4 Reliability, Resilience, and Developing a Problem-Solving Culture

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Abbreviations

HRO	High reliability organization
LOR	Level of reliability
MFI	Model for Improvement
mFMEA	Modified failure mode and effects analysis
PDSA	Plan-Do-Study-Act
SMART Aim	Specific, measurable, achievable, relevant, timely aim

Chapter Objectives

- Understand how to use the Model for Improvement to drive change in an organization.
- Understand how to incorporate principles of reliability science within the Model for Improvement framework to achieve an outcome by coupling safety culture and process design.
- Learn how to incorporate the power of problem-solving and the expertise of frontline staff to achieve an outcome.
- Recognize the interplay of problem-solving techniques like the Model for Improvement with reliable process design and resilient safety culture.

Vignette 4.1

A tertiary care, academic hospital has a problem with hand hygiene compliance rates. This is not a new problem, but with the added focus of a new "Zero Harm" campaign, the executive team demands that all hospital units achieve hand hygiene performance rates of 100%. Despite efforts to educate and remind employees to clean their hands, hand hygiene performance rates remain at 85–92% with wide variation across areas. The Chief Medical Officer seems visibly frustrated that these efforts have failed, and she charges the quality improvement team with fixing the problem.

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Opening Question/Problem

The intent of this chapter is not about how to perform effective hand hygiene but rather how to design a quality improvement project using high-reliability concepts operating within the Model for Improvement framework [1]. This case-based example of a quality improvement project about hand hygiene will illustrate these concepts throughout the chapter [2]. Understanding the principles of high-reliability science that couples reliable process design with the values of resiliency in the safety culture are key to achieving and sustaining higher levels of performance. While the results achieved in this case are not at the level of a highly reliable process (>1 error in 10,000–100,000 events), it illustrates how a project team can incorporate specific change concepts with known levels of reliability to achieve their desired level of reliability.

Vignette 4.2

A multidisciplinary improvement team, representing the medical-surgical care units, has been assembled including two nurse managers, an infection prevention nurse, medical director, nursing care assistant, and hand hygiene auditor. The team evaluates the system that has been in place for years and notes the presence of a hospital-wide hand hygiene auditor program that directly observes and records encounters, monthly dashboards displaying unit performance, posted signs, and intermittent educational programs targeting units with poor compliance. Hand hygiene performance data with targets are included on the unit, and aggregated balanced scorecards are updated monthly. Managers are held accountable for meeting these targets annually and share data with nursing staff during monthly meetings. Hand hygiene results have been plotted on a statistical process control chart that displays the combined units' monthly average hand hygiene compliance percentage. The results show a baseline median of 87% and wide variation with a range of 64–94%. The team decides to use the Model for Improvement to design the project. They map the process, conduct a modified failure mode and effects analysis (systematic method of identifying and addressing potential failures) (Key Point Box 4.1), develop a SMART aim statement, examine key drivers, and prioritize interventions in a key driver diagram (Fig. 4.1) [1].

Key Point Box 4.1 Modified Failure Mode and Effects Analysis (mFMEA)

A simplified version of the method used by process and product designers to identify and address potential failures before implementation of change. This method is used in a proactive manner rather than tools that evaluate a problem that has already occurred such as root cause analysis or cause and effect (fishbone) diagram. The mFMEA is used with the project team as a group exercise with the goal of defining a high-level process map, then identifying failures in each step of the process, and finally proposing solutions to address the failures. The solutions proposed in this exercise can be used to populate the "interventions" section of the project key driver diagram.

Model for Improvement

When facing a difficult problem or task, one needs a structured problem-solving technique to provide a framework for an effective, focused, and disciplined approach. The Model for Improvement (MFI), the subject of *The Improvement Guide*, provides such a framework for any type of improvement task – from personal life, to industry, and, of course, to healthcare [1].

