An hour is set aside that begins with the check-in meeting and is then followed by rounding, which helps the people rounding to know specific things they should focus on.

    - Incorporate multiple purposes for rounding. While some places only round to focus on the patient experience, Sentara and other systems also focus on safety and use rounding to reinforce the values of teamwork and equality that they want.

- Consider unannounced rounds. Wishard is beginning to use these as a way to increase continuous sensitivity to operations and to prepare for changes in the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) inspection process.

- Action plans can be used to effectively deal with all types of problems. Sentara described level 1 and 2 action plans, borrowed from the nuclear industry, which stress that all identified problems need to have an owner and a plan for fixing the problem. Sentara has introduced these plans to ensure accountability and ownership and to ensure that someone is empowered to fix every problem that's identified. Suggestions for making these plans work include the following:

  - Every problem must have a single owner who is accountable for the problem and can delegate people and resources to fix it. Sentara saw considerable improvements when they began insisting that owners of problems be individuals and not groups.

  - Each action plan needs an executive sponsor who is expected to monitor progress on the activities and to intervene to address any obstacles the problem owner does not have the power or resources to fix.

  - Each problem must have a clear and short explanation and a goal.

  - High-level action plans (level 1) must list required actions in chronological order and be shared with the supervisor of the problem owner.

  - Level 2 action plans consist of more detailed actions that support each higher level action. These plans are developed and supervised by staff. Sentara has found that this process also helps to develop leadership skills.

  - Level 2 plans are the best way to ensure that safety and quality issues are aligned with operational issues. Plans that are developed by people in operational roles are less likely to cause conflicts between operational processes and safety processes.

  - To be most effective, plans should be tracked. Things that there are value in monitoring include:

    o Who is responsible for solving what

    o How many action plans are new, open, and closed

    o How long it takes for problems to be solved

    o How well the problem is resolved

  - Executive leaders should use the plans to set priorities and make sure too many things are not being taken on for them to be successful. Cincinnati Children's has a systematic review of all goals and actions within Microsystems. In some cases, low priority actions are eliminated or filed for later to help focus on the most important issues.

- Safety huddles can increase operational awareness. Sentara uses these huddles in units every 12 hours. This plan ensures that the unit is thinking specifically about safety issues at least twice a day as a team. The huddles are very short, lasting only about 4 minutes. A typical safety huddle allows people to comment on any safety issues they observed or were concerned about. They also allow people to comment on their own condition. If they're having a bad day, they can alert their peers and ask for extra attention. Sentara uses the wingman concept to legitimate this type of support for other members within teams.

- Behavioral observation and coaching help reinforce the behaviors that matter most. This type of observation is done by a trained coach, who provides immediate feedback on good or bad things they see and who enters the data into a database to immediately calculate a performance score. Keys to making this approach work include:

  - Simplify job expectations enough so that all key elements can be observed and employees can do all that they're expected to do. Too much complexity makes reliability impossible.

  - Link performance on the BBEs to bonuses. Alignment of incentives is regarded as essential for success.

  - Have appropriate people doing the observation and coaching. Sentara invests a considerable amount of time training these coaches, who need to be respected in their teams, be fully bought into the approach, be effective communicators, and model the BBEs for the unit.

  - Aggregate data that are collected into broader system measures that are monitored across the whole hospital. This reinforces attentiveness to these details by executives and helps set priorities for areas where more training, root cause analysis, or resources may be needed.

- System interruptions are a major cause of momentary losses in situational awareness. Sentara found that in some units, these interruptions were a major cause of errors. They've tried a range of things to both reduce the number of interruptions and to help staff recover from interruptions without causing errors. Ideas discussed for accomplishing these aims included:

  - Identify the causes of interruptions and then redesign systems to reduce these interruptions. For example, Sentara's microbiology and serology unit had many interruptions and errors caused by them. They found that phone calls were a major cause and redesigned processes for handling these calls to reduce the number of interruptions.

  - Develop standardized processes for recovering from interruptions. These include processes to ensure that the person resumes the task in the right place and processes for self-checking when resuming a task. Sentara has seen substantive reductions in interruptions in these units since putting these processes in place.

- Properly divide the responsibilities of workers and managers. Managers are responsible for creating and enforcing processes that minimize interruptions. Workers are responsible for following the correct procedures.

- Measure system interruptions and other stressors. In areas where interruptions often cause errors, such as drug dispensing, counting the number of observed interruptions or other things that can stress the system is a good idea. Sentara has put red tape around the medication dispensing machines to warn people not to interrupt the person who is using them. Such interruptions also are a Red Rule in these units and everyone is trained to challenge anyone who may be causing an interruption or distraction.

- Stress the need for all staff to avoid interrupting others and to challenge others who do. This reinforces equality and teamwork.

- Share stories about near misses, mistakes, etc., so that the values are constantly reinforced.

- Consider sharing data. Some hospitals are posting data on key indicators publicly, while others didn't feel they were ready for this. There was agreement that data should be shared with leaders before posting it in any form.

- Hand hygiene remains a major problem in many hospitals. One system took samples from staff members' hands and posted pictures that showed the types of bugs people were carrying. These pictures had a positive effect on efforts to improve hand hygiene.

- Sometimes mistakes happen when equipment made by different suppliers can be mistaken for other things that can be dangerous when used by mistake. Several of the systems keep records of these types of mix-ups and are working actively with the manufacturers so that these types of mix-ups can be eliminated.

Preoccupation With Failure

High reliability systems are preoccupied with things that can go wrong and things that have gone wrong. Only by focusing on these issues will a system be able to reduce the number of errors likely to occur in the future. According to Weick, high reliability systems encourage people to report errors and examine and talk about errors and near misses so that they can learn from them. They also are constantly alert to the risks that accompany avoiding errors, such as complacency, the temptation to reduce safety margins, and the tendency to do things automatically without thought. This section captures ideas shared by the systems on how to become more preoccupied with failure.

- Sentara and other industries it has learned from use three strategies to reduce complacency:

  - They continuously raise their standards so that what has been good enough is no longer good enough.

- They look to other units and industries for benchmarks. Almost always they find others who are doing things better, which helps drive efforts for continued improvement.

- They use quick and continuous feedback and reinforcement.

- Part of preoccupation with failure is constantly looking at things that went wrong or almost went wrong to find out their causes and improve systems to circumvent the problem. While all hospitals use root cause analysis (RCA), discussion focused on how to maximize the value of these activities, including:

  - Use common cause analysis to aggregate learning from near misses and other less serious events. While RCA is very detailed, a common cause analysis looks for recurring themes (e.g., interruptions) that may have caused a number of events.

  - Use various analytical tools. Sentara uses a less detailed tool of apparent cause analysis to learn from events that are less serious and don't require a full RCA. This approach stresses the need to pay attention to potential problems before they even happen.

  - Make the final step in an RCA an evaluation to see whether the changes designed to prevent a recurrence are working. RCA often stops short of this step, which can make the process seem less valuable to staff.

  - Don't waste time on RCA when you know a system or process is badly flawed. Use the same time and resources to make improvements that you know are needed. When the system is improved, you can then start studying errors more closely.

  - Make sure that the RCA process is owned by staff in operations roles, not QI or safety. Staff in operations know the processes that are really used as opposed to those that may be documented. If they own the process, the solutions they develop are more likely to be workable.

  - Make sure RCA goes all the way back to the management system failures. Without this, it is too easy to blame staff and ignore systemic problems that will cause staff to repeatedly fail.

- Track déja vu errors, which are errors that have happened all over again. These are important because they can help identify where the process for fixing errors has failed to work. Tracking these errors also reinforces the message that solutions to problems do not guarantee that the mistake will not occur again.

- Focus and simplify work processes. There was widespread agreement that staff have too many policies and procedures to consistently follow—or even to recall that they exist when the policy or procedure is relevant. Simplification is at the core of greater reliability. Suggestions for focusing and simplifying included:

  - Have job aids at the site of a specific task as a substitute for policy and procedure manuals on shelves that people cannot easily reference when they need to know how

to do something. Jobs are complex and staff can be more reliable if they can easily access guidance exactly where they need to use that guidance.

- Develop short handouts that address key issues. Sentara has developed a one-page BBE document related to safety. It summarizes five key concepts required for safety (and is posted on the portal). By doing that, they distilled what was a very large number of documents and policies into something employees could remember and do.

- Make sure that cures match problems. Many times rules are overly complex because people do not really understand the problem. Sentara divides errors into three types: skill-based errors, rule-based errors, and knowledge-based errors. Each error type has a specific type of response.

- Define the process of simplifying processes as a leadership responsibility. Leaders are responsible for making sure that they've designed work processes that make it easy for employees to do the right thing. For example, Sentara put red tape on all the ventilator plug outlets to make sure that they were always plugged in correctly. Although leaders are in charge of simplifying, they can get very good ideas on how to do this from their staff—especially after they've established a climate that encourages sharing ideas.

- Look to simplify all types of rules. One system reduced 70 critical care procedures to 10, making it much easier for the rules to be followed.

- Develop focus and simplification experts to help on key projects. It is not easy to do this, and without expert help, efforts can fail. Sentara has experts who help units get started on simplifying forms. In the process, they train and mentor others who may become experts to help other units.

- Make sure all the key players review the new processes and are comfortable with them. Involving them in the simplification process will increase the likelihood of rapid acceptance.

- Ensure that the changes are translated into work practice, which is the key (and biggest challenge).

- Use Red Rules effectively. While Red Rules are an extremely valuable part of a safety culture, there were several keys to using them effectively. These keys are described in the "Observations" section, last bullet.

- Commit to training staff of all types to champion and support all these efforts. Sentara has worked to develop a pool of staff with training in Lean manufacturing principles, Six Sigma®, and human factor approaches. No single approach was enough to give them a full toolkit for taking on problems of all types.

Spreading Out Improvements

Because all participants represent systems that encompass multiple hospitals and other care settings, spread is a significant challenge. During the day, several types of spread were discussed and a range of options were shared. This section addresses ideas and recognized challenges related to spreading:

- Across units within the care setting

- From nurses and other staff to physicians

- From one setting where an improvement has been made to other hospitals or parts of the system

Spreading Across Units

- Aggregating and sharing data sharing across the hospital has been used by several of the systems to raise awareness of key issues and to motivate other units to improve to a standard being set in other units.

- Stories were regarded as key to spreading ideas. Specific ideas related to sharing stories effectively included:

  - Capture people doing good things and share those stories. Stories about staff who challenged violations of Red Rules with positive outcomes have to reinforce the message that safety is everyone's job and anyone can be asked about an issue of concern. One such story was about a transporter who observed that the blood he was delivering looked different from the blood delivered the preceding day. That led to a discovery that the blood had been irradiated one day but not the other and to the prevention of a serious mistake.

  - Talk openly about mistakes and near mistakes to reinforce the message that they can occur everywhere and that they should be acknowledged when they occur. This was regarded as essential to creating a high reliability culture across the whole organization.

  - Share stories from and about all types of staff and from patients to help reinforce the principle of equality and teamwork.

  - Share success stories. Success stories (and data) make staff feel good about what they are achieving and create a context in which other units are more willing to try similar types of improvements.

  - Tell success stories about processes, not just outcomes. For example, stories about how the implementation of a new procedure had saved time rather than created more work convey an extremely important message.

  - Make it a habit to begin all staff meetings with a safety-related story. This communicates the importance of a safety focus.

Spreading Improvements to Physicians

Every system present agreed that developing and implementing HRO concepts for staff other than physicians was much easier than doing the same thing with physicians. Each system acknowledged that their efforts with physicians were much farther behind. This section shares ideas related to involving physicians in high reliability activities.

- Do not try implementing changes focused on physicians without very strong executive and physician leadership. The few success stories that were shared involving physicians all occurred where strong leadership support existed.

- Begin by making successful changes that involve other staff. These successes increase the willingness of physicians to try them. One hospital in Sentara's system is introducing Red Rules for physicians, but this is still a work in progress.

- Avoid changes that make physicians feel more inefficient. There is a greater willingness to change when physicians think they are becoming more efficient—even if it may involve some loss of independence.

- Allow physicians to violate some rules based on their clinical judgment—but only if they document the reason for the exception. Some systems felt that allowing these types of exceptions also encouraged the mindfulness required to be an HRO.

Spreading Improvements Across Systems

No system was satisfied with their efforts to systematically and quickly spread improvements across their facilities. However, several approaches were identified that facilitate this type of spread:

- Sharing data systemwide can be effective in creating awareness of performance differences between hospitals. If improvements are substantive and effectively measured, this can create demand for those improvements so that other hospitals can achieve similar improvements.

- Creating informal and even formal settings for peers from different facilities to network and share ideas with each other can help spread good ideas. A number of improvements that have spread in Sentara have occurred because of informal discussions between peers.

- Some systems have tried formal rollouts from one hospital to others in the system. It was not clear whether these efforts worked better than spread that occurred informally.

- Seeing where spread may be occurring informally and then supporting those efforts with well-trained staff was a strategy that appeared to work well. This ensures that the interest in change already exists and maximizes the impact of the trained staff.

Appendix B: High Reliability Organization Learning Network Operational Advice From the Exempla Healthcare Site Visit

Overview

This appendix summarizes practical suggestions on how to move toward high reliability using "Lean" concepts. These concepts have been adapted from Toyota Motor Company's practices and culture that it developed over the second half of the past century. Lean concepts have been applied by a number of innovative health care systems. Both Exempla Healthcare (who hosted the site visit) and Denver Health are using the Lean approaches and have learned a great deal about the challenges and opportunities they present. Most of the examples in this document were drawn from Exempla Lutheran Hospital, a 400-bed facility in Denver, Colorado.

Ideas are organized into three general categories to make locating information of most value to you easier:

- What is Lean thinking (in a nutshell)?

- What are the preconditions for using Lean concepts and tools effectively?

- What examples exist of improvements that can be achieved using these concepts and tools?

Slides from Exempla's presentations as well as other materials related to the use of Lean thinking in health care are available on the HRO Learning Network extranet and from AHRQ and Delmarva staff.

What Is Lean Thinking?

Lean thinking is an interpretation of an organizational philosophy that evolved within the Toyota Motor Company over the last half of the 20th century. The motor company's application of its own Toyota Production System (TPS) has resulted in unparalleled success. In this document, the terms *Lean* and *TPS* are used interchangeably. Understanding the tools, leadership behaviors, and cultural underpinnings that led to Toyota's success have been elusive. A few scholars have recently contributed to our understanding of these elements. For example, Jeffrey Liker, in his book *The Toyota Way*, described 14 management principles.[1]

Although the term *lean* suggests that the core focus of this approach is increased efficiency, the true focus of "Lean" is on evolving to a state in which work processes relentlessly emphasize eliminating waste. *Waste* is defined as acts that do not add value to customers and includes wasted resources, time, and human spirit.

Like Alcoa (one the most successful adopters of the TPS), Exempla chose safety as the first area for application of Lean strategies for its hospitals. That is, Alcoa chose employee safety; Exempla chose patient safety. In both organizations, the leadership realized that the economic connotations of Lean as a cost-cutting strategy could lead employees to reject the approach out of hand. Instead, Exempla emphasized that standardizing work processes and minimizing

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[1]Liker, J. The Toyota way: 14 management principles from the world's greatest manufacturer. New York: McGraw-Hill; 2004.

variation, as embedded in Lean tools, would result in safer care. Further, by corralling employees around a morally unquestionable goal (safety), the essential culture and leadership principles are more likely to take hold. Thus, Lean principles were introduced as a tool for ensuring safer care rather than cheaper care.