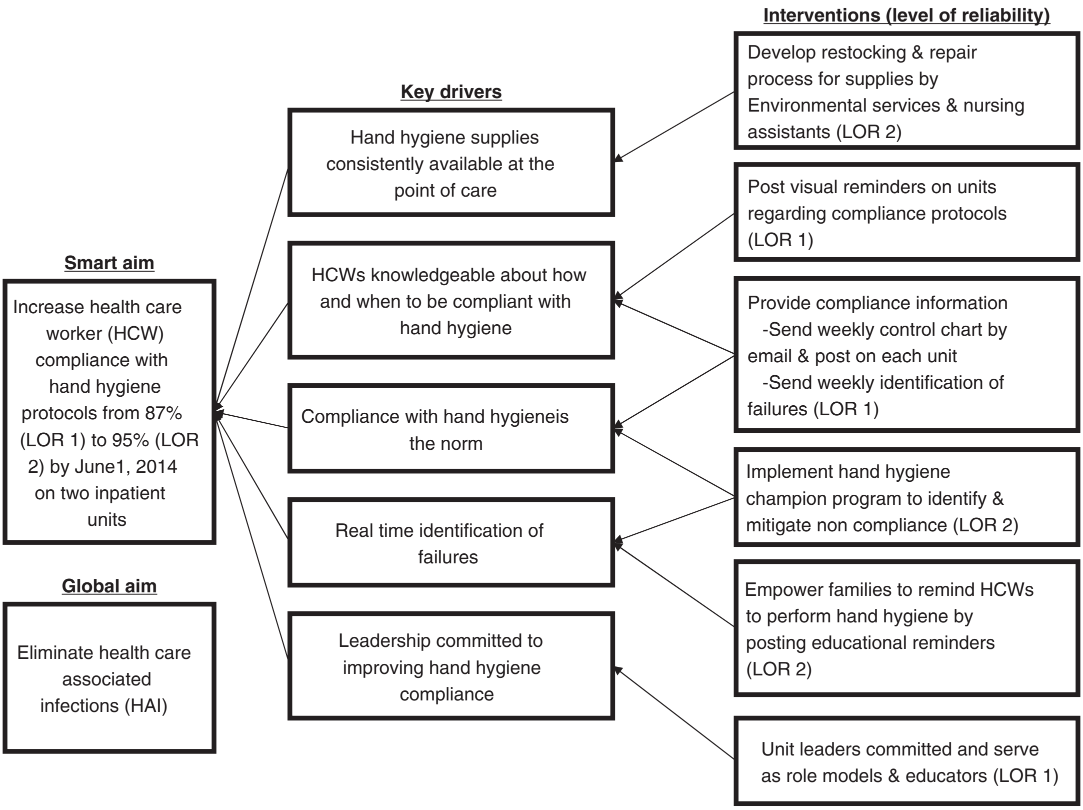

Fig. 4.1 Hand hygiene project key driver diagram. (Reproduced with permission from Hospital Pediatrics, McLean et al. [2] © 2017 by the AAP)

This model, comprised of three questions followed by the Plan-Do-Study-Act (PDSA) cycle (Fig. 4.2), has proven to be a powerful tool for driving improvement. The three questions include (1) What are we trying to accomplish? (2) How will we know that a change is an improvement? (3) What change can we make that will result in improvement?

Many healthcare professionals believe improvement occurs by holding meetings which often don't result in actionable plans. The topics in these meetings may drift, and often a consensus plan is never reached. The attraction of the MFI is twofold. First, a small amount of initial planning to sequentially answer the three questions, followed by focused testing (PDSA cycles) based on those theories, can result in more efficient improvement. Second, as the MFI becomes more widely used in healthcare, it can serve as a universal language between hospital units, hospitals, and health systems to help spread quality improvement successes.

Question 4.1: What Are We Trying to Accomplish?

While this question seems easy enough to answer, many teams experience difficulty articulating exactly what they are trying to accomplish unless they specifically set out to answer this question. In healthcare, team members often come to the table to discuss a problem, and lengthy conversations can ensue with multiple ideas put forth. If each member were asked exactly what they are trying to accomplish, few would be able to articulate a goal, and many might articulate *contrasting or conflicting* goals. This poses numerous prob-

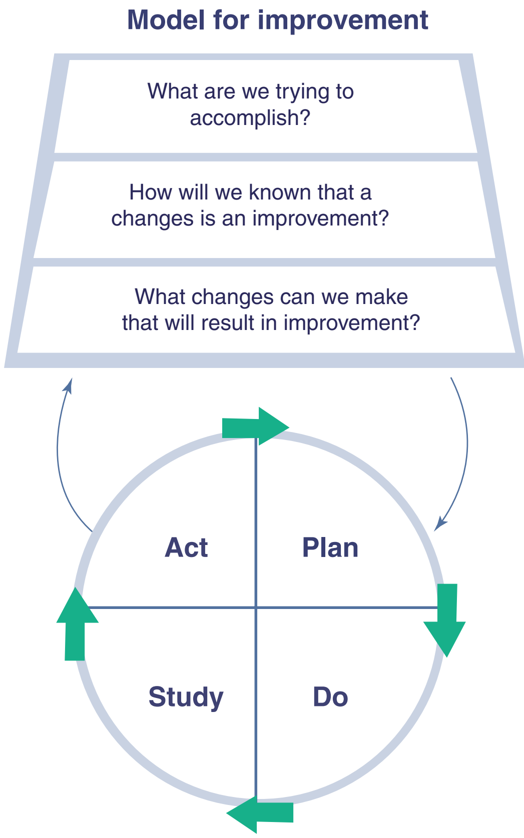

Fig. 4.2 Model for improvement. (Reproduced with permission from Associates in Process Improvement [9])

lems, not the least of which is that team members might be working to accomplish different tasks, and sometimes these can be at odds with each other.

Teams benefit when they spend time documenting exactly what they want to accomplish. Though creating this aim itself can take considerable time for some groups to achieve, this diligence will help prevent scope creep, and the long-term benefit toward the team's goals will be considerable. Goals that use the SMART aim mnemonic [3] provide a concise, easily understandable goal for team members and non-team members alike. These goals are Specific, Measurable, Achievable, Relevant, and Timely. The handwashing SMART aim for the hospital in this chapter is to increase healthcare worker compliance with hand hygiene protocols from 87% to ≥95% within 9 months in two pediatric inpatient units, leaving very little doubt to anybody who knew their work exactly what they were striving to do.

Question 4.2: How Will We Know That a Change Is an Improvement?

In quality improvement, measurement and data analysis are paramount. To determine if a change results in improvement, a team needs to know exactly what it is they are trying to improve and what is the unit of measurement for success. Often, the main measure of interest is articulated in their SMART aim statement which provides the team with some guidance. However, sometimes the measurement requires some clarification, and an operational definition is needed [1, 4]. For example, in our hand washing example, what does it mean for somebody to properly wash their hands? Does it have to be with foam? Can it be soap and water? When does hand washing have to occur in relation to donning a gown and gloves for patients on isolation? Such definitions provide clarity to the team to ensure they are comparing "apples to apples" during their improvement cycles with data collection and provide a concrete definition of what is to be improved. The operational definition for measurement also provides the staff with a standard work process expectation as they enter and exit patient rooms.

Once a team knows what to measure and how to measure it, the methods of analyzing the data become important. Since improvement, by definition, occurs over time, it is necessary that the data be tracked as such, with more frequent data collection (daily or weekly) being preferred over longer periods of time. Multiple, successive data points provide near real-time information to teams as they test changes, implement proven changes, or work toward sustainment. When analyzed with run or statistical process control charts, teams use specific statistical rules to understand variation in their data, separate data signals from noise, and quickly learn the impact of their tests of change on their systems. Identifying common cause variation (variation inherent to a system) and special cause variation (variation that is not expected within the system) provides teams valuable insight into each intervention's impacts and the actions they should take [1, 5, 6].

Question 4.3: What Changes Can We Make That Will Result in Improvement?

For many novice teams, this is where quality improvement work both begins and ends. Everybody wants to provide a solution, and team members jump to answer this question before answering questions 1 and 2. A group describes the problem, people say with some certainty what should happen to fix the problem, discussion ensues, action items are identified, and the meeting adjourns. No real goals. No measurement plans. And there will likely be frustration at the follow-up meeting because the only "proof" of whether or not something helped is personal anecdotes. When using the Model for Improvement, this question should only be addressed after questions 1 and 2 are answered. With a unified goal, the team knows exactly what measure they are following to determine whether or not their interventions are altering their system.

The key driver diagram (Fig. 4.1) for the case vignette visually depicts all three questions of the Model for Improvement. A key driver diagram can quickly anchor a team, answering the first two questions very clearly in the *aim* statement and with the key drivers. The team is then ready to brainstorm some ideas for question 3 and can easily see how any potential ideas relate to the key drivers and the SMART aim, resulting in more focused discussions and preventing scope creep. The diagram is also a living document, changing as the project progresses with new knowledge and potential interventions.

Testing Changes: The Plan-Do-Study-Act (PDSA) Cycle

The Plan-Do-Study-Act (PDSA) cycle might be the most well-known quality improvement acronym but might also be the most poorly understood conceptually. There are multiple misperceptions of the cycle itself [7], and, perhaps as a result, the medical literature is full of instances where the term PDSA was invoked, but there is no evidence that PDSA cycles actually took place [8]. The PDSA cycle, which is informed by and used in conjunction with the first three questions for the Model for Improvement, enables teams to learn quickly about the feasibility and effectiveness of the proposed interventions. The PDSA cycle is based historically in the scientific method with the intention of producing new knowledge based on hypothesis testing [4]. Therefore, a true PDSA cycle requires not just putting a change in place but also deliberately studying the results in relation to the team's hypothesis. The bidirectional arrows between the first three questions and the PDSA cycle in the Model for Improvement are deliberate and vital to its purpose (Fig. 4.2) [9]. In essence, each PDSA cycle builds the team's knowledge of their process over time by gaining insight from data through these sequential tests of change (Fig. 4.3) [1].