Exempla shared its recognition of the many areas of overlap between Lean principles and hospital models to increase safety, quality, and reliability. As shown in Table 1, the four key concepts of the TCP correspond to hospital models for increased safety and quality.

Table 1. Four Key Concepts Between Lean Principles and Hospital Models

Lean Principles	Hospital Model
Continuous improvement driven by the frontline team	Malcolm Baldrige Pursuit, Shared Governance
All work focused on customer needs	Patient-centered care
Eliminating waste	Eliminating waste of time, lives, materials
Eliminating defects	Eliminating medical errors

Several key emphases of Lean principles are reflected in Table 1:

- Although leadership action, teaching, and support are essential, operational change is driven by the frontline staff who best understand the processes that need to be improved.

- Rather than organizing work processes to accommodate physicians, nurses, ancillary departments, or other hospital needs, Lean stresses the need to make the customer or patient the *starting point* for all process design, with all subsequent decisions guided by the notion of narrowing down all actions to only those that the patient deems valuable. Examples of occurrences that the patient does not perceive as valuable include waiting to be seen, getting a hospital-associated infection, not having a medication when needed, and so forth.

- Lean stresses the need to continuously drive both waste and defects out of processes. This includes not only lost lives and resources, but also lost human potential that can be applied more usefully to providing better care if waste and defects are eliminated.

The remainder of this document discusses what Exempla and other systems have learned about how to succeed in applying Lean concepts to their efforts to become a safer organization. It starts with key success factors and then provides examples of how Exempla has applied Lean concepts and tools to the hospital.

What Are the Preconditions for Successful Applications of Lean?

Members of the Exempla team stressed that they found no magic checklist for applying Lean concepts or tools with certain success. Experience, persistence, and effective execution help, but using Lean is not easy. That said, there are some factors to consider before even starting a Lean-driven initiative. Many of these preconditions are applicable to a broad range of strategies and tools you may use to transform your system into one that is highly reliable.

Leadership

Although committed leadership is essential for success, Jeff Selberg, CEO at Exempla Healthcare, noted that in many cases, commitment still does not lead to the desired results. His assessment is divided into two sections:

- What leaders must understand
- How leadership should be assessed

What Leaders Must Understand

Creating a culture of safety requires that leaders understand three things:

- Why and how systems currently function
- A vision for how to arrive at the desired end state
- The resolve to carry out the transformation

  Organizational leaders must fully understand what the organization is and why the organization is what it is in order to generate clarity about its current and desired state. Only with this clarity can transformation occur.

- Creating a high reliability organization that is safe requires that leaders recognize the following:

  - **Culture is the foundation for vision and strategy.** A culture characterized by fear and self-protection will not lend itself to openness, learning, and improvement.

  - **Transparency is the key to change the culture.** An unwillingness to face and share the hard facts is an indicator of denial, and denial is not compatible with a safe environment.

  - **Safety must be the overarching strategy.** Safety should be the root cause of achieving efficiency and effectiveness. If the inverse of this relationship exists, the likelihood of having unsafe yet highly efficient processes increases. Only if safety is the starting point can the correlation among safety, efficiency, and effectiveness remain positive.

  - **Leaders must take ownership for setting the climate and focusing the work.** Generating clarity, setting the example, and demonstrating confidence will help to transform organizational culture. However, without outright acceptance of ultimate accountability for setting organizational direction, a leader's vision will not be legitimized in the eyes of his or her followers.

How Leadership Should Be Assessed

- Leadership actions must clearly support the vision laid out for the desired state of the organization. Priority setting and adoption of a learning organization mentality are only valuable if both are truly used to guide the decisionmaking process.

- One way to assess whether leadership decisions are aligned with stated priorities is to track management-based sentinel events. As much as leaders promote evidence-based medicine, they must also promote evidence-based management practices. Decisions based on environmental pressures and fear of market retribution do not illustrate a leader's commitment to the priorities he or she outlined and do not illustrate alignment.

- In gauging success as a leader, the following key questions can be used as a guide:

  - **Are you committed to your own growth as you grow your organization?** Your organization's ability to transform and improve is directly correlated to your ability as a leader to transform and improve.

  - **Are you creating the environment so that the right and, most of the time, the wicked questions are asked?** It is not your role to have an answer for all of the questions but, rather, to create an environment where the right questions are asked and greater personal and organizational awareness are achieved. Asking these types of questions may feel risky, but the result will be a greater organizational tolerance for diversity of thought.

  - **Are you engaging in patient-centered versus ego-centered conversations?** You must take yourself out of the center of your strategy and replace yourself with the patient to ensure that you are protecting your patients first and foremost. A great deal of self-awareness is required to know where you are in every conversation.

  - **Are you embracing challenges that stretch your capacity as a leader?** Your approach must be that every situation, no matter how challenging, is the perfect opportunity to learn, grow, and meet long-term objectives.

Just Culture

A just culture is one where people can report mistakes, errors, or waste without reprisal or personal risk. This does not mean that individuals are not held accountable for their actions, but it does mean that people are not held responsible for flawed systems in which dedicated and trained people can still make mistakes. A just culture that promotes sharing and disclosure is a precondition for using Lean because it depends heavily on frontline staff to drive improvements. All staff must feel empowered to identify errors, defects, and system failures that could lead to an unsafe environment for patients.

Alignment of Lean With Organization Goals, Performance Reviews, and Organization Resources

- **Lean applications must be aligned with the organization's core values and mission.** This is why Exempla's first applications of Lean were to strengthen patient safety rather than to save money.

- **Lean should be aligned with performance reviews for both people and units.** Exempla is just starting this process but has already seen the value of this alignment. Currently, some training in Lean is required of certain staff, and completion of this

training is a component of the performance review. A substantial pay-for-performance component exists in the physician contracts.

No Overcommitment of Resources and Staff

Exempla has recognized the importance of understanding its capacity for quality improvement efforts at the organizational and microsystem level.

- **Too many initiatives can overwhelm frontline staff who are working diligently to provide safe care.** Exempla has coined the phrase, "Get it right for every patient, every time," and encourages frontline staff to consider patient safety one patient at a time.

- **At the organizational level, there is only so much capacity for change.** Exempla has realized that the threshold for change depends on many things, such as staff, facilities, timing, and funds. When staff members are recruited to participate in intensive system redesign activities, Exempla finds replacement staff for them during that period. Without this, it is unrealistic to expect that efforts will succeed.

- **Extensive research on Lean should occur before implementation and the initial focus should be kept small.** Exempla's capacity to use Lean was expanded to other areas as efficiencies were gained.

Extensive Communication at the Organization and Microsystem Levels

- **Communication is key throughout the organization.** Exempla has struggled with explaining the term *Lean* to staff, as it may be misconstrued with reducing the workforce or changing a job or job description. This can prove problematic when getting frontline staff to be actively involved in Lean because people are hesitant to participate in efforts that may lead to the loss of their job or a change in their job description. The pharmacy department currently is coping with low morale from technicians whose physical location and job description have been changed due to recent efforts using Lean.

- **Including only some frontline staff in quality improvement efforts may be a struggle.** Exempla's pharmacy department has found that some frontline staff feel left out when one individual is representing the team on a Lean initiative. This has led to a need for improved communication.

Change Management

- **Change management training is important to leaders in Lean.** Many frontline staff are placed in difficult positions as change agents, often feeling the brunt of negativity from other colleagues who are not as involved.

- **One key to successful change management is avoiding taking on tasks that are too large.** One of Exempla's first applications of Lean was to redesign patient flow. However, it quickly found that this process was too complex, and the effort bogged down. To succeed, changes needed to be limited to manageable chunks, particularly when just starting to use Lean tools.

How Can Lean Be Used?

This section captures ideas about how Exempla applied its overall Lean strategy and summarizes, through examples, how it used the strategy.

Overall Strategy

Health care organizations have used several approaches to implementing Lean principles. Exempla has elected to use "Kaizen Events," which involve selecting a specific process for improvement and identifying a team to spend one week studying, redesigning, and deploying a new Lean-inspired process with the guidance of a corporate facilitator. These Kaizen Events involve three key components:

- Planning
- Change processes
- Appropriate tools

Planning

During this phase, a multidisciplinary team is first formed to work on the quality improvement initiative. Exempla found that these teams should include 8 to 10 people.

- About one-third of the team should be directly affected by the outcomes of the change because they are most knowledgeable and motivated.

- One-third should be leaders in their units, whose opinions and choices will be respected by their peers.

- The remaining third should include individuals from multiple disciplines involved in the process. Exempla also has found value in including one or two outsiders, called "spotters," who have no familiarity with the process. The role of spotters is to:

  - Be an advocate for team members.
  - Help others to ask the question behind the question.
  - Help to mitigate unintended consequences.
  - Challenge assumptions and assist others to voice concerns.

Second, before a Kaizen Events team is convened, the Exempla facilitation team spends several weeks preparing. An example preparation checklist is found at the end of this appendix.

Third, a Value Stream Analysis, which is the flow of steps that result in a specific output, is conducted. Multidisciplinary teams at Exempla use Post-it notes to outline the flow on a conference room wall to facilitate structuring the analysis. The Value Stream Analysis has two components:

- **Current state analysis:** This analysis outlines which steps in the process are value added and which are not needed to achieve the desired objective from the patient's perspective.

- **Future state design:** This component lays the groundwork for next steps. It identifies the quality improvement initiatives, including the very small (do-its), the medium (events), and the large (projects). This component also considers the upstream and downstream impact of the initiatives as well as the proper sequencing and prioritizing of these initiatives.

Change Processes

Following the planning component, the quality improvement initiative is implemented. The Lean quality improvement initiative is called a Kaizen (Kai = change, zen = good) Event. These rapid-improvement events involve multidisciplinary and interdepartmental teams, including frontline staff.

A Kaizen Event comprises the following steps:

1. Three weeks of preparation: topic, team, targets.
2. Five days of rapid, focused team action.

   - Day 1: Study current state.

   - Day 2: Redesign to a future state.

   - Day 3: Test and implement changes.

   - Day 4: Develop standard work and plan for implementation.

   - Day 5: Present and communicate.

3. Three weeks of followup: mentoring, monitoring, measuring.
4. Ongoing monitoring. Exempla has found that changes need to be studied 30, 60, 90, and 120 days from implementation. Longer periods are needed to understand the true impact of the change. Exempla also has found that this process rarely leads to the ideal future state. Instead, it may take several iterations to get gradually closer to the final goal.

Appropriate Tools

A range of tools and concepts are considered when developing and implementing a change. Potential concepts and tools are summarized in the next section and described in much greater detail in other sources. Failure to select the right tools is one reason change processes fail.

Examples of Implementing Lean Concepts and Tools

For a glossary of Lean tools, visit one of the following Web sites:

- http://www.shopwerkssoftware.com/lean_glossary.aspx
- www.tpslean.com/leanglossaryall.htm

The following are examples of using Lean. Many relate to the pharmacy department because it has had supportive leadership to drive the redesign process. Exempla has attempted 16 Kaizen Events, with 60 percent achieving positive results. As the examples show, further progress often is still needed.

Specimen Processing Improvement

Challenge. The laboratory at Exempla receives 127 specimens per hour. Each specimen is matched with orders, recorded into the computer system, and prepared for distribution to testing sites. The laboratory found that 35 percent of specimens arrived without orders, causing these to be reworked and the patient and specimen to wait.

Objectives

- Redesign the Specimen Processing workstation.
- Create process flow, standard work, and an organized and improved work area.

The Laboratory team used the following tools and concepts to meet the objectives:

- **Six S** to organize and redesign the space:

  1. Sort out: Get rid of what is not needed.
  2. Straighten: Organize what is needed (visual management).
  3. Scrub: Clean up (see and solve).
  4. Safety: Address unsafe acts, conditions, and motions.
  5. Standardize: Establish who, what, and when for upkeep.
  6. Sustain: Be self-disciplined and care.

- **Standard work,** or process, for all procedures
- **Work flow** for processing specimens
- **Eight wastes:**

  1. Overproduction: rainbows on ED patients
  2. Overprocessing: retesting
  3. Excess inventory: batching lab samples

4. Defects: redraws

5. Unused employee creativity: grassroots improvement

6. Excess movement: too many handoffs

7. Excess transport: delivering specimens

8. Waiting: ED for test results

Metrics and Results

- Redesigned Specimen Processing workstation using six S.

- Created more workspace (increased counterspace by at least 33 percent), an organized area, and flow of work in L-type shape—the HIGHWAY.

- Created visual workspace and reduced inventory.

- Moved equipment to aid in flow for specimen processing, phlebotomy, and hematology.

- Wrote standard work for specimen processing for all procedures.

- Learned one important lesson about the need to involve all shifts in the redesign. Night shift staff members were not included initially, and they did not like or understand the changes, which they promptly undid. Further discussions with the night shift were needed to obtain agreement and understanding.

Chemotherapy Process Improvement

Challenge. Problems were identified with providing chemotherapy treatment to adult patients in the oncology unit. This improvement was prioritized as very important due to the high risk related to chemotherapy. Problems existed in the following areas:

- **Storage and procurement:** drug not available or limited strengths, look-alike–sound-alike drugs stored together

- **Prescribing:** lack of standardization, abbreviations causing errors, illegible handwriting, look-alike–sound-alike prescribing, no weight, poor fax quality

- **Transcribing:** errors on medication administration record

- **Pharmacy review and order entry:** labs not available; references not current; errors in order entry; height, weight, and body surface area not available; no alerts to prevent errors

- **Preparation and dispensing:** mislabels, such as wrong drug, diluents, and volume; check process inconsistent; nurse unable to find where the drug was delivered

- **Administration:** inconsistent check process

- **Monitoring:** missed vitals and monitoring parameters

Objectives

- Map out details of current process.
- Label steps as value added or waste.
- Review concepts of error proofing.
- Create ideal state.
- Create future state.

The Chemotherapy team used the following tools and concepts to meet the objectives:

- **Identification of waste:** reduced interruptions (change location of chemo preparation).
- **Error proofing:** standardized chemo orders, up-to-date references, competency, standardized checklist for pharmacist and nurses
- **Standard work:** medication locations, chemo medication administration record in same sequence as administration, improved pharmacy–nurse communication

Metrics and Results

Safety Metrics

Metric	Baseline March 2006	Followup September 2006
Abbreviations (avg. #)	3	2
Standardized order sets (%)	0	80
Illegible orders (%)	56	28
With diagnosis (%)	78	91
Protocol (%)	9	81
Weight/body surface area available (%)	16	47

- While early results are promising, Exempla commented that the results are still not at their target.
- More than one cycle of Lean will be performed and additional tools may have to be applied to improve the process and decrease abbreviations and improve order legibility.

Staff Satisfaction Metrics: Nursing

Metric	Baseline March 2006[a]	Followup September 2006[a]
Overall satisfaction	2	4
Comfort with chemo process	4	4
Safety of process	4	3
Orders clear and understandable	2	4

[a]Pharmacy survey: 1 = worst/never, 5 = best/always.