Having answered the first three questions of the Model for Improvement, a team now has a specific SMART aim statement and understands how they will know if the changes result in an

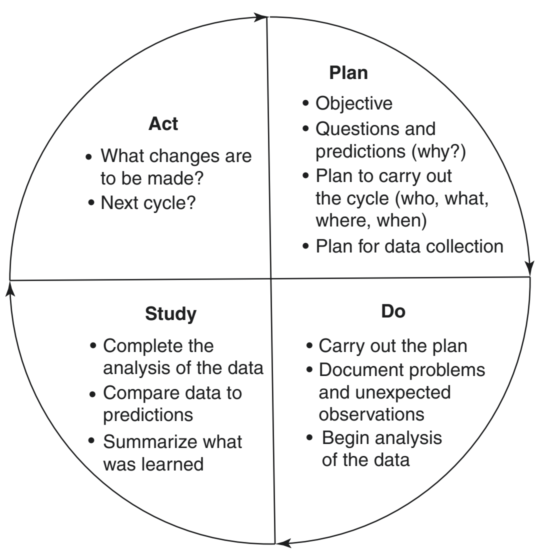

Fig. 4.3 The Plan-Do-Study-Act cycle. (Reproduced from the Improvement Guide Fig. 5.2 with permission from Wiley Books; Clifford et al. [1])

improvement (their chosen measure), and they will have brainstormed ideas that might improve their system. Teams are now ready to conduct their PDSA cycles.

Plan

Teams first *plan* a small test of change based on their team's predictions. Taking one of the proposed interventions, the team can try to incorporate that on a limited scale to begin to understand the effectiveness. For example, in our case vignette, the team would learn much faster by testing interventions on a single room than "rolling out" a new policy to an entire hospital. The team should be explicit about the details of their test – where it will happen, what they will do, what data they will collect and how, and even predict what might happen. The team needs not to have consensus before testing an intervention as there might be significant resistance to change. In fact, allowing team members to predict failure can assist teams' cohesiveness and encourage everyone to share their thoughts and concerns.

Do

They then *do* the test exactly as it is laid out. The intervention might be done by a single provider or in a single room. As the intervention is tested, data are collected to inform the next steps.

Study

Using feedback from the person or people doing the test or those impacted by the test, they then *study* the results. The study of the results can be either in the form of qualitative data or a quantitative measure related to the SMART aim. Did it go as planned? How were the staff impacted by the change? Did it have the intended effect? Do the results move the team closer to their intended goal? How do the data change the perceptions (if at all) to those that were resistant to the change? If their concerns were borne out by the data, what other changes would they suggest? If the test resulted in signs of improvement, how can these data be used to begin to assuage their hesitancy for change?

Act

Through the new knowledge gained in this testing, the team then *acts*. They choose to either adopt, adapt, or abandon this test. In rare cases when the first test achieved its desired effect perfectly, the team may adopt the test and attempt it on a larger scale, ramping up to conduct another PDSA cycle with multiple providers or multiple rooms. More commonly, there are mixed results from which important lessons are gleaned about the intervention's potential effectiveness. Modifications to the test of change are done, and a new PDSA cycle is conducted again on a small scale. Finally, in some scenarios, the tested intervention does not have the desired effect or is not well-received by those whom it will affect, and the team chooses to abandon the intervention altogether. Regardless of whether the team chooses to adopt, adapt, or abandon, the PDSA cycle is a success because they gained important insight into their system without disruption.

The Strength of the Model for Improvement

The Model for Improvement brings structure and discipline to any quality improvement project and applies to all organizational levels [5]. This focused stepwise learning process based on testing theories through the iterative PDSA cycles allows teams to learn from their tests, use accepted statistical methods, and improve their process faster than other approaches [5]. This model is also easy to teach and can be adopted by frontline staff who can begin to work as teams and solve everyday issues that might not rise to the level of management or leadership. Allowing staff to solve their own problems and have early wins can improve morale and resilience. Finally, the structure of the Model for Improvement can be utilized as the framework alongside many other quality improvement methods such as Lean and Six Sigma.

In our vignette, the previous system was not achieving the desired results despite hard work and the best intentions. We needed to use a structured problem-solving approach. The creation of a SMART aim statement provided a unified vision for the team, and each person knew what they were striving for and how to play their part (Question 1 in The Model for Improvement). Data analysis using the control chart (Fig. 4.4) allowed them to analyze their data in real time, providing important insight as to whether or not the tested changes were making a difference (Question 2 in The Model for Improvement). The key driver diagram allows them to propose interventions that would result in improvement (Question 3 in The Model for Improvement) and then proceed with PDSA cycles to inform their decisions. With this new problem-solving structure in place, the frontline staff could now address concerns using the Model for Improvement and be empowered to voice larger concerns to their leadership.

Vignette 4.3
Now that the initial phases of the project were complete, the team is excited to start testing the interventions they had planned. First, the team decides to develop new posted paper signs and computer screensavers to remind staff to clean their hands to see if fresh new ones placed in different areas would help nurses who no longer noticed the old ones. In addition, unit leaders (nurse managers and medical directors) decide to leverage their roles by discussing hand hygiene performance during meetings and to provide regular, frequent feedback to nurses, nursing care assistants, and physicians. The team uses a control chart (Fig. 4.4) to display weekly hand hygiene compliance data and posts them in

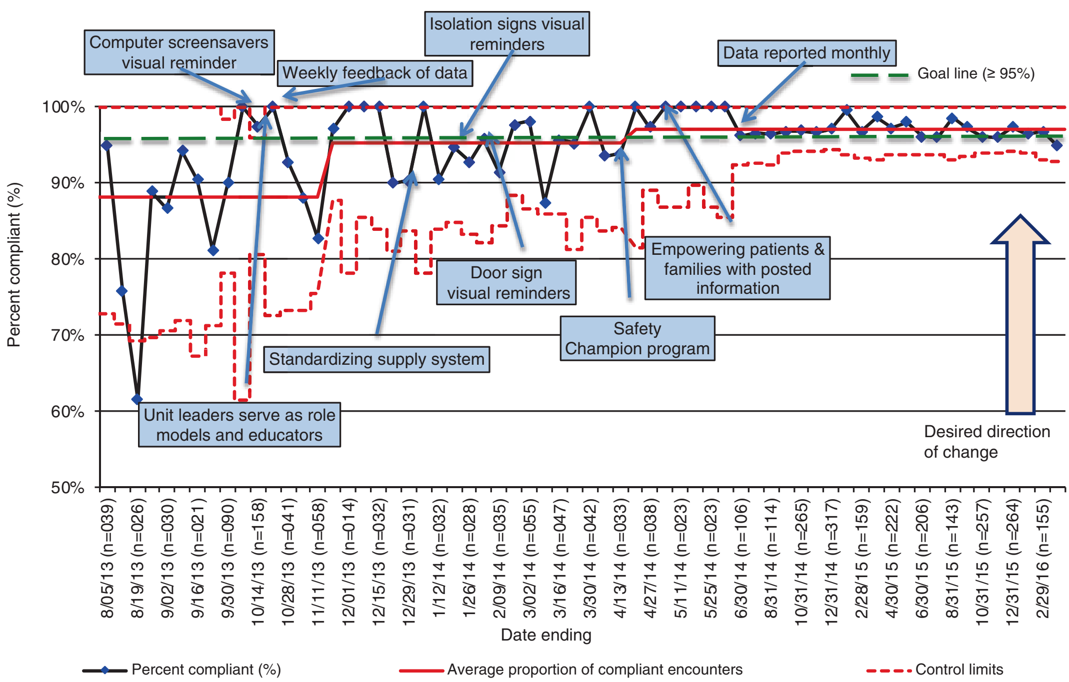

Fig. 4.4 Statistical process control chart (percent or p-chart) showing percent compliant hand hygiene encounters on two inpatient units with annotations of test of change. The x-axis is labeled with every other week or month, and data points are weekly until June 2014 when they are measured monthly. (Reproduced with permission from Hospital Pediatrics, McLean et al. [2] © 2017 by the AAP)

workrooms and distributes them in emails so the performance is viewed by all nurses, physicians, and other staff working on the units. Performance improves >95% at first but, unfortunately, drifts back down to the mid-80s in a few weeks. The team feels frustrated with these results and decides to take a step back. A quality improvement coach suggests the team needs to understand the principles of reliability science before proceeding with the project. The team agrees that the interventions used so far will not sustain a high level of performance and want to learn more about how they can design the process in a different way.

In this case vignette, the team has so far focused on using the Model for Improvement framework to improve a process. The team is missing two key elements and needs to incorporate them into their work if they are going to achieve and sustain the results they are seeking – developing a more *reliable* process and *resilient* safety culture. Both are needed for the team to achieve the goals of this project. So what does this mean? How can the team apply these principles to improve hand hygiene? (Key Point Box 4.2).