- The drop in the nurses' perception of safety may be because the nurses were not completely aware of all the potential for error at the time of the baseline measurement and their awareness was heightened through the Lean process.

Medication Dispensing Machine

Challenges. The following problems were identified with the use of medication dispensing machines on the floors:

- Three separate medication dispensing machines existed on each floor.
- Each medication dispensing machine had different inventory, and there was no way of knowing which machine had the medication the nurse was looking for.
- All three medication dispensing machines were located away from the patient care areas.
- Some medications that looked alike or sounded alike were placed next to one another within the machines.
- Inventory within the medication dispensing machines was difficult to manage.

Objectives

- Reevaluate standard medications.
- Determine inventory needs based on usage.
- Redesign medication dispensing machine locations to improve nursing efficiency.
- Establish a process for separating high-risk medications.

The medication dispensing machine team used the following tools and concepts to meet the objectives:

- **Gemba walk:** moved the medication dispensing machine to its own room so that it was easy to locate
- **Create standard work for medication dispensing machine maintenance:** consolidated the three medication dispensing machines to one
- **Reduce wastes:** decreased number of stock-outs
- **Reduce wait or delay of care:** standardized medication delivery times to the medication dispensing machines and decreased the time until the medication was available for administration
- **Waste in motion (nurse):** reduced the distance that nurses had to travel to access the medication dispensing machines
- **Overprocessing:** changed inventory to meet the needs of the patients instead of stocking excess medications that did not get used

Metrics and Results

Medication Dispensing Machine Team Results

Metric	Baseline	Result	Comments
Inventory reduction	3 machines: $16,163.59	1 machine: $8,276.26	$7,887.33 reduction
Number of medications sent to ICU (3 days)	255	184	28% decrease
Number of medications in medication dispensing machine not used	362	136	62% decrease

- Consolidated medication dispensing machines from three to one

- Decreased the distance traveled by nurses to access medication dispensing machine

- Decreased stock-outs

- Changed inventory to meet the needs of the patients

- Decreased the time until the medication was available for administration

- Still working to ensure that only one medication at a time is being removed from the medication dispensing machine

Patient Transfer Process

Challenges. The following problems were identified with the patient transfer process between floors and to testing areas:

- Communication was lacking about patient ready-for-transport status; patients not ready for transport resulted in delays.

- Patient transportation log did not exist.

- Patients were not placed on monitors when returned to room.

- Isolation precautions were not followed during transport and testing.

- Transport equipment storage was lacking on units.

Objectives. The transfer process team outlined the following objectives to address the problems with the transfer process:

- Improve the handoff of patients between transporter and requester.

- Review the communication process between transporters and requesters.

- Evaluate the transport process.

- Develop script for transport team members.

- Determine how to add in-house transfers to current workload.

The Transfer Process team used the following tools and concepts to meet the objectives:

- **Visual workplace:** use of transport safety checklist sticker to identify patients ready for transport
- **Standard work**
- **Gemba:** creation of central dispatch station to control all in-house transfers

Metrics and Results. The transfer process team expects to achieve the following results:

- Improved flow from more efficient communication
- Decreased wait times pre- and posttest

Overall Process Redesign Lessons Learned

- Even a seemingly simple process can be very complex.
- Mapping out the discrete steps in any process can highlight additional challenges and problems not previously identified.
- The team needs to dig deeper (collect more information on all aspects of event) before the event and consider increasing the planning time.
- The team has to have a reason to buy in for change.
- All team members need to be unified about the purpose before the event starts.
- There never is too much communication among team members.
- The scope of work must be kept manageable.
- Frontline staff should be responsible for deciding what changes need to be made.
- Required engagement of various physician groups and physician availability are a challenge for the dedicated time needed to complete an event.
- Patient-centered solutions can help to keep the team on track.
- Solutions can be reached more quickly by pulling together a multidisciplinary team.
- Staff members must remember to listen to others before speaking.

Rapid Improvement Checklist

Team: Date of Event:		
6 Weeks Before Event Due Date	**2 Weeks Before Event Due Date**	**1 Week Before Event Due Date**

Project Planning
1. ❑ Select area and topic.
2. ❑ Determine coleader and team members.
3. ❑ Complete Team Charter.
4. ❑ Ask a few hard questions, e.g.:
  — Will this team improve your value stream?
  — Will this team improve the area's key measurements?
5. ❑ Prepare the business case for this improvement event.
6. ❑ Define the objectives and deliverables expected from the event team.
7. ❑ Define the measurements and targets for the team. Make sure there are only three or fewer key measurements.
8. ❑ Review action deliverables, measurements, and targets with the external or internal consultant. Revise if needed.
 	
Details
9. ❑ Schedule event team meetings for next 2 weeks.
10. ❑ Schedule meeting to educate stakeholders (ssc/managers/directors of involved departments).
11. ❑ Send invitations to join to team members.
 	
Schedule Team Meetings
	Project Planning—Develop Plan To Gather Current State Data
	1. ❑ Determine actual customer demand.
	2. ❑ Determine backlog or wait times.
	3. ❑ Determine actual output.
	4. ❑ Determine total hours worked to create this output.
	5. ❑ Calculate productivity: output/total hours worked.
	6. ❑ Calculate relevant cycle times.
	7. ❑ Determine top 5–10 problems.
	8. ❑ Review occurrences/complaints in the past 12 months, if applicable.
	9. ❑ Review customer and patient satisfaction comments. List top five issues from complaints, rework, and delays.
	
	Communication
	10. ❑ Post announcement about rapid improvement event date, time, and focus.
	11. ❑ Put up a blank flipchart to get suggestions/feedback. Ask questions, clarify, and put these ideas on a list.
	12. ❑ Discuss rapid improvement event in staff meetings. Explain objectives, measurements, and targets.
	13. ❑ Review and confirm team members. Confirm entire week commitment.
	
	Team Meeting
	14. ❑ Team introductions
	15. ❑ Why are we here? What is the scope?
	16. ❑ Lean orientation
	17. ❑ Event schedule, measurements, targets, and action deliverables
	18. ❑ Business case and Team Charter
	19. ❑ Tasks to team for data preparation
		1. ❑ Resolve open items.
		2. ❑ Define clearly the boundaries of the event:
		  —Who are the customers? What are the outputs? What triggers the area to do something for a customer?
		  —Who are the suppliers? What are the inputs?
		  —Prepare additional flowcharts, spaghetti diagrams, layouts, and time studies, as needed.
		3. ❑ Brief the consultant.
		4. ❑ Prepare supplies and logistics for the team:
		  —Locations and schedules
		  —Food, supplies
		
		Team Meeting
		5. ❑ Review measurements, targets, and objectives.
		6. ❑ Review data collected to date.
		7. ❑ Ask for feedback; try to address concerns.
		8. ❑ Reinforce what's in it for them.
		9. ❑ Establish group norms.
		10. ❑ Discuss roles of team members during week.
		11. ❑ Reconfirm scheduled commitments with each team member, supervisor, etc.

Appendix C: High Reliability Organization Learning Network Operational Advice From the Cincinnati Children's Site Visit

Overview

This appendix summarizes practical suggestions on how to transform an organization by creating an infrastructure for supporting improvement initiatives geared toward making the organization more reliable. All ideas reflected in this document were suggested by representatives of Cincinnati Children's Hospital Medical Center and other health care systems attending a site visit as part of the AHRQ-sponsored High Reliability Organization (HRO) Learning Network.

Cincinnati Children's is a world-class facility, with an endowment of more than $1 billion, more than $900 million in research contracts and grants, and a history of innovation that includes a Robert Wood Johnson Foundation (RWJF) Pursuing Perfection grant. As a prestigious children's hospital, Cincinnati Children's attracts 50 percent of its patients from outside its service area.

Participants in the site visit were interested in how Cincinnati Children's is transforming itself into a national leader in quality improvement and safety initiatives, as well as how its efforts could be adapted to different systems.

This document synthesizes the site visit discussion to answer several key questions about organizational transformation toward high reliability:

- What does it mean to transform a hospital using high reliability concepts?

- How can an organization build a business case for organizational transformation and quality?

- How has the broad commitment to organizational change been translated into specific initiatives to improve patient care and the patient experience?

- What can be learned about how process redesign efforts can drive organizational transformation?

The discussion of these questions relates specific activities and initiatives to a framework for high reliability organizing. In addition, specific examples are provided to help illustrate the tangible impact of a commitment to organizational transformation. Finally, by focusing on change processes and not just end products of improvements, other systems can understand the processes that led to Cincinnati Children's improvements and be better able to take these insights and create processes that will work in their own systems.

Other materials that were shared at the site visit, including slides from the presentations and other examples of improvement materials, are available on the HRO Learning Network extranet and from AHRQ and Delmarva staff.

Organizational Transformation

Although Cincinnati Children's has been nationally prominent for many years, the organizational commitment to fundamental improvement is less than 10 years old. When Cincinnati Children's received the RWJF Pursuing Perfection grant in 2001, it lacked a comprehensive quality improvement strategy or clear understanding of where its improvement efforts should be focused. The IOM Report *Crossing the Quality Chasm* provided a conceptual framework for the organization to think about its quality improvement efforts and aspects of care in which improvement could occur. While Cincinnati Children's has made great progress on its transformation journey, key leaders from Cincinnati Children's strongly emphasize that they are still on the transformation journey and believe that improving reliability will be a continuous process.

This section addresses two key questions one would ask when starting to transform an organization into one that provides highly reliable, high-quality care:

- How can a vision for transformation be created?

- What key components need to be addressed as the transformation process begins?

Creating a Shared Vision for Transformation

Cincinnati Children's spent a significant amount of time defining what transformation should mean for its organization. These discussions led to the conclusion that achieving organizational goals requires more than a series of incremental performance improvement projects. Instead, the vision for transformation emphasized:

- **The need to focus on large-scale organizational changes that are linked directly to the strategic plan.** Particularly given Cincinnati Children's size, the only way the organization as a whole could be transformed was through aligning strategic planning with the investments being made in safety and quality improvement.

- **Goal setting for systems based on 100 percent performance and 0 percent defects.** Leaders agreed to establish these perfection-oriented goals even when it was not clear whether those goals were achievable. They reasoned that these standards of excellence were the only way to avoid accepting errors and defects that were inconsistent with the organizational mission.

- **An emphasis on creating transparent processes for sharing successes and failures with internal and external customers.** To build a foundation for a culture in which ongoing improvement was the norm, Cincinnati Children's accepted that almost every process in the system could and should be better and that leaders needed to talk about what they were learning as they attempted to improve these processes. By creating extremely high standards, the leaders made it easier for staff to discuss failures and opportunities for improvement because the failure to achieve something extraordinary is not anything to be embarrassed about. But high standards also made it more difficult to remain complacent, even in systems where performance was comparable to those of their peers.

Identifying Essential Elements for Transformation

Like other organizations who have committed to major change, leaders at Cincinnati Children's view transformation as a continuous process that requires persistence. A mantra that senior leadership has used to avoid "overplanning" was to "start before they were ready"; this coupled with setting audacious goals has helped them begin the transformation process more quickly.

Cincinnati Children's leadership has found it useful to think about the following five elements as key focus areas for their journey:

- Leadership

- Institutional infrastructure, organizational alignment, and resource investment

- Rigorous measurement

- Transparency

- Accountability

Leadership

Leadership at the system and unit levels has proven to be essential for jump-starting and sustaining organizational transformation. Cincinnati Children's identified three leadership essentials that help to clarify how leaders drive organizational change:

- **Leaders must own the process of creating the culture and focus required for transformation.** It is up to leaders to help others clearly understand priorities. Leaders also have to model the transparency and accountability that transformation requires. Perhaps most important, leaders are responsible for ensuring that staff can succeed in their improvement efforts and for sustaining the positive outlook that encourages people to continue trying to make changes successful even when progress is slow. Each example of major change within a unit reflected the efforts of a leadership team who exhibited these characteristics.

- **Leaders must remain united.** A key success factor at Cincinnati Children's is support for transformation from the entire leadership team. This process did not happen immediately. Key leaders, including the chief financial officer (CFO), only gradually bought into the commitment to a quality-based transformation of the organization. Over time, some leaders who remained uncommitted to transformation left or were replaced by others who were supportive. As the commitment to transformation grew, it became easier to attract and retain leaders committed to transformation. Now that transformation is central to organizational culture, there is a consistent senior leadership response to complaints related to the transformation: "This is how we work, and this is now part of your work." Although this response might have been inconceivable or highly risky 5 years ago, unity among leaders now enables Cincinnati Children's to respond to complaints in ways that help to drive organizational transformation.

- **Leaders are more effective when working in teams.** Many improvement projects have a team leadership structure that brings complementary skills and influence to a project and may include a physician, nurse, and sometimes an administrator. This structure is used for several reasons:

  - *It helps to avoid the perception of winners and losers, which can lead perceived losers to withdraw from the improvement effort.* Problems owned by the physician and nursing staffs are much more likely to be solved in ways that are supported and sustainable for both groups.

  - *It fosters a breakdown of the traditional cultural barriers between physicians and nurses and leads to an atmosphere where everyone recognizes the contributions of multiple staff types.* Transformation requires a culture that rejects hierarchy and embraces relevant expertise. By creating leadership teams, Cincinnati Children's is modeling the type of culture required for all types of staff to feel that their insights are valued and that their warnings of potential risks to patients will be taken seriously.

  - *It creates more favorable conditions for stimulating enthusiastic physician engagement and involvement.* In some hospitals, physicians are regarded as obstacles to quality improvement, and those perceptions create resentments that lead to self-fulfilling prophecies. Cincinnati Children's works extensively to provide resources and expertise that will allow its physicians to help lead improvement efforts. Each Clinical System Improvement Integrating Team is led by a physician and a nonphysician. In this capacity, physicians work collaboratively to help develop and lead initiatives that improve systems and processes. The net effect of this effort is a growing number of physician leaders who can provide valuable perspectives and ideas required to drive the transformational goals that have been established.

Institutional Infrastructure To Support Transformation

Having a well-developed organizational infrastructure is key to efforts to achieve organizational transformation. Typically, infrastructure is equated with technology and information systems required to support an organization's mission. But when Cincinnati Children's began its transformation, it defined infrastructure development more broadly. This section addresses infrastructure at two levels: support infrastructure and technology infrastructure.

Support Infrastructure

Initial efforts focused on developing a support infrastructure for improvement that would provide the units and teams working on initiatives the expertise and resources they would need to succeed. This investment supports efforts to make the right thing to do the easy thing to do.

Cincinnati Children's also regarded support infrastructure as essential for addressing quality improvement at points where distinct subsystems intersect with one another. Facilitating improvement and breaking down silos within the system were major emphases. Developing this support infrastructure made it easier for Cincinnati Children's to establish unit and leadership accountability for improvement efforts by ensuring that units and their leaders had the resources

needed for them to succeed. The remainder of this section describes in more detail the support infrastructure that was created.