Key Point Box 4.2 Reliability and Resiliency

Reliability – the measurable capability of a process, procedure, or health service to perform its intended function in the required time under commonly occurring conditions [10]

Resiliency – the safety culture of an organization is able to systematically understand failures that occur and make adaptations to improve over time [11]

First, let's understand how to develop a more reliable process. The term reliability, as it applies to healthcare, as described by Berwick and Nolan in 2003, is defined as "the measurable capability of a process, procedure, or health service to perform its intended function in the required time under commonly occurring conditions." [10]. Reliability can be quantified as a ratio of failures or errors per number of opportunities (Fig. 4.5). Most healthcare processes operate at levels of reliability with error rates of 10 or more per 100 opportunities (10–30% or 10^{-1} failure rate or level of reliability of 1 [LOR 1]) as compared to high reliability organizations (HROs), such as the nuclear power industry or commercial aviation, which have failure rates of 0.0001% or 10^{-6} (LOR 6) [12]. The hand hygiene failure rate the

Ratio of errors/opportunities	Reliability	Failure percent rate	Failure rate	Examples
1/10	0.9	10	10^{-1}	Hand hygiene compliance
1/100	0.99	1	10^{-2}	Pediatric adverse drug events
1/1000	0.999	0.1	10^{-3}	General surgery deaths
1/10,000	0.9999	0.01	10^{-4}	Road safety
1/100,000	0.99999	0.001	10^{-5}	Giving wrong blood to patient
1/1,000,000	0.999999	0.0001	10^{-6}	Nuclear industry

Fig. 4.5 Measures of reliability displayed as ratios of failures per number of opportunities, reliability, failure percent rate, and failure rate with examples from healthcare and industry for each level to illustrate these differences mathematically. (Adapted from Pediatric Clinics of North America, Luria et al. [12], © 2006, with permission from Elsevier)

team observes is 10–15% or level of reliability of 1 (LOR 1). We know from our vignette that this is expected since the process in place includes only training, feedback, and reminders. The Chief Medical Officer in our case is asking the team to design a process with a higher level of reliability equal to or better than 1 or fewer failures per 100 opportunities (1% failure rate or 10^{-2}). In order to achieve this failure rate, the team in the vignette will need to incorporate additional interventions into the project design if they are going to achieve this level of reliability. Studies of human factors engineering and design show us that the team needs to consider interventions such as incorporating decision aids, redundancy, and taking advantage of habits and patterns in order to achieve this level of reliability [12]. Put another way, the team will need to "hard wire" the process by using these types of tactics to create a more reliable design. Use of a visual trigger placed at the entrance of the patient room that notifies the healthcare worker of noncompliance in real time is an example of a human factors engineering intervention that could be used to improve hand hygiene compliance results. Smart process design is critical, but without changing the culture or behaviors of the people working in the area, the team will not be able to achieve and sustain the results they are seeking. To understand more about coupling reliable process design and resilient culture into a healthcare improvement project, we can learn from industries that are high reliability organizations (HROs).

High reliability organizations, such as nuclear power and commercial aviation, achieve both a reliable process and resilient culture with error rates in the order of 1 in 10,000–100,000 opportunities. Weick and Sutcliffe examined HROs and described key features that can be applied to complex healthcare processes, measure performance, and design interventions to achieve desired results. These authors identified five principles of high reliability that are common to HROs shown in the box below (Key Point Box 4.3) [11]:

Key Point Box 4.3 Five Principles Common to High Reliability Organizations (HROs) [11]

1. Preoccupation with Failure – small failures are noticed, reported, and learned from continuously by the organization
2. Reluctance to Simplify – embrace complexity and welcome diverse experience
3. Sensitivity to Operations – attentive to frontline workers' expertise
4. Commitment to Resilience – ability to learn and bounce back after failure
5. Deference to Expertise – authority migrates to the person with most expertise regardless of rank

In summary, the team can use the Model for Improvement framework for the overall project design and implement both reliable process and resilient safety culture change concepts as interventions that are indicated on the key driver diagram (Fig. 4.1). Using PDSA cycles and tracking the impact of these multimodal changes over time on the control chart (Fig. 4.4) will help the team understand when they have achieved special cause variation and reached their goal of ≥95% compliance (less than 5 failures per 100 opportunities) with hand hygiene protocols.

Vignette 4.4

Empowered with a new understanding of concepts of reliability and resiliency, the team reviews the key driver diagram (Fig. 4.1) and decides to test interventions with a level of reliability (LOR) greater than 1. Now it is clear that the reminders, education, feedback of data, and engagement of leaders were examples of level of reliability 1 (LOR 1) interventions and these alone will not give the team the results they desire of less than 5 failures per 100 hand hygiene opportunities. The team also realizes they need regular interaction with frontline staff and real-time observation of the unit practice to get to the root of the problem. It is clear to the team that engaging the true experts (deference to expertise and sensitivity to operations) in the testing and implementation is the key to achieving and sustaining the goal.

During observation of hand hygiene practice on the units, the project team learns from frontline staff that hand sanitizer canisters in and outside of each patient room are not replaced consistently. As a result of this problem-solving, the team decides that it is important to standardize the hand sanitizer resupply process for both the environmental services worker and the nursing care assistant roles. The idea is to not only create standard work but also to have each worker role responsible for the hand sanitizer and soap resupply process. Therefore, if one individual fails to replace a hand sanitizer canister, then the other one will catch it so that it would be a rare occurrence for there to be no sanitizers available at the point of care, thereby incorporating the design concept of redundancy into the system. During additional observations and discussion with frontline staff, the team recognizes the value of when a healthcare worker gently reminds another person to clean his/her hands before entering or leaving the patient room. In order to foster a culture in which compliant hand hygiene practice is the norm, the project team decides to implement a multidisciplinary hand hygiene champion program to provide real-time mitigation across the units. The idea is to have a knowledgeable peer recognize noncompliance (separate from the hospital-wide auditing process) and provide gentle and respectful feedback, therefore turning a noncompliant encounter into a compliant one. Not only will this practice improve hand hygiene compliance results, but it will also create an environment where people feel comfortable raising concerns that foster a resilient safety culture. Finally, during observations and discussion with patients and families on the units, the decision is made to involve the patients and families as partners in this process. Since care is centered around the patient and family, empowering them to speak up provides an additional layer of accountability and further strengthens the culture of safety. Implementation of all three of these change concepts positively impacts safety culture and process design by incorporating the high reliability principles described by Weick and Sutcliff (See Key Point Box 4.3).

Value of Problem-Solving

Problem-solving involves an intentional process to break down complex issues into actionable components in an effort to create solutions. The Model for Improvement represents only one problem-solving technique, but many more methods exist that can help inform or augment a team's problem-solving strategy. For example, the "5 Whys" can help determine the root cause of a problem [13] and inform a team's plan to test changes through the Model for Improvement. Toyota Production System's 8 Steps of Problem Solving, discussed elsewhere in this text, provides another established framework to solve problems and ultimately improve outcomes.

In healthcare, problem-solving often requires altering the fundamental way a system operates, impacting the frontline staff much more directly than management and leadership who classically are the ones determining how to solve the problem. Quality improvement and patient safety in healthcare require a different approach – an approach in which the experience, expertise, and knowledge of the frontline staff are valued and in which they are given the freedom to improve their environment for the better of their patients. This embodies the essence of Weick and Sutcliffe's five principles of HROs [11]. When done well, most problems can be solved quickly by those doing the work to reduce "workarounds." Management and leadership personnel are then freed to spend more time with forward-thinking exercises and less time "putting out fires."

W. Edwards Deming's theory of profound knowledge focused intently on people's abilities and their innate desire to feel like an important contributor to their workplace [14]. A key component of this desire is its ability to solve daily problems and see immediate results. Fostering a sense of cooperation instead of competition will raise the level of performance of an entire team, resulting in better results than the sum of each team member's abilities [14]. When teams can harness these abilities and use a disciplined framework such as the Model for Improvement, the frontline team members' understanding of their process, observation of the issues at hand, and ideas for improvement can be harnessed to problem-solve efficiently and effectively.

Importantly, as teams work together, they must not only think of their own results but the goals of the entire organization. Russell Ackoff, a revolutionary systems thinker, wrote: "If each part of a system, considered separately, is made to operate as efficiently as possible, the system as a whole will not operate as effectively as possible." [15] In essence, working in "silos" might help one team meet a metric, but that team's "win" may hinder the system as a whole. This issue is not unique to healthcare. As an example, General Stanley McChrystal led the Joint Special Operations Task Force in Afghanistan and had to rethink how his teams worked together. He discovered that traditional military hierarchy was not nimble enough to effectively accomplish his Task Force's goals. By creating a "team of teams" (also the title of the book), he was able to empower the frontline members on his units to solve problems efficiently and effectively. This approach also created relationships between the teams such that the broader mission's goals were taken into account as decisions were made in the field [16]. In effect, he harnessed and magnified each team members' ability as they worked within and between teams. This approach empowered team members to speak up and to problem-solve within the boundaries to their stated mission, fostered a sense of self-worth and cooperation, shattered silos, flattened hierarchy, and led to efficiencies and successes that the Task Force had not previously seen.

The ability and desire of people to problem-solve based on their knowledge of their system propelled McChrystal's model to success. This approach essentially established a high reliability organization by building reliability and resilience where it was needed most – in the people who were carrying out the important work. Healthcare can harness problem-solving in a similar manner. Frontline workers, based on their knowledge of the system, can provide ideas to lead to improvement through structured approaches such as the Model for Improvement. When teams discover changes to the system that are successful, "cross-talk" between silos can lead to larger improvements through more reliable process design. And, perhaps most importantly, this cross-talk between silos can lead to profound resilience as teams around an organization are able to speak freely to each other and to leadership, identify and verbalize a problem, and propose action knowing that their voice will be heard.