Central to the support infrastructure is the Division of Health Policy and Clinical Effectiveness, which was created to support the needs of the improvement teams. This division has grown to 30 full-time employees, including experts in patient safety, evidence-based care, measurement and analysis, and quality improvement. Rather than hiring clinical experts who had some training in quality improvement or people who really wanted to help improve care processes, Cincinnati Children's has chosen to hire quality improvement consultants from outside the field of health care. Several factors make these consultants unique:

- They have established track records of improving processes that give them credibility with the clinicians they work with. Because they do not have clinical backgrounds, they are well suited to ask process and flow questions without threatening the clinical staff. Most of these consultants have a minimum of 5 to 7 years of experience in quality improvement and training in Lean methodology and Six Sigma.

- Their role is to serve the teams working on the improvement rather than the leads responsible for achieving the change. This consultative role ensures that ownership of the improvement efforts remains with the units and teams that provide patient care. This approach increases staff buy-in as well as the sustainability of improvement efforts.

In addition to these consultants, the division includes data analysts. Typically, data analysts have master's degrees; a background in clinical or health services research; and competency in precise definition of metrics, study design, internal review board (IRB) processes, and project management. Beyond these skills, the analysts must be able to communicate effectively with clinical staff to define measures, explain results, and support the development of processes for collecting and reporting data in ways that help drive improvement.

Cincinnati Children's support infrastructure also encompasses the budgeting of:

- Time for staff training off of their unit on quality improvement strategies.

- Resources, such as additional staffing, funding, and enhanced data analysis capabilities, to support staff working on high-priority quality improvement projects and to support the testing of new ideas and innovative practices to determine whether they work and can be spread across the organization.

Technology Infrastructure

Cincinnati Children's has invested a substantial amount of time and money in technology to collect and monitor key clinical and efficiency measures more easily and efficiently. Although it regards these initiatives as critical, a major emphasis has been placed on ensuring that processes are designed well before they are automated.

At present, the organizational infrastructure is the foundation for efforts to monitor performance at the unit and system levels. This allows clinical systems improvement teams, business units, and clinical divisions to be held accountable for improving and sustaining performance measures. This infrastructure also supports the commitment to rapid cycle improvement driven by current and accurate data.

Some participants in the site visit were impressed with the resources available at Cincinnati Children's to help drive organizational transformation, so group discussion addressed similarities and differences between the organization's situation and those of other hospitals. Cincinnati Children's does not believe that additional funding and extra staffing were key to the success of its initiatives, and there are many examples of organizations with a great deal of funding and limited staffing constraints who have accomplished very little. At Cincinnati Children's, there is a clear recognition of ongoing challenges that it must still address, including:

- Building capability for widespread use of improvement and reliability sciences
- Creating sufficient time to do improvement work and embedding it into daily activities
- Recognizing improvement work as a legitimate academic pursuit

Clearly, investments in the infrastructure required for transformation are important, but even organizations that may lack capital for major technology investments can profit from what Cincinnati Children's has learned about how to most efficiently invest in support infrastructure.

Rigorous Measurement

Although it is a world-class research center, Cincinnati Children's began its transformational journey with comparatively little data about many important clinical outcomes. Absent such information as well as much research on expected outcomes for pediatric care drawn from the published literature, it was difficult to determine where to focus improvement efforts and hard to motivate units to work on improving outcomes. Recognizing the importance of these limitations, a major effort was made to develop, implement, and monitor an expanding set of process and outcome measures. Several important insights from these efforts to promote rigorous measurement have broad relevance:

- Concentrate on developing useful and measurable outcome measures as a main goal. Through its transformational development, Cincinnati Children's has learned that it is more important to measure fewer, yet significant, outcomes and resist the temptation to measure too much too soon.
- Ask key questions before starting the data collection process:
  - What do we want to know?
  - How are we going to collect that information in the clinical process?
  - What are we trying to show at the end of the data collection?
- Hire a manager for data infrastructure, if possible, who will lend credibility to the process.

- Establish regular reporting schedules and stick to those schedules, be it monthly, quarterly, or yearly.

- Use the information collected to help drive improvement. If information is not used, it is important to understand why so that either the measures can change to ones that are more relevant or the information can be compiled and shared in ways that are easier for people to use.

Transparency

In a culture that stresses continuous improvement, easy and open access to information is essential. Like other organizations that have embraced high reliability organizing, Cincinnati Children's embraces the belief that open communication is necessary for its transformation to succeed. The following are key aspects of transparency:

- **Transparency must span all levels of the organization.** Holding information about organizational successes and failures at the leadership level often can be counterproductive. If you don't make information available to all staff, they cannot fully participate in rapid-cycle improvement. Moreover, in order to motivate staff to change behaviors and give them freedom to think creatively about potential improvements, they need full access to information about what is working well and what could be working better. Once information is shared, the opportunity exists to actually address the underlying cause.

- **Transparency must include recognition of successes as well as failures.** Improvement can only occur if failures are identified and addressed, but building a culture of trust that encourages staff to report failures is difficult. Cincinnati Children's has worked with one unit in particular to increase reliability and celebrate successes. When a near-miss event takes place and a staff member accurately records the event, that staff member is acknowledged for reporting the event. Because continuous improvement efforts will entail both successes and failures, communicating about both is essential for transformation to occur.

- **Transparency should include patients and families.** Sharing information with patients and families can actually alleviate questions and concerns that may arise during the course of care. The key is to ensure that any information shared is presented in a way that is meaningful to the families and is easily understood. Involving families in organizationwide advisory councils and unit-based improvement teams is an effective way of sharing information and soliciting feedback on opportunities for improvement. In some units of systems in the HRO Learning Network, information about unit performance is posted in public locations where it can be seen by patients and their families.

- **Transparency should occur through multiple media.** Reporting information in multiple locations and through multiple media increases the odds that the information will be seen by a larger audience. Cincinnati Children's takes advantage of bulletin boards, computer screensavers, its intranet, and the Internet to share information with staff, patients, and families. Although it is a challenge, the organization has made a

commitment to posting information in ways that patients and their families will be able to understand and use.

Accountability and Alignment

To drive system change, people and units must know what they are being held accountable for, and these goals must be aligned with one another and a range of performance incentives. Developing a culture of accountability for outcomes takes good data and time. Cincinnati Children's has found value in taking the following factors into account:

- **Recognition and responsibility for outcomes have to be at the unit or division level to make the leaders more aware of, engaged with, and accountable for the initiatives.** This requires plausible data at the unit and division level, not just data that are aggregated across the entire facility.

- **Individual providers must clearly understand and buy into their role and contribution and that they are accountable for outcomes.** Discussion at the site visit addressed the issue of whether this is easier or more difficult when physicians are directly employed by the hospital. On one hand, physician employees may be easier to incentivize through bonuses; on the other hand, physician employees who are uncooperative are more difficult to replace or eliminate than physicians with looser connections to the hospital.

- **Accountability at the provider and all other levels should be embedded into the annual review.** Beyond the ability of the review process to reward achievements, embedding performance metrics into the annual review reinforces the importance of performance measurement and quality improvement to the organization. Unit directors and division and department heads should be responsible for delivery system performance metrics because system performance is a key aspect of their responsibilities.

Summary on Organizational Transformation

Much discussion at the site visit focused on the role that resources play in achieving substantial and rapid organizational transformation. Cincinnati Children's clearly has made a major financial commitment to its organizational transformation. Although resources may have enabled the organization to attempt more transformation efforts more rapidly than would be possible in other systems, they are convinced that the success factors relate to the dimensions noted previously. Although resources are essential, leadership, support infrastructure, rigorous measurement, and accountability are the keys to maximizing available resources in support of transforming the organization.

Building a Business Case for Quality and Organizational Transformation

Building a business case for quality is critical to achieving the unified support for organizational transformation on which success depends. If quality, safety, and continuous improvement are not regarded by the CFO and the board as key elements of the business model, the organization will lack the full alignment required to achieve substantial change. When

Cincinnati Children's began its transformation, it did not have the CFO's full support. Instead, the CFO asked the leadership team at Cincinnati Children's to help him understand the benefits of investing in quality improvement initiatives so that he could set up a business model based on science and data that would still protect the institution's financial well-being.

Being a pediatric hospital, Cincinnati Children's generates much of its revenue from patients with highly complex conditions who travel distances to receive care at their institution because of the quality of care they believe they can obtain. Pediatric hospitals receive little revenue from Medicare, so their revenue is directly linked to the services they provide as opposed to the diagnosis-related-group (DRG)-based system through which most adult hospitals are paid. Despite the differences between pediatric and adult facilities, the process Cincinnati Children's used to engage its CFO and build its business case is one that, potentially, can be applied to other systems.

Engaging the Chief Financial Officer

Three themes emerged in the presentation by Scott Hamlin, Senior Vice President, Finance, and Chief Financial Officer of Cincinnati Children's, and subsequent discussion:

- Getting the CFO on board is critical. To the extent that the CFO influences resource allocation decisions, interacts with the board, and shapes compensation strategies for organizational leaders, organizational transformation is unlikely without the full support of the CFO.

- Getting the CFO on board is a gradual process. The CFO needs to be tactfully and patiently educated about issues related to quality and safety, as well as how these issues affect the hospital's financial performance. In Mr. Hamlin's case, it took several years for him to evolve from a skeptic about issues related to quality to a champion for quality's role in the hospital's business case. CFOs are trained to be skeptical and focused on financial issues, so it is unrealistic to think that a single presentation, workshop, or set of data will lead to a dramatic change in their outlook. More time and patience will be required.

- Giving CFOs data and tools that they can use to convince themselves of the business case for quality is essential. Cincinnati Children's helped to train the CFO's staff to perform analyses using matched-case designs (see page 78) that helped convince the CFO of the business case for quality. Analyses performed by quality staff would have been suspect, but once the financial analysts could evaluate data independently to draw financial conclusions, the results were credible to the CFO. The approach used at Cincinnati Children's involved providing the CFO with the data and tools that he and his staff could use to convince themselves of the business case for quality. This self-persuasion worked for them and was consistent with the experiences in other HRO Learning Network systems.

Building the Business Case

Cincinnati Children's business case grew out of some basic assumptions that leaders made about what the organization must do to attract patients. Over time, these assumptions have been synthesized into three value statements that form the basis of their business case for quality.

Value proposition: Success requires providing things of value to our patients.

- Patients and their families place value on:

  - Quality (the best opportunity for a positive outcome and an experience with the hospital and its staff that is better than with competitors)

  - Cost (both direct costs of care and indirect costs associated with travel, length of hospitalization, etc.)

- The goal is to provide the highest possible quality in our target price range (we will earn our price).

Value orientation.

- Conclusion about value: Improving quality (outcomes and experience) will create value for which customers will pay. More often than not, improved quality can either reduce cost or create opportunities to generate more revenue.

Value commitment.

- We must continuously prove our current value (which is only possible through the measurement and analyses that are part of improvement initiatives).

- We must constantly be in a position to improve our future value (which requires ongoing strategic improvement activities).

A key insight to creating this business case was the recognition that better utilization through quality improvements can increase revenue. Most hospitals try to increase revenue by building more buildings and adding more staff. Although such growth was a part of its strategy, Cincinnati Children's leaders also recognized that they could increase revenue by more efficiently using existing resources. For example, preventing infections and other complications through a commitment to quality allowed patients to spend less time in the hospital. Beyond greater levels of patient and family satisfaction associated with shorter hospital stays, reduced infections also made more beds available for sicker patients, who generate more revenue for the hospital in the early days of their hospitalizations. Cincinnati Children's has created demand for these beds and increased its patient population by positioning themselves as a leader in treating rare and complex childhood disorders, which has led to referrals and patients outside the Cincinnati region. These efforts have led to 17 percent annualized revenue growth over the past 5 years, with 50 percent of that revenue coming from outside the region.

Beyond general recognition that quality is a key component to the value proposition of its system, Cincinnati Children's leaders have monitored their investments in quality infrastructure to assess their ability to simultaneously increase quality and reduce costs. Three examples of these efforts are provided to illustrate an approach to building a concrete business case.

Use of Evidence-Based Care

The organization works in a collaborative effort with community physicians to improve care given at home to children with asthma, bronchiolitis, fever of an uncertain source, and gastroenteritis. Evidence-based medicine (EBM) shows that for many children, these conditions can be effectively treated by community physicians without admission to the hospital. In addition, they are low revenue-generating conditions. As a result of this effort, length of stay and need for hospital admission decreased from 1996 to 2005 for children with the diseases targeted by clinical guidelines and improvement initiatives (see Table 1).

Table 1. Reduced Inpatient Bed Utilization

Condition	Decrease in Admission
Asthma	376%
Bronchiolitis	436%
Fever of uncertain source	586%
Gastroenteritis	6%

Because Cincinnati Children's has limited capacity, the bed space created by keeping these children out of the hospital created space for patients whose conditions generated more revenue for the hospital. Being able to schedule care more rapidly for these patients with complex needs contributed to greater patient and family satisfaction and probably reduced the number of patients who went elsewhere with shorter waiting times.

Effective Discharge Planning

Cincinnati Children's recognized that an improved discharge planning process would free beds for other patients and cut the number of beds occupied by patients who were generating little revenue for the hospital. The impact of their efforts to improve flow and inpatient capacity is illustrated below in Figure 1.

Figure 1. Percentage of Patients on General Pediatric Unit Who Go Home Within 4 hours of Meeting Discharge Goals

Goal: 80% of patients
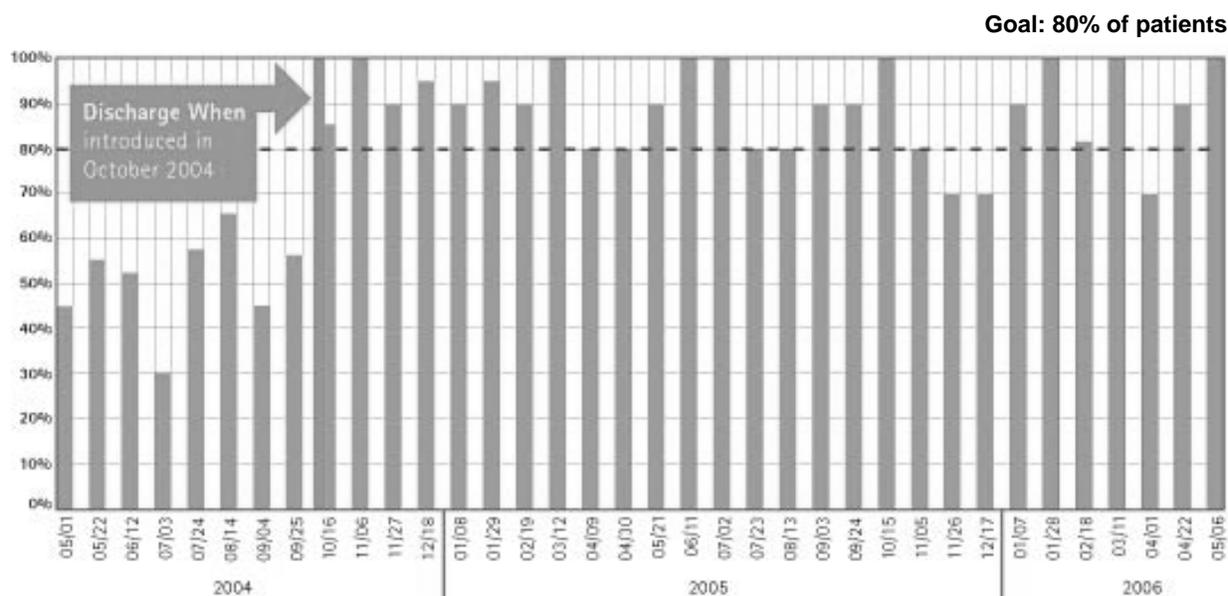
Effective discharge planning improves flow and inpatient capacity.

Beyond the clear impact that improved discharge planning had on bed capacity, this initiative allowed Cincinnati Children's to better monitor the availability of different types of hospital beds required for patients of different ages and with different medical issues. These kinds of initiatives make a compelling case for increasing capacity without the expensive capital investments required to expand hospital facilities.

Discussion at the site visit also turned to the impact of improved flow on a range of staffing issues. To the extent that better flow reduces delays and ensures that beds will be available, Cincinnati Children's reduces the need to reschedule surgical procedures that inconvenience both patients and the surgical teams. Moreover, improved ability to manage bed space is key to staffing units, such as assuming full capacity rather than assuming less than full capacity and needing to pay expensive overtime or add staff when a unit is full. Converting to this staffing model helps to reduce staffing costs while providing employees with a more consistent schedule.

Reducing Ventilator-Associated Pneumonia and Surgical Site Infections

Using a bundle of interventions to reduce ventilator-associated pneumonia (VAP), Cincinnati Children's saw an increase in days since the previous VAP from 7 days in December 2003 to 238 days in May 2005 (see Figure 2 below). VAP increases mortality as well as the patient's length of stay and cost of hospitalization.

In addition to VAP, Cincinnati Children's is implementing an Institute for Healthcare Improvement (IHI) bundle of interventions to reduce surgical site infections (SSIs). There has been a decrease from 1.5 infections per 100 procedure days in December 2004 to just over 0.5 in May 2006.

Figure 2. Clinical Excellence: Reduction in VAP Infections per 1,000 Ventilator Days

# of VAP cases
57 in 2005
3 in 2006 YTD (Jan-May)
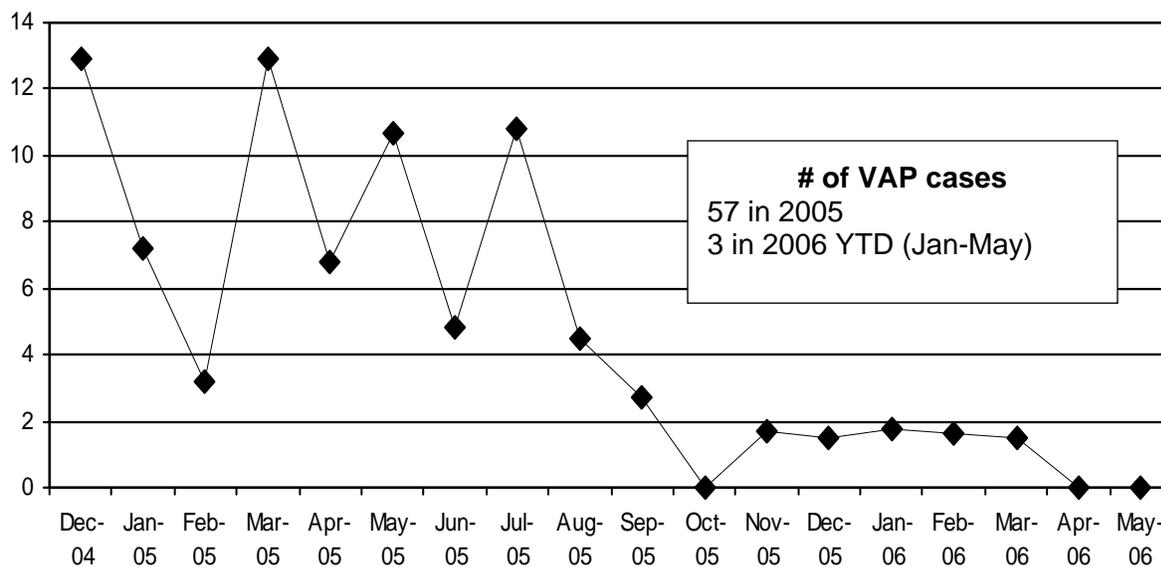
Some hospital administrators might regard these initiatives not as improvements in quality, but as reductions in the amount of revenue generated by the hospital. Cincinnati Children's examined the financial impact of these activities more closely using a matched case–control design study. Their analysis matched patients who did not have SSIs with the same or equivalent surgical procedure, age, procedure date, and comorbidities with patients who had SSIs. Chart reviews were conducted to refine candidates and assess whether the SSI was preventable.

As they expected, the SSIs added on average 10.4 days to the length of stay and $60,480 in additional charges (see Figure 3 and Table 2). They also found, however, that the SSIs in their study caused a loss of 208 days of time that beds could have been occupied by higher utilization, sicker patients. Moreover, because many of Cincinnati Children's patients are on Medicaid, which pays only one rate for a stay regardless of an SSI, the costs associated with the SSI for these patients were entirely borne by the hospital.

Figure 3. SSI Study Results: Aggregate Cumulative Charges

71
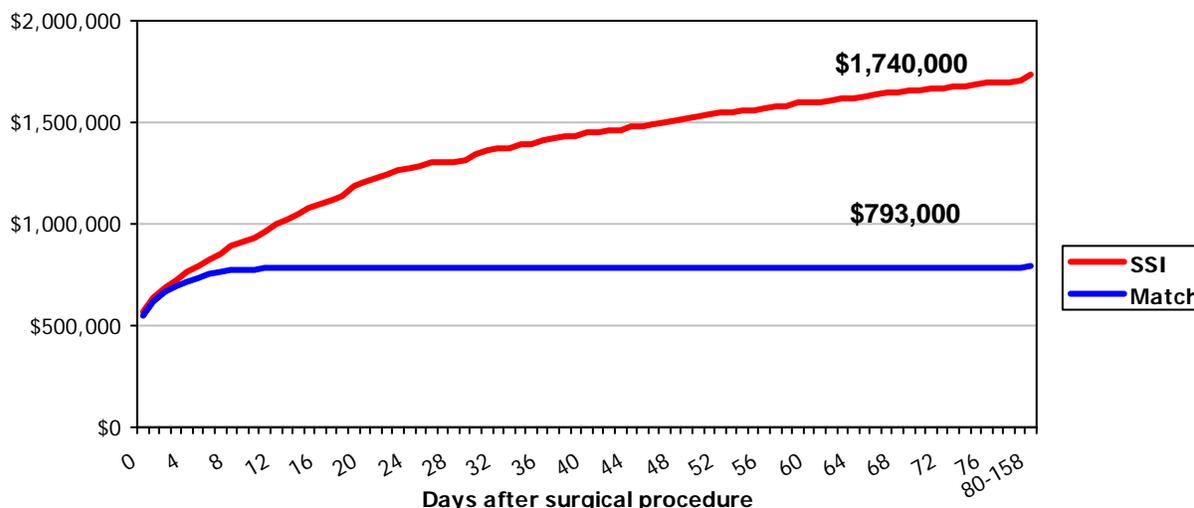
Table 2. SSI Overall Results

	Aggregate 16 Patients		Average per Case (*n* = 16)	
	Hospital Days	Gross Charges	Average Length of Stay	Gross Charges
Pre-SSI	74	$772,000	4.6	$48,250
Post-SSI	166	$968,000	10.4	$60,480
Total SSI	240	$1,740,000	15.0	$108,730
Total match	70	$793,000	4.4	$49,563

This example illustrates how a matched case design can help assess and document the business case for many quality improvement initiatives. By considering costs resulting from complications, the extent to which those costs are (and are not) passed on to payers, and the opportunity costs associated with those complications, Cincinnati Children's was able to provide compelling financial reasons for supporting a key quality improvement initiative.

Summary of Business Case Issues

Building a business case for quality is a slow process that requires the ability to measure quality, assess costs accurately, and engage the CFO and financial analysts in developing analyses to assess financial impact accurately.

Specific Improvements Toward Organizational Change

How has the broad commitment to organizational change been translated into specific improvements that make patient care and the patient experience better than it used to be?

More often than not, more improvement opportunities exist than an organization has time to tackle at any given time. Given the excess projects and the competing demands for time and resources, how can improvement priorities be set?

At Cincinnati Children's, several factors influence improvement priorities, including the significance of the clinical outcome, national imperatives for improving patient safety, and national benchmarking. Leaders at Cincinnati Children's have also developed a system for setting improvement priorities based on managing internal demands, which is described below.

All new initiatives at Cincinnati Children's are classified as a system-level, department-level, or unit-level project. An upfront determination about the project level will help to determine the scope and resources needed to complete the project. A unit-level project, for example, may require a greater time commitment from the nursing staff on a specific unit and less time from a senior executive. By recognizing the difference, the hospital can plan additional staffing resources for the unit to compensate for time invested in the project.

Once initiatives are classified by level, how are they prioritized at each level? Cincinnati Children's prioritizes initiatives with what it calls the DICE methodology, which is an acronym for a set of guiding questions to help with the prioritization process. The DICE guiding questions are:

- Duration: How long will this initiative take to complete?

- Integrity: Will this initiative break down if manipulated?

- Capability: Do we have the skill set within our staff to successfully complete this initiative?

- Effort: How much effort is required for this initiative?

Initiatives that score high on the DICE scale receive highest priority and access to resources.

After improvement priorities are set, the work of implementing the initiatives begins. The following are examples of improvement initiatives from Cincinnati Children's that helped to make processes and systems more reliable. These specific examples were highlighted during walkabouts on the first morning of the site visit. The information reported below is a reflection of the information reported by the groups who participated in those walkabouts.

To make this section easier to navigate, each example is structured to answer the following questions:

- What is the challenge being addressed in this initiative?

- What are some of the HRO concepts taken into account during this initiative?

- What was the transformation process for this initiative?

- How did Cincinnati Children's know whether the process changes represented improvements for this initiative?

Emergency Department

Identified challenge. The Cincinnati Children's emergency department recently underwent physical plant renovations. As a result of the renovations, the emergency department had an opportunity to change the existing processes for admissions, triage, and electronic registration to be more reliable and efficient. To date, the emergency department has not shown significant improvement in the flow measures, yet the team is continuing to look for and test factors in trying to find that breakthrough.

HRO concepts employed. The emergency department process redesigns primarily involved two high reliability concepts:

- Preoccupation with failure

- Deference to expertise

Transformation process. The new admissions process in the emergency department employs clerks at the front desk who greet and admit the patient, asking only for the patient's name, age, and chief complaint. The patients are directed to the newly designed waiting area and are called back by pager to the desk when a nurse is ready for triage. Sensitivity to patient privacy has ruled out the old method of calling the patient's name to the group. Using the HRO principle of deference to expertise, the new admissions process requires a clear understanding that admitting clerks are not assessing patients beyond the "first look" method in which they have been trained. If they, or the family, believe that there may be reason for concern, a nurse is made available immediately to assess the patient's condition.

During triage, a nurse assesses the patient in an individual room located in a separate triage area. A process change based on preoccupation with failure has made it more reliable for nurses to document and monitor each patient's condition by having access to a computer terminal in each triage room. This changed from entering and referencing information with the electronic medical record (EMR) system at a central terminal after the triage examination. Similarly, as in the example above, deference to expertise is practiced during the nurse triage process. The nurses do not give any medication beyond Tylenol or fever reducers. If they or the family believe that immediate medication or treatment is needed, an emergency department physician is made available.

The EMR process further helps staff to be more preoccupied with failure by using a color-coding system that alerts all staff to the progress of a patient's care, monitoring levels of acuity and sending alerts to staff based on certain preset parameters about the patient's condition. All staff have received training on the EMR system.

Observed improvements. For more information about the observed improvements in the emergency department, please feel free to contact a Cincinnati Children's representative. Contact information can be found at the end of this appendix.

Pharmacy Redesign

Identified challenge. The pharmacy department at Cincinnati Children's faced three challenges: alleviate inefficient use of workspace in the pharmacy; decrease the number of missing, wasted, or returned medications from patient rooms; and reduce the processing time for medication orders.

HRO concepts employed. The high reliability principles used to address the pharmacy challenges were:

- Sensitivity to operations

- Preoccupation with failure

Transformation process. One way in which the pharmacy addressed some of the challenges was by using a real-time observation and implementation plan. A team was formed and asked to observe the process and workflow of pharmacists and pharmacy technicians during a regular workday. In one example, the observation team noted an inefficient use of lab workspace and

asked the technicians for improvement suggestions. The technicians suggested that the addition of extra shelves would create a less cramped and more reliable workspace. A member of the observation team phoned the maintenance staff in the moment, and temporary shelves were installed so that the team could determine whether the additional shelves had a positive impact on the workspace. Following subsequent observations of that space, it was determined that the shelves had made a positive impact on the reliability of the technicians' work, and permanent shelves were installed.

The second way in which the pharmacy addressed some of the challenges was to adopt the Lean methodology coupled with physical plant renovations to remove waste in existing processes. A Lean consultant was hired to train staff on how to look for waste in processes. Physical plant renovations also reduced the distance that pharmacy staff had to walk to process and deliver medication orders.

Observed improvements. Results have shown a 50 percent reduction in the number of returned medications from patient rooms. Process efficiency measures also show a 58 percent reduction in pharmacy technicians' walking distance, a 43 percent increase in workspace and a 75 percent reduction in processing time, shortening the lengthy full-day process to just 5 hours.

Codes Outside the Intensive Care Unit

Identified challenge. Cincinnati Children's staff on unit A6S noticed that there was a higher than expected rate of codes occurring outside the ICU. To address this problem, a decision was made to focus on prevention in their unit, which had already begun adopting high reliability concepts to improve quality and patient safety. The unit developed the Pediatric Early Warning Score (PEWS) as an improvement initiative aimed at reducing codes.

HRO concepts employed. The PEWS initiative primarily involves two high reliability concepts:

- Preoccupation with failure
- Sensitivity to operations

Transformation process. While A6S tried to find solutions to help prevent codes in the unit, the clinical director found an early warning score system for adults in the United Kingdom. Adapting that to children, the unit developed PEWS, which is an objective assessment of every patient to determine their clinical deterioration and how likely they may be to code. Depending on the score (ranging from 0 to 10), staff must take certain actions to ensure proper treatment and decrease the likeliness of a code.

When the unit first began implementing the initiative, it discussed PEWS with unit staff. Because staff were already doing the different clinical assessments, they just needed to change how they were reporting and using this information. The PEWS chart has specific instructions for what to do depending on a patient's score. This is sensitive to the fact that sometimes nurses are reluctant or hesitant to call interns and residents if they are unsure of the necessity. Instead, the PEWS algorithm makes this decision for the nurses, so no debate or questioning is necessary.

In addition, the unit discussed the initiative with patient families and got family buy-in for the display of a large PEWS chart in the hallway, which shows each patient's PEWS and allows the staff to review it regularly as they walk by.