Vignette 4.5
Brainstorming and feedback from staff now regularly occur during safety and operational meetings as well as during intermittent, unannounced visits to the units. Use of the multidisciplinary champions helps to sustain the results and continue to incorporate the principles of high reliability. Following standard statistical process control chart rules, the centerline shifted twice during the project when special-cause variation occurred (Fig. 4.4). The project control chart now shows the

results they desire with hand hygiene compliance sustained ≥95%. Project results are reported to executive leadership of the hospital with an emphasis on pairing reliable process design with a resilient safety culture that is needed to give these two units the results they need. The hospital Chief Medical Officer celebrates the results of the project and helps the team plan for spread to other units in the hospital.

Conclusion

In this chapter, the example of the challenges faced, and successes achieved, by an actual improvement team highlights the importance of using a structured improvement approach (the Model for Improvement) and in harnessing the knowledge and ability of frontline staff to problem-solve. This, in turn, creates a resilient safety culture that is coupled with reliable process design. The Model for Improvement propelled the team to the next level, assisting them in identifying a SMART aim and producing theories that would help them test and measure interventions to determine if intended changes were occurring. These small wins achieved through using the Model for Improvement improved morale, provided frontline staff a voice, and engaged staff in identifying solutions that could be tested. Each organization must make incremental changes, using examples of small wins gained through quality improvement methods to reinforce frontline problem-solving. With this, reliability and resilience become symbiotic with the quality improvement methods, each building on the other, creating an upward spiral toward any healthcare organization's goal of becoming an HRO and bringing them closer to a goal of "Zero Harm."

Editors' Comments

Reliability, resilience, and problem-solving are the core of improvement science. This chapter highlights the difficulties we face in healthcare using a vignette of hand hygiene. The vignette demonstrates that something as simple as washing one's hands prior to caring for a patient is complex to perform reliability and consistently. There is no better exemplar than hand hygiene; if we cannot deconstruct this issue into its constituent parts and perform it with reliability and with resilience, then we will fall short of major improvement initiatives, which are sorely needed in healthcare, such as reducing readmissions, decreasing length of stay, and optimizing patient throughput.

We would like the reader to appreciate the significance of the Model for Improvement and strategies to approach change (PDSA cycles); the authors go in depth on these concepts to ensure that the reader will have the requisite knowledge to try and use these approaches for their improvement. This chapter espouses the traditional surgical mantra of see one, do one, teach one; the chapter is fundamental and written at an appropriate level to serve as a primer or toolkit for a novice to understand the techniques and try these on a small scale in their span of control.

The important concept of reliability is further developed in this chapter with the authors once again pulling from Weick and Sutcliffe's five principles of high reliability organizations. We feel it crucial for the reader to continually hear about these five principles and see how they are applied to various situations; it is in this way that the reader will develop a profound respect and understanding of the power of these principles as an overarching framework for improvement science.

Conceptually, the hardest part of the chapter is to describe and attempt to reach problem-solving. We believe the authors convey this very well toward the end of the chapter. Once we understand reliability and resilience, the difficulty is how to develop and sustain a problem solving culture. The authors draw from their experience and the literature to provide approaches for this difficult part of quality improvement.

Chapter Review Questions

1. What are the three questions the Model for Improvement asks teams to address in the design of a project?

   Answer: (1) What are we trying to accomplish? (2) How will we know change is an improvement? And (3) what change can we make that will result in improvement?
2. What is the difference between the concepts of reliability and resiliency?

   Answer: *Reliability* is the measurable capability of a process, procedure, or health service to perform its intended function in the required time under commonly occurring conditions [10]; *resiliency* is the safety culture of an organization and its ability to systematically understand failures that occur and make adaptations to improve over time.
3. What are the five high-reliability principles that are described by Weick and Sutcliffe?

   Answer:
   (1) Preoccupation with Failure – small failures are noticed, reported, and learned from continuously by the organization
   (2) Reluctance to Simplify – embrace complexity and welcome diverse experience
   (3) Sensitivity to Operations – attentive to frontline workers' expertise
   (4) Commitment to Resilience – the ability to learn and bounce back after failure
   (5) Deference to Expertise – authority migrates to the person with most expertise regardless of rank
4. True or false: "Zero harm" results in patient safety can be achieved by incorporating reliable process design into a healthcare system alone.

   Answer: False (need to use both reliable process design and resilient safety culture concepts in order to achieve "zero harm" results).
5. True or false: Engagement of frontline staff in the PDSA cycles for improvement can be essential for successful problem-solving and positively impacts the safety culture of the organization.

   Answer: True.

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