Observed improvements. There are two major ways that Cincinnati Children's knows that the PEWS initiative has made a difference. First, at the time of the site visit, it had been 164 days since the last code in the unit, which is an improvement. The unit has a goal of reaching one full year since the last code. Second, the staff has incorporated PEWS review as part of their daily activities. After reviewing the PEWS chart, they are immediately aware of the overall status of each patient and where and how to devote their attention.

Decreasing Errors Through Computerized Work Orders

Identified challenge. Another area where Cincinnati Children's wanted to focus its improvement efforts and become more reliable was with physician order entry. The challenge was to reduce errors in orders and transcriptions.

HRO concepts employed. The implementation of computerized physician order entry (CPOE) was successful because of its focus on:

- Deference to expertise
- Reluctance to simplify

Transformation process. Cincinnati Children's began using a Siemens Web product for its CPOE, although the system has been greatly customized to meet the organization's specific needs. Cincinnati Children's first began implementing the CPOE in a few of its inpatient units and then expanded the implementation to almost all its inpatient units within 18 months. In most of these units, two mobile laptops now are used on clinical rounds. One of these computers is devoted to computerized work orders so that staff can enter work orders during rounds. In addition, there are workstations in the hall where work orders are entered. During the initial implementation, residents found the order sets too complicated, and they actually got actively involved in the redesign.

One of the unique aspects of Cincinnati Children's CPOE system is that the help desk support team is composed of clinical staff as well as technical staff. Therefore, the help desk staff fully understand clinicians' language, needs, and processes.

Observed improvements. Immediately upon implementing the CPOE system, Cincinnati Children's found fewer clarification calls about orders, an elimination of transcription errors, and a 52 percent decrease in medication delivery time to the unit. The intermediate results included a decrease in unsigned verbal orders from 40 percent to 8 percent. The system itself has built-in improvements, such as automatic hard stops and automatic links for certain drugs. If a clinician ignores a system recommendation, he or she must give a reason in the comment box. Therefore, the work order system is designed to be comprehensive and to improve care, not to be the quickest to navigate and put in entries.

Surgical Site Infections

Identified challenge. Cincinnati Children's recognized the need to address the challenge of SSIs in both inpatients and outpatients. Evidence-based studies demonstrate that patients receiving prophylactic antibiotics before surgical incision have lower SSI rates. Cincinnati Children's same-day surgery and inpatient surgery units are implementing evidence-based practices to reduce Class I and II nosocomial SSIs to 0.75 and 0.25 per 100 procedure days, respectively, by July 2006. The outcome measure is: nosocomial SSI rate/100 procedure days for Class I and II procedures. Process measures include timely antibiotic administration (percent given within 0 to 60 minutes before incision) and complete preoperative antibiotic orders received before 10 a.m. the day before surgery for same-day surgery patients and timely antibiotic administration (percent given within 0 to 60 minutes before incision) for inpatients. The site visit focused on same-day surgery.

HRO concepts employed. The SSI initiative primarily involves two high reliability concepts:

- Preoccupation with failure
- Sensitivity to operations

Transformation process. Cincinnati Children's used a bundle of interventions in this initiative. The transformation process included the following phases: define opportunities, measure performance, analyze opportunity, PDSA (plan, do, study, act), improve and sustain performance, and spread improvement. Two examples of how it implemented the bundle follow:

- Cincinnati Children's recognized the need to ensure that all patients wear a proper indicator identifying whether they received a preoperative antibiotic. A patient wristband is placed over the patient identification band on the same wrist to remind the clinician to check whether the patient received preoperative antibiotics when he or she checks the patient identification wristband. In addition, other preoperative antibiotic reminders, such as stickers, all use the same color: orange. Cincinnati Children's engraved this into the minds of its staff through a marketing campaign: ABC—Antibiotics Before Cutting. These methods of preoccupation with failure work to minimize errors.

- As an example of sensitivity to operations, Cincinnati Children's recognized the need for one form for surgical prophylaxis antibiotic orders for all physicians to use. In addition, the department realized the need for a nurse to check all orders the day before the scheduled surgery. The nurse checks the next day's schedule, the antibiotic list, and the physician order form, paying particular attention to missing information. Because of the time it takes for the nurse to perform this function (2 hours), the role of "antibiotic nurse" was created. Some nurses on the floor are trained, and the 2 hours of time is built into their schedule to be used for this function only.

Observed improvements. Efforts led to a decrease in Class I infections from an average of 1.57 per 100 procedure days in 2004 to 1.15 in April 2006. Class II infections decreased from an average of 0.76 per 100 procedure days in 2004 to 0.30 in April 2006.

Safety of Handoffs

Identified challenge. A lack of clear communication among staff may have contributed to a child's death during a transfer from a unit to surgery. In response to this event, Cincinnati Children's is in its third year of an effort to improve communication between clinicians when a patient is transferred between departments.

HRO concepts employed. The handoff initiative primarily involves two high reliability concepts:

- Deference to expertise
- Reluctance to simplify

Transformation process. A checklist for patient transfers has been created and is used throughout the hospital. In addition to the checklist, Cincinnati Children's requires the anesthesiologist to receive a handoff before the child is transported to surgery. After surgery, the attending surgeon or fellow must accompany the child back to the receiving floor for a handoff. Handoffs are measured on a 200-point scale where 100 points are based on objective measures regarding the completion of the handoff, 20 points are based on physician satisfaction, and 80 points are based on nurse satisfaction. A score of less than 180 is considered a failure. The HRO site visit focused on transfers to and from the cardiac care ICU.

The transformation unfolded over the course of 3 years. Cincinnati Children's rolled out this initiative with cardiac surgeons and otolaryngologists. As the improvement initiative spread, other specialties were included. Gaining the support of one neurosurgeon in particular was the tipping point for gaining the support of the rest of the surgeons.

In addition, when this initiative was initially instituted, the attending physician, fellow, and residents could act as the single physician present during the handoff. It was soon realized that residents did not have enough knowledge to be the sole physician at a handoff, and the rule was changed to attending physicians or fellows. This shows the organization's commitment to defer to expertise, which the residents had yet to develop. However, residents may accompany attending physicians or fellows.

Finally, the patient transfer checklist indicates the names of the physician and nurse present. Although many in the hospital know one another, Cincinnati Children's requires all handoffs to begin with introductions by all present. This reluctance to simplify a process addresses instances where staff do not know one another, which could occur often because of the various schedules both nurses and physicians keep.

Observed improvements. For more information about the observed improvements in the safety of handoffs, please feel free to contact a Cincinnati Children's representative. Contact information can be found at the end of this appendix.

Neonatal Intensive Care Unit

Identified challenge. The neonatal ICU (NICU) at Cincinnati Children's faced the challenge of decreasing occurrences of VAP on its unit. In March 2005, the NICU experienced 11.3 VAP infections per 1,000 device days. At that time, Cincinnati Children's believed that the number of occurrences of VAP could be reduced and began working to create a more reliable process for preventing VAP.

HRO concepts employed. In working to reduce the occurrence of VAP, the two primary HRO principles that emerged during the transformation process were:

- Preoccupation with failure
- Sensitivity to operations

Transformation process. To address the challenge of the increasing occurrence of VAP, the NICU chartered a VAP team to create a bundle for preventing VAP using evidence-based medicine, as well as an education plan for teaching staff how to use the bundle. By May 2005, a bundle had been created, and education had begun. With the implementation of the bundles, the NICU saw the VAP infection rate drop to 0 per 1,000 device days by July 2005.

During August and September 2005, a small spike in VAP infection rates prompted the team to become more preoccupied with failure. The team put together a couple of job aids, including a ventilator care checklist, to help nursing staff document and remember the important points outlined in the bundle. In addition, the bundles were attached to all ventilators for quick reference.

Being sensitive to operations, the NICU partnered closely with the infection control department to receive information about potential VAP cases earlier. This allowed the ICUs to conduct real-time investigations. Root cause analyses are always conducted for process and practice failures, and changes to the process are made immediately to improve patient care.

Observed improvements. Since the implementation of the new checklist in August 2005 and the addition of a few new heaters in September 2005, the NICU was able to track and post infection rates of 0 per 1,000 device days between October 2005 and May 2006.

The NICU credits sustainability of the reduced VAP infection rate to the following:

- Promoting ownership of work at the staff level
- Hard wiring the VAP bundle into flowsheets
- Including improvement work measures in performance evaluations
- Updating orientation competencies to include the VAP bundle
- Measuring compliance with the bundle elements as well as patient outcomes continuously
- Testing the use of real-time notification of VAP from infection control

Transitional Care Area

Identified challenge. The transitional care area at Cincinnati Children's is a stepdown unit. The challenge this unit, as well as other units in the hospital, faced was figuring out ways to involve families in the discussions about the care being provided in a way that was meaningful and made the families feel like part of the decisionmaking team.

HRO concepts employed. In working to create ways for families to become more involved in the discussion about the care being provided to the patients, the primary HRO principle was:

- Preoccupation with failure

Transformation process. Involving families in the discussions about the care being provided for the patients in the transitional care area has been done in two ways. The first is to ask families whether they would like to be present and involved during rounds so that they are up to date on the plan of care. Using the HRO principle of preoccupation with failure, staff in the transitional care area use a job aid in the form of a blue note card to cue them to the family's preference. This blue card is taped to the outside of the patient's door and indicates the family's preference to be present during rounds, to be woken up if they are asleep, to decline the opportunity to be present during rounds, and to just receive an update on the patient's condition at a later time. When rounding occurs, the caregivers simply refer to the blue card to determine whether the family would like to be involved.

Families of children awaiting or who have had liver transplants are provided with a portal that allows them to see important information, such as the medication list, dosages, improvements in condition, and physician names. Families also can use the portal to send messages to the patients' caregivers and to track the patients' progress over time.

Observed improvements. For more information about the observed improvements in the transitional care area, please feel free to contact a Cincinnati Children's representative. Contact information can be found at the end of this appendix.

High Fidelity Simulation Center

Identified challenge. High fidelity simulation is widely regarded as an important way to train staff to work as teams on patients experiencing the range of conditions observed in a busy emergency department. The simulation center at Cincinnati Children's wanted to maximize the value of the training for participants and demonstrate its value to other hospital departments and health care providers so that the costs of its operations could be spread as broadly as possible.

HRO concepts employed. The simulation center emphasizes the creation of a realistic experience that will require teams to work together to successfully treat multiple patients at the same time and to respond to family members' concerns about their child's welfare. Effective teamwork presumes all of the aspects of a high reliability system, including:

- Preoccupation with failure

- Deference to expertise

- Sensitivity to operations

- Reluctance to inappropriately simplify the care of a patient

- Resilience

Transformation process. Several innovations make the simulation experience at Cincinnati Children's one of high perceived value for physicians, nurses, and other staff:

- Staffs are trained as multidisciplinary teams, which allow them to practice principles of effective teamwork and to receive feedback on what could allow their team to function more successfully.

- Patients experience complications that challenge participants to monitor and adapt to changes in the patient's condition, as reflected in real-time monitors of heart rate, pulse, and other vital signs. Beyond the clinical care of the patient, the teams also must address the concerns of parents and others in the room so that the experience matches the norm in many emergency departments.

- Participants receive immediate feedback on their performance as a team. Performances are scored so that progress can be trended over time and so that future training sessions can avoid duplicating experiences that the team handled effectively. The center has found that the impact of training tends to lessen after about 6 months, so continuous retraining is regarded as critical.

Observed improvements. The center retains scores and videotapes for all simulation sessions. It uses multiple strategies for assessing the impact of this training. Evidence of impact includes:

- Improvements in simulation scores for teams that have more training

- Observation of videotapes to establish improvements in team performance following additional training and practice

- High levels of repeat and new business from departments other than the emergency department, from the nursing school, and from other health care providers outside Cincinnati Children's

At present, the center gets some funding from the emergency department; some comes from the training budgets of other departments; and some support comes through an AHRQ grant. A major ongoing challenge of the center is the creation of a sustainable business model. Key to this model will be the ability to support not only the equipment required for high fidelity simulation, but also the staff who program the simulators to exhibit complications and medical conditions that meet the needs of the center's constituencies.

Lessons Learned

What can be learned about how process redesign efforts can drive organizational transformation?

Many insights were shared at the site visit about organizational transformation. Following are a few key lessons that consistently emerged as critical knowledge for effective transformation:

- **Reducing resource investment in quality improvement initiatives during lean times is a mistake.** Optimally, dedicating resources to quality improvement initiatives should be a priority before an organization faces lean time. But if lean times are upon the organization, continuing to invest resources in quality improvement initiatives is imperative, especially if there is waste in the system. Additional savings and resources can be realized over time by eliminating wasteful practices and implementing more reliable, safer practices. Consider how efficiencies can be realized in all departments, not just in clinical areas. To determine which initiatives will make the best investments, one may use the DICE methodology and assess the initiatives on duration, integrity, capability, and effort.

- **Beware of bucketing errors into preventable and unpreventable categories.** Once errors fall into the unpreventable category, they often fall prey to the "out of sight, out of mind" phenomenon. Subscribe to the philosophy that all errors are preventable, but recognize that knowledge has yet to be created to prevent some errors. Invest research dollars and time in understanding how to make errors preventable.

- **Transformation requires ambitious targets and setting transformational versus incremental goals.** Pursuing perfection goals can help one to quickly identify serious system-level barriers that need to be addressed. Cincinnati Children's focuses on designing systems that will achieve 100 percent effectiveness and 0 percent defects and believes that it is not that much harder to strive for 100 percent effectiveness versus small incremental goals.

- **Start before you are ready.** Don't be paralyzed by the pursuit and creation of a perfect implementation plan. Much can be learned during the process of actually doing the work. If one is careful to prioritize initiatives ahead of time, then it is easier to strike a balance between working on what can be done now and slowly "peeling the onion."

- **Involving leadership at every level is critical.** Without engaged leadership, transformation is difficult to start and even more difficult to maintain. Leaders must take ownership for setting the climate and focusing the work. Cincinnati Children's believes that the role of leaders is to make the job easier for those at the department level.

- **Create a culture of accountability and responsibility.** Helping staff to recognize that quality is everyone's responsibility will help to create a platform for making systems more reliable.

Acknowledgements

A special thank you goes out to the leadership team at Cincinnati Children's for the time and energy they invested in hosting such a valuable site visit for the HRO Learning Network. Their commitment to excellence and remarkable transparency provided a forum for a more open, honest, and robust discussion among Network members at the site visit.

Contact Information

If you are interested in acquiring more details about any of the information provided in this appendix, please see the contact information below for representatives from Cincinnati Children's Hospital Medical Center.

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Appendix D: High Reliability Organization Learning Network Operational Advice from the Fairview Health Services and Allina Hospitals & Clinics Network Site Visit

Overview

This appendix summarizes practical suggestions on how to create a community-level infrastructure for supporting improvement initiatives aimed at making health care services provided within that community safer and more reliable. All ideas reflected in this document were suggested by representatives of Allina Hospitals and Clinics, Fairview Health Services, participants in the statewide collaboration that includes representatives from the Institute for Clinical Systems Improvement, the Minnesota Alliance for Patient Safety, the Minnesota Community Measurement Project, and Safest in America, as well other health care systems attending the meeting as part of the AHRQ-sponsored High Reliability Organization (HRO) Learning Network.

Participants in the meeting were interested in how Allina and Fairview joined with other Minnesota health care organizations to work collaboratively toward improving quality, patient safety, and reliability at the community level, as well as how those efforts could be adapted for different communities across the Nation.

This document synthesizes the meeting discussion to answer three key questions about community collaboration:

- Why is community collaboration a valuable strategy for enhancing patient safety and organizational reliability?

- How do you begin developing a successful model for community collaboration?

- What improvements in patient safety and organizational reliability can be achieved through community collaboration?

The discussion of these questions will help illustrate how community-level collaboration can advance the use of high reliability organizing concepts to support health systems' efforts to improve patient safety and quality. Some specific examples are also provided to demonstrate how collaboration across a community can not only improve safety and reliability, but can also eliminate redundant work and create a more standardized approach to implementing new processes.

Other materials that were shared at the site visit, including slides from the presentations and other examples of improvement materials, are available on the HRO Learning Network extranet and from AHRQ and [Delmarva](#) staff.

Value in Community Collaboration

The concepts of patient safety and organizational reliability typically focus on units, hospitals, or clinics within individual health care systems that are working to improve quality and reduce errors. These efforts are, however, often limited by factors at the environmental or community level. When recommended behaviors differ across systems or when regulations or other environmental factors make it harder to do the "right thing," efforts at the hospital and microsystem levels are more difficult to implement and sustain. Such barriers suggest that

collaborations between organizations in the same community can be a very effective and rewarding strategy in working toward improvement goals.

Health care systems in the Minneapolis/St. Paul area began talking informally with each other and with other key stakeholders seeking to promote improvements in the quality and efficiency of health care. Over time, these discussions have led to a range of initiatives that have positively affected care. Looking back on these experiences, leaders of these initiatives could identify a range of benefits of working collaboratively on key issues, including:

- **Gaining new ideas and insights.** Engaging in community collaboration with other organizations with similar quality improvement goals creates a great resource and forum for dialogue about ideas and insights regarding regional issues that can help health care systems learn and grow from each other. Instead of facing the challenge of patient safety and organizational reliability independently, collaborations can offer support and ideas for organizations that are involved.

- **Addressing environmental barriers more effectively.** Collaborating on community-level barriers to improve safety and reliability is more likely to be successful than individual organizations' attempts to address the same barriers. By engaging all the key stakeholders within a community, organizations have more leverage to effect change on a larger scale. Without the power of community alignment, individual organizations may falter and be more at risk in their attempts toward community-level change. For example, cross-community collaborations can make it easier to work with legislative groups and occupational oversight boards to change policies needed for a culture of high reliability. Broad-based support is critical to efforts to develop an innovative and successful system for reporting near misses and errors.

- **Achieving standardization.** Sharing a workforce among hospitals, including nurses and specialists, is great motivation for standardizing forms and processes across all institutions. This strategy has reduced variations in work patterns, as well as the potential for errors and unnecessary rework. Additionally, community collaborations create opportunities for standardizing the measuring and reporting of quality issues. This has made it easier to more accurately set priorities, develop consistent requirements, and evaluate progress.

- **Building relationships.** Working collaboratively on patient safety and organizational reliability can result in strong connections between organizations in the same community. The stronger the community network, the more widespread the quality improvement efforts and those results may extend within that community.

Model for Community Collaboration

Background

Some aspects of the current climate in Minnesota may have enabled leaders to more rapidly develop effective community collaborations. Although it is a very competitive marketplace, Minnesota does not have any for-profit HMOs or for-profit hospitals. It does have leaders for its health care organizations who know each other and are familiar with challenges that they and

their peers are facing. Although less than 10 years ago, collaboration between health care stakeholders was very limited, there has been growing awareness that it is possible to compete on aspects of care while still collaborating on safety and quality issues in mutually beneficial ways. This section offers insights into how Minnesota evolved into a market with appreciably more collaboration on quality and safety issues than exists virtually anyplace else. It addresses the following two questions:

- Which community organizations are involved in the collaborative network that has formed in Minnesota?

- What practical insights can be acquired from the work that has been done in Minnesota about how a successful model for community collaboration can be created?

Minnesota Collaborations

The past 5 to 6 years in Minnesota yielded an evolution in collaboration that was fueled by the Harvard Executive Session on Medical Error and Patient Safety. Harvard Executive Sessions bring together senior leaders to learn and act on a variety of issues through a series of dialogues to address a topic of significance. After the Harvard Executive Session on Medical Error and Patient Safety, leaders in Minnesota decided to form their own local version: The Minnesota Executive Session on Patient Safety. Once leaders were engaged, the next steps were to determine (1) which community health care providers and associations would be willing to collaborate; (2) how that collaboration would provide assistance to and be beneficial for hospitals; (3) how to define the role of the State; (4) how to design a measurement and reporting process; and (5) how to create a nonpunitive culture that breeds transparency. The diagram below illustrates the current structure of the Minnesota Collaborative Network.

Figure 1. Minnesota Collaborative Network Structure
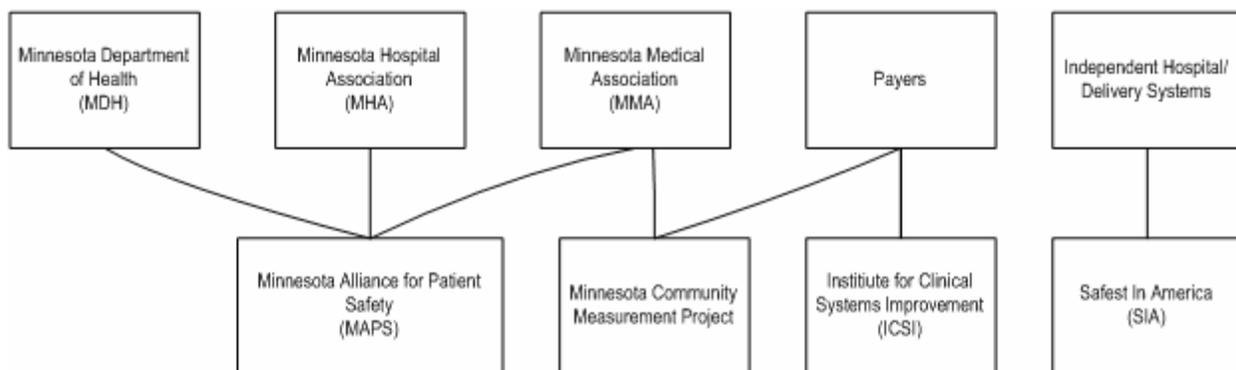
Table 1 provides more detail about the four primary organizations shown above and their role in the Network.

Table 1. Organizations' Role in the Minnesota Collaborative Network

Organization	Description
Minnesota Alliance for Patient Safety (MAPS)	MAPS is a partnership among the Minnesota Hospital Association, Minnesota Medical Association, Minnesota Department of Health, and more than 50 other public-private health care organizations working together to improve patient safety. MAPS was formally announced at a press conference on November 1, 2000. Its mission is to promote optimum patient safety through collaborative and supportive efforts among all participants of the health care system in Minnesota. Its goal is to improve the culture and to mobilize community resources for patient safety. MAPS is governed by three structural bodies in order to make substantial change, share leadership, engage a broad stakeholder group, and drive action: executive committee, steering committee, and subcommittees and task forces. The MAPS governing principles include leadership, membership, operations, expectations of MAPS members, resources and support, and MAPS legislation review.
Minnesota Community Measurement Project (MNCM)	The Minnesota Community Measurement Project (MNCM) is a nonprofit community-based organization dedicated to accelerating the improvement of health through public reporting. MNCM has a 16-member board of directors, with representation from health plans, hospitals, physicians, employers, business groups, and consumer organizations. The organization strives to share reliable quality information that clinicians can use for improvement purposes and consumers can use to make choices about their care; reduce reporting-related expenses for medical groups, health plans, and regulators; and communicate findings in a fair, usable, and reliable way to medical groups, regulators, purchasers, and consumers. Since 2002, MNCM's collaborative community approach has encouraged medical groups to improve health care quality by publicly reporting on several measures. All seven of Minnesota's nonprofit health insurance plans participated in developing the initial MNCM reports. MNCM is involved in a national initiative funded by the Centers for Medicare and Medicaid Services (CMS) and AHRQ to pool data to produce reliable quality measures.
Institute for Clinical Systems Improvement (ICSI)	ICSI is an independent nonprofit organization, originally focused on developing guidelines for improving quality of care. It now facilitates the collaboration of more than 50 medical groups, hospital systems, and health plans in the State of Minnesota and in adjacent areas of surrounding States. ICSI was founded in 1993 by Health Partners Medical Group, Mayo Clinic, and Park Nicollet Health Services. Today, the combined medical groups and hospital systems represent more than 7,600 physicians. Over the years, the ICSI members realized that to improve care, they needed to create more than standards and to help organizations understand basic quality improvement principles. Since then, ICSI has become a very successful organization for supporting improvements in quality and patient care at the community level.
Safest in America (SIA)	Safest in America is a collaboration of 10 Twin Cities and Rochester hospital systems and ICSI. SIA works to improve patient safety by learning from the aggregate experiences of all group members by sharing data, highlighting best practices, and implementing evidence-based, community-tested solutions. SIA committees are facilitated by ICSI. ICSI helps hospitals select topic areas, review literature for best practices, select process and outcome measures, and monitor progress. SIA's work is peer review protected, meaning each hospital is committed to sharing data, maintaining each other's confidentiality, and refraining from release of their own data for competitive purposes. Protocols developed during SIA initiatives, including safe prescribing, safe site surgery, and prevention of hospital-acquired infections, among other topics, are publicly available to any interested hospital.

Minnesota's Model for Collaboration

While leaders were deliberate and thoughtful about setting the aim of improving patient safety and reliability, developing successful community collaboration in Minnesota did not happen overnight, nor was the path for developing a successful collaboration always apparent. Reflections at the HRO Network meeting on the formation of the collaborative network in Minnesota over the past few years resulted in valuable insights that others just beginning to explore community collaborations might consider:

- **Do not compete on patient safety.** A frequent barrier in the collaboration process is ensuring that organizations are willing to work together and share information, instead of being focused on or worried about competing with each other. Health care systems in the same community have the same market. When these organizations first come together to begin a collaboration, it is natural for them to be hesitant about sharing quality and operational information with their competitors. It is essential to agree at the beginning of any collaboration that the organizations involved will not compete on patient safety initiatives such as wrong site surgery and medication abbreviation errors. Competing on patient safety will both derail collaborative efforts toward improvement and misalign individual system focus with the wrong priority. Even in areas where hospitals do compete, there still may be grounds for collaborating with each other. In Minnesota, even though there is competition related to performance on quality measures, hospitals have worked collaboratively to develop common quality metrics that can be used to measure comparative performance.

- **Do not underestimate the value of incremental muddling.** Many of the successful collaborations began with informal conversations between relevant leaders about issues of potential interest. While some of these discussions did not progress, others evolved into more focused discussions and formal agreements to work together to achieve important goals. This approach to planning allows ideas to be explored without major commitments of time or resources and reduces the likelihood of a major investment in ideas that lack widespread support.

- **The importance of leadership cannot be overestimated.** Having the right people in the right place at the right time is only half the battle. Leaders must be willing to take small steps toward collaboration even when they are not sure where it is leading. Sometimes these discussions lead to clear proposals for collaboration; other times they lead to the decision that the idea being considered is not a high enough priority to pursue at that time.

- **Local community collaborations can be more powerful than national collaborations.** Geography is an important factor in collaboration because the people involved have a common understanding of the local conditions, such as the market, transportation, and money. National collaborations are sometimes scoped too broadly to be applicable to local health care systems and practitioners. Collaboration can be very effective at the local level for this reason.

- **Building community collaborations takes time.** One criticism of collaboration is that there are so many possible focuses of work. Rather than attempting to involve all the organizations and their leaders in all initiatives at the same time, Minnesota has been successful by developing collaborations one at a time and including only the relevant groups for specific initiatives. Trying to do too many things too quickly is always in tension with trying to make sure particular initiatives have enough traction to succeed. Building a coalition over time and bringing in different stakeholders with different needs at the appropriate time makes collaborative work more feasible.

- **Identify at the outset where the creative tensions are going to be among the key stakeholders.** Creative tensions are sure to exist in collaborations. Progress will not be stifled if you allow the group members to work through the tensions together and give these tensions the attention they deserve. The value of sharing and working together over a long period of time is that trust can be built.

Specific Improvements Through Community Collaboration

After organizations in a community have formed a structure and model for collaboration, the work of improving patient safety and reliability begins. The following are a few examples of types of improvement initiatives that are possible through community collaboration. The examples provided below were taken from discussion at the site visit and from work done by the collaborative in Minnesota that helped to make processes and systems more reliable in their community:

- Changing the punitive culture mindset and managing media presence

- Standardizing medication concentrations and eliminating medication abbreviations

- Standardizing surgical site marking

- Standardizing measurement processes and results reporting

- Creating systems to improve quality of care

Changing the Punitive Culture Mindset and Managing Media Presence

Barrier: Punitive culture mindset. A common barrier to improving transparency, and in turn reliability, in health care is having a punitive culture mindset when addressing errors. Historically, health care systems blamed individuals when errors occurred. Research has led to a mindset change at many health systems, which now prefer to use a learning perspective when trying to determine the reason for system-related errors. Most State boards, which are responsible for regulating health care professionals, however, are still operating under the previous mindset of shame and blame. In cases where the hospital believes that a system error, versus a staff error, has taken place and staff are unwilling to come forward with errors, this difference in approaches may ultimately lead to staff termination by the board.

Collaborative approach. A few specific ideas about how to use community collaboration to reduce punitive culture mindset are described below:

- Use leverage acquired through community collaboration to engage in discussions about reliability with State boards, as well as to advocate for improved board review and approaches toward errors.

  - Baylor Health Care System is working with the Texas Medical Association to improve the Board of Nursing's approach to review of medical errors. Recently, the board changed one of their policies to include as part of the review that consideration must be given to the environment in which the practice took place.

- Adopt improvement concepts that focus on transparency and accountability, such as Just Culture algorithms from David Marx and James Reason, to begin educating and changing the punitive mindset both internally and externally in the regulatory environment.

  - In Missouri, the State Board of Nursing is holding its annual meeting in conjunction with a program by David Marx that will educate the nursing board about just culture.

- Look for opportunities to interact with health occupation board members outside of crisis situations, to educate them about nonpunitive responses to errors and early identification of problematic processes. For example, the collaborative in Minnesota worked with the State boards to help them see that typical responses to errors from boards of nursing and medicine were based on outcomes, not on the error itself or the process through which the error was made. Thus, in the absence of adverse outcomes, boards were permitting flawed processes to go unchecked. Alternatively, when a flawed system produces an error that does not have a major adverse impact, it is much easier for these boards to focus on improving the systems rather than satisfying public pressure to penalize the person who is perceived to be responsible.

Barrier: Managing media presence and consumer perception. The media can have a huge impact on how consumers perceive an error. The presence of the media can create pressure from the community for health care systems to take more stringent action, instead of focusing on learning from the error and improving quality. Media attention and views of consumers can cause a system to worry more about their reputation than the best way to improve care. In a collaboration that involves sharing and transparency about quality issues, the presence of the media may also make members of the collaboration hesitant to disclose information that will make them look bad in the community.

Collaborative approach. While no health care system can control the media, they can use the presence of the media as an opportunity to discuss quality improvement and efforts to become more reliable, which can help consumers understand that the system is actively trying to learn from mistakes. A collaborative network can support this discussion and education, as well

as help systems not lose focus during a period of media scrutiny. A few ideas about how to work with the media based on lessons learned from the collaboration formed in Minnesota are below:

- Build strong relationships with the media. One-on-one personal education and mentoring with the media helps them to be more informed about the information being reported. Keep in mind that members of the media work at organizations with deadlines, but they are not always experts about what they are reporting on. They will be grateful when they can get expertise they can trust. Fairview now often gets calls from media members seeking to understand issues they are covering that do not involve crises or their health care system. This relationship makes it easier for Fairview to be trusted when media cover an error or other crisis.

- View those strong relationships with the media as a give and take. Calling a media representative first with a good story to report will help to build trust and will provide a forum for educating the public about important health information. Remember that a good relationship will not keep the media from asking tough questions when an error occurs but may make the reporter more likely to approach you first to understand what actually happened.

- Do not be afraid to invite media representatives to events. Most media coverage on events in Minnesota has been informative and benign. As media become more informed about the issues, however, their ability to ask fair but very challenging questions has grown. It is important to view efforts to inform the media as useful but not as a strategy for avoiding criticism. Such education can reduce unfair reporting, but good reporting can still be very critical if the criticism is warranted.

Standardizing Medication Concentrations and Eliminating Medication Abbreviations

Barrier: Nonstandardized medication concentrations. In a community with multiple health care systems, patients may frequently be transferred between facilities to receive care. Critical information such as medication dosage must accompany the patient during the transfer. Because each hospital may dose medications differently, the potential for a medication dosing error exists for transferred patients.

Collaborative approach. In Minnesota, the health care systems recognized the potential for error given the number of patients transferred between facilities and the differences in dosage at each facility. To help reduce the probability that a medication error of this type would occur, the health care systems, as members of the Safest in America collaboration, worked together to create standardized drug concentrations across all hospitals so that the dosage recorded in one hospital would be equivalent to that recorded in another hospital. Because personnel often shift between health care systems, this initiative also has reduced the risk of these personnel making errors due to differing practices across the systems.

Barrier: Medication abbreviations. Substituting inappropriate medical abbreviations for drug names when prescribing a medication has been identified as one of the factors that may increase the risk of causing a serious medication error. In May 2005, the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) affirmed its "do not use" list of

abbreviations as part of the National Patient Safety Goals. While most health care systems agree that the use of inappropriate abbreviations should be eliminated, trying to change individual provider behavior can be difficult.

Collaborative approach. In Minnesota, Safest in America hospitals have adopted a common procedure to enforce the use of safe abbreviations in handwritten prescriptions in the Twin Cities and Rochester communities. Nine unsafe abbreviations were targeted for elimination. Instead of gradually phasing out the use of unsafe abbreviations, all the hospitals in the community agreed on a "hard stop" approach in which certain abbreviations became prohibited on the same day in all the community hospitals. This Safest in America initiative actually preceded the JCAHO mandate by 3 years. This approach helped to signify the importance of eliminating abbreviations and is an effective way to reinforce staff behavior, especially when a great deal of the medical staff practices at multiple hospitals in the community.

Standardizing Surgical Site Marking Protocols

Barrier: Wrong-site surgical marking. Wrong-site surgeries are devastating errors that continue to occur because many providers rely on staff to ensure the accuracy of the surgical site, instead of providing tools and standard protocols that can be used to reduce risk of errors. Although these events do not happen often, when they do occur, they can generate negative publicity and result in large lawsuits.

Collaborative approach. Through collaboration, hospitals in Minnesota have adopted a universal protocol to eliminate wrong-site surgeries and ensure that surgical site marking is occurring at the appropriate time and by the appropriate person. Through the Safest in America community, hospitals have implemented a common surgical site protocol to ensure the correct patient received the correct surgery at the correct site. The protocol requires the physician performing the surgery to mark the surgical site him or herself. Safest in America currently is working to expand the protocol to apply to outpatient procedures. Additionally, the Safest in America hospitals all implemented the protocol on the same day to help avoid confusion among staff who may work in multiple hospitals, thus improving reliability, and to emphasize the importance of the initiative.

Standardizing Measurement Processes and Results Reporting

Barrier: Inconsistent measurement processes. A significant barrier to working in a collaboration to become more reliable is the multitude of definitions, measurements, and regulatory reporting requirements health care systems must deal with. Between internal reporting and regulatory reporting at the local and Federal levels, health care systems struggle with different definitions and measures of quality issues.

Collaborative approach. Working together to standardize reporting will ensure health care systems in collaboration can compare relevant information and data, as well as help standardize reporting in the local regulatory environment. Standardized reporting principles across providers, insurers, and employers allow for substantial analysis of quality data, which can be the basis for becoming more reliable. In Minnesota, the Minnesota Community Measurement Project (MNCM) was created to focus on improving quality through public and standardized reporting. Between this project and a State law requiring reporting on the National Quality Forum's 27

"never events," Minnesota has been able to standardize measures and reporting, which has been crucial in their community efforts to improve the quality of care. A few lessons learned from the work done by MNCM include:

- Take deliberate steps and lay the appropriate groundwork. MNCM has been successful because each planning step has been deliberate. MNCM works with CMS to find additional ways in which standardized measurement protocols can be spread across the country. The key is to ensure that the focus of the work is around improvement, not competition.

- Don't wait for all measurements and reporting methods to be perfect before beginning. The measures outlined by MNCM were not perfect when the project began. The perfecting of the measure will occur over time and to get started the measures just need to be good enough for improvement to occur.

- Remember that building trust among stakeholders is critical. Sharing quality data can be a controversial topic for providers who are competing in the same market. To build trust among the health plans and providers, the groups were asked not to compete on quality, but rather to share data in a secure manner to help improve quality at the clinical levels. MNCM was established as a separate nonprofit organization to ensure that privacy, security, and trust could be established.

Creating Systems To Improve Quality of Care

Barrier: Lack of organizations to help create and implement systems to improve quality of care. In most communities, traditional collaborative work to improve health care focuses on creating standards or regulations that are imposed on hospitals and health care providers as a way to track quality and patient safety. While creating standards and regulations is often necessary, standards alone cannot improve care. It is also important to provide hospitals and health care providers with training and advice about how to carry out quality improvement initiatives, as well as strategies that will meet required standards and regulations.

Collaborative approach. In Minnesota, the Institute for Clinical Systems Improvement (ICSI) serves as a major resource for quality improvement. ICSI is a voluntary collaboration of more than 50 medical groups, hospital systems, and health plans that was originally focused on developing guidelines for improving quality of care. Over the years, the ICSI members realized that to improve care, they needed to create more than standards and to help organizations understand basic quality improvement principles. Since then, ICSI has become very successful in supporting improvements in quality and patient care at the community level for the following reasons:

- ICSI views itself as a coach and mentor to its members, but not as an entity driving the measurement process. ICSI provides its members with quality improvement education, training, and coaching, thus serving as a valuable resource in quality improvement. Because the resources and training that they provide are in response to stated needs from the physician community, ICSI ensures that they are not attempting to "push" training onto unwilling participants. Instead, they have to deal with demand for their assistance that is exceeding their ability to provide it.

- ICSI is funded by six health plans and there is no financial charge for providers or medical groups to participate. Organizations, however, must demonstrate a commitment to quality improvement as a condition of membership:

  - ICSI members are required to participate in an annual core commitment cycle. Member groups select four or more projects or topics where they commit significant time and energy to make improvements. Groups may select a combination of clinical and service-related topics to fulfill their core commitment requirement. All ICSI members provide annual reports of progress on their core commitment cycle topics, and the reports are shared with all ICSI groups as a way of sharing information and ideas.

  - Member organizations also choose four or more ICSI guidelines to be the focus of intensive improvement efforts annually, such as diabetes or waiting time for appointments. The members set their own goals and measures for these projects and then share the results of their work with one another.

- ICSI helps develop guidelines for prevention by having clinicians from member medical organizations survey scientific literature and draft health care guidelines based on the best available evidence. Having members develop their own guidelines facilitates greater buy-in and acceptance versus adopting previously existing guidelines from other national organizations.

ICSI welcomes diverse membership because it helps to foster relationships in the community that may not otherwise have been developed. The number of organizations that can participate in ICSI has to be limited to ensure that the value currently being provided is not lost as membership continues to expand.

Conclusion

The examples taken from the collaborative efforts made in Minnesota provide evidence that considerable progress can be made on key safety and quality efforts. But this progress will require persistent effort over an extended period of time that is supported by key opinion leaders in the marketplace. It also suggests that successful projects often begin small and informally, rather than requiring upfront agreement that a major initiative should be undertaken. Finally, the Minnesota collaborations reflect the value of focusing on joint efforts that address key concerns that are widely shared and that require collaboration in order to successfully be addressed. By focusing on these types of issues, Minnesota has been able to make substantial progress in improving the safety of health care in their market. The exact means to achieving similar ends will need to evolve in every market, as they have in Minnesota. But this document shows what is possible when key stakeholders in a given area work together on projects of mutual concern.

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

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 health care 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 behaviors and in their cultures. Sentara Leigh Hospital, a 250-bed community hospital in Norfolk, Virginia, 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 walkarounds." This appendix shares Sentara Leigh's experience. It has three goals:

- Document simple but important innovations designed to reduce medication errors and increase staff communication.

- 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 appendix was acquired as part of a High Reliability Organization (HRO) Learning Network sponsored by the Agency for Healthcare Research and Quality (AHRQ). As one of the 20 participating health care 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.

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

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

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 ingrained part of work life, staff leaders recognized that environmental changes would make it easier to enforce efforts to prevent interruptions. These included the following:

- Large signs were posted 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:

- Making announcements about the new behavioral practice in staff meetings and newsletters

- Introducing new staff to the "no interruption zones" in their orientation

- Including 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 chief executive officer 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 3 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 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 ensure 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 transitions of patients to different hospital units create a need for effective communication to ensure that 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. 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 walkarounds

Daily check-in meetings allow nurse managers, facility managers, physician staff, and hospital administrators to coordinate on issues that affect each other. Sentara Leigh implemented these daily "check-ins" to ensure 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"—5- to 7-minute meetings at the beginning of each shift that allow personnel on the outgoing and incoming shifts to exchange information and ensure that there is no loss of situational awareness. With practice, nurses' abilities to provide concise updates have improved and key information can be exchanged quite efficiently.

Sentara Leigh also realized the need for hospital executives and leaders to directly observe and communicate with staff providing direct patient care. Such opportunities would allow leaders to identify issues they needed to address. Of equal importance was the need to reflect the significance they placed on direct patient care and on understanding and supporting the staff who provide it. To address this need they implemented "executive walkarounds."

Each day at 8:00 a.m., 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 walkarounds observe, ask questions, and note issues raised by staff, which they address after the walkaround 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 succeeded in using them to create a culture in which staff believe that their concerns are taken seriously and in which staff and managers have better access to the information needed to perform their jobs effectively.

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 knows, 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]

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[2] Forest Service, Rocky Mountain Research Station. Managing the unexpected in prescribed fire and fire use operations: a workshop on the high reliability organization. Washington, DC: U.S. Department of Agriculture, 2004. General Technical Report RMRS-GTR-137. Available at: http://www.wildfirelessons.net/documents/MTU_Santa_Fe_Workshop_rmrs_gtr137.pdf.

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."

As part of Sentara's overall emphasis on patient safety, it developed a set of five behavior-based expectations (BBEs) 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 health care 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. 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, 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. Sentara Leigh's preoccupation with failure was shared among all staff members, to share stories and prevent further problems from occurring elsewhere.

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[3] Note: On August 26, 2006, a commuter plane crashed in Louisville, Kentucky, 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.

Preoccupation with failure also affected 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 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. 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. They emphasize 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 hospital's senior staff and "executive walkarounds," the hospital leaders made a concerted effort to understand and address the concrete issues 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 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 cause a pharmacy technician to lose track of which medications have already been stocked or nurses to forget to share information about a patient with their replacement at the end of a shift, situational awareness has been lost and the risk of error has 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 walkarounds, 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 can improvise and quickly develop new plans to respond to the 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 walkarounds" 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 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 insights and recommendations from the person or people most knowledgeable about a situation—even if those people have less seniority, organizational prestige, or rank in the organizational hierarchy. This mentality is illustrated in Sentara Leigh's "check-ins," "nurse huddles," and "executive walkarounds," 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 (e.g., physicians-nurses-nonclinical staff; administrators, managers, care providers). By implementing executive walkarounds 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 nonclinical 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 health care 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. 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. While simplifying work processes is highly desirable, it is risky to oversimplify *explanations* or *interpretations* 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 e-mail,

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 used 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:

  - Recognizing 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 interruption" 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. Instead, 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 such as nurses stations.
    - Delegating responsibility for handling calls and pages to another person so that 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 the following:

- 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. Once leaders begin to move toward 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. There is value in considering all five of these processes, so 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, and 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 toward that end.

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.

Appendix G: About the High Reliability Organization Learning Network: An Explanation

In March 2005, AHRQ authorized the formation and support for a learning network that would focus on applications of high reliability organizing in health care. Participants would be organizational leaders from health care systems attempting to make these applications who wanted to learn from each other and from the emerging research in this area sponsored by AHRQ and others. From that point until spring 2007, AHRQ sponsored a range of activities designed to support this initiative. These activities included:

- A kickoff meeting in Chicago that discussed the goals and potential activities of the Network

- A site visit to Sentara Healthcare

- A site visit to Exempla

- A site visit to Cincinnati Children's Hospital

- A site visit to Allina/Fairview

- A Web event focused on setting priorities for improvement initiatives

- A Web event focused on engaging physicians in improvement initiatives

AHRQ and its contractors would organize and facilitate the events; network members would cover the time and costs required to attend. These activities were somewhat different from other projects sponsored by AHRQ. Members helped to choose the events and facilitated each event. The events tried to avoid extended presentations in favor of a much more interactive format where participants could ask questions about the things that mattered most to them.

Twenty systems ultimately participated in the Network. Most systems had multiple participants, all of whom shared an interest in the application of high reliability theory to their organization. One goal of the Network from its outset was to share both what has been learned and what has been achieved by the systems working to apply these concepts. This manual brings together many of those insights but cannot hope to capture the remarkable passion and perspectives of the Network members (see table).

HRO Learning Network members

Allina Hospitals & Clinics
Ascension Health
Baylor Health Care System
Brigham and Women's/Faulkner Hospital
Christiana Care Health System
Cincinnati Children's Hospital
Exempla Healthcare
Fairview Health Services
Johns Hopkins Medicine
Kaiser Permanente – California
Lahey Clinic

New York-Presbyterian Healthcare Network & System
OSF Healthcare System
Sentara Healthcare
SSM Health Care
Trinity Health
University of California, San Francisco Medical Center
University of Mississippi Medical Center
University of Rochester Medical Center - Strong Health
Wishard Health Services

Index One: Topic References

Index Two: HRO Concept References