Using Strategies from the Nuclear Power Industry to Improve Patient Safety

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Ever since the Institute of Medicine released its pivotal report "To Err is Human: Building a Safer Health System" in 1999, much attention has been focused on improving patient safety. Tens of thousands of patients die each year as a result of medical errors, two-thirds of which are preventable. Forty-two percent of adults in the U.S. say they were involved in a situation where a medical error occurred, while 84 percent have heard about such an incident.[1] Modern healthcare involves increasingly complex technologies, yet safety practices in medicine have not kept pace with these developments and the risks they pose.[2]

Considering the frequency with which errors occur and the potentially disastrous consequences when they do, it makes sense for health care experts to look to other organizations where risks are high and safety records are exemplary. High reliability organizations, such as nuclear power plants, have developed systems to identify the potential for human error as well as analyze what went wrong when errors occur. Many of these strategies can be adapted to the healthcare setting, creating an environment that minimizes the potential for error and maximizes the potential for avoiding the same mistake in the future. In fact, in its 1999 report, the Institute of Medicine advised: "The experiences of other industries provide valuable insight about how to begin the process of improving the safety of health care by learning how to prevent, detect, recover and learn from accidents."[3]

Lessons Learned that Apply to Healthcare

On March 28, 1979, the most serious accident in U.S. history took place at the Three Mile Island (TMI) nuclear power plant in Pennsylvania. Although there were no deaths or injuries to plant workers or nearby residents, the realization of what could have happened was frightening, drawing attention from around the world. As a result of TMI and later the Chernobyl accident in 1986, the nuclear power industry underwent sweeping changes that have had the effect of enhancing safety at such facilities.[4]

Careful analysis of the events that took place at TMI and Chernobyl revealed a number of areas that could be improved or changed to prevent such accidents from happening in the future. In addition

to upgrading plant design and equipment, the effect of human behavior was examined in order to formulate an approach that ultimately improved safety. Today, the nuclear power industry has an excellent safety record. Shutdowns decreased from 530 in 1985 to two in 2007, and the average number of significant reactor events over the past 20 years has dropped to nearly zero.[5]

Medicine has several parallels with nuclear power plants that make it an ideal setting for adopting some of the same safety precautions. For example, both settings involve:

- Highly complex procedures that can rapidly lead to unpredictable and dangerous consequences. Additionally, an early but wrong interpretation of events can lead to further crises.[6]
- Constant and vigilant monitoring and a timely response to crises with predetermined actions.[7]
- Transfer of responsibility during shift changes.[8]
- The need for clear communication among colleagues.[9]
- Large and complex operations facilities that require well implemented policies and procedures.[10]
- The need for strong leadership to establish and maintain a culture of safety.

By examining the strategies involving human behavior that have proven to be successful in the nuclear power industry and adapting them to the medical context, healthcare organizations have the opportunity to significantly improve patient safety.

Creating a Culture of Safety

Just as in the nuclear energy industry, the risk of error in healthcare settings has the potential to involve calamitous consequences. Yet healthcare often fails to recognize itself as an inherently high-risk enterprise. In order for healthcare organizations to successfully adapt practices from the nuclear power industry, they must undergo a transformation in which they abandon the practice of requiring error free performance from individuals and instead focus on designing systems that promote safety.[11]

One of the lessons that can be borrowed from the nuclear energy industry is that human factors play a major role in causing accidents, and that this encompasses not only the humans operating the system, but also the humans who manage the organization.[12] The concept of a safety culture in an organization was developed in relation to the disaster at the Chernobyl nuclear power plant. It's easy to see how the definition provided by the Advisory Committee on the Safety of Nuclear Installations can be adapted to the concept of patient safety: "The safety culture of an organization is the product of

individual and group values, attitudes, perceptions, competencies, and patterns of behavior that determine the commitment to, and the style and proficiency of, an organization's health and safety management. Organizations with a positive safety culture are characterized by communications founded on mutual trust, by shared perceptions of the importance of safety and by confidence in the efficacy of preventive measures."[13] The Institute of Medicine concurs; in its 1999 report, it states "The health care organization must develop a culture of safety such that an organization's design processes and workforce are focused on a clear goal – dramatic improvement in the reliability and safety of the care process."[14]

While the specifics of a safety culture may vary among different organizations, they tend to have the following components:[15]

- Acknowledgment of the high risk, error-prone nature of the organization's activities
- An environment free of blame in which individuals are able to report errors or close calls without punishment
- Collaboration across ranks to seek solutions to safety issues
- Willingness to direct resources to address safety concerns

In an organization with a well-developed safety culture, individuals at all levels are accountable for safety. Senior management recognizes that the importance of safety lies not only in sound practices, but also in the environment of safety consciousness that permeates the entire organization. In such a culture, workers are quick to recognize indicators that serve as warning signs for potential problems. When a problem is identified, management embarks upon a fact-finding process, rather than a fault-finding mission.[16]

Even the most meticulously planned systems for ensuring patient safety may fall short if a culture of safety does not exist. Such a climate seeks to solve problems rather than place blame. By documenting all errors (not just the catastrophic ones) and including near-misses, healthcare organizations can address them proactively. In the nuclear industry, the continuous monitoring of processes and behaviors to identify precursors to errors so that they can be corrected before an even occurs is known as an "Observation Program." [17] Patient safety can further be increased by openly sharing best practices and lessons learned regarding safety procedures with other institutions. By promoting a culture of safety, the negative cycle of errors, defensive behavior, higher costs, and more errors can be transformed into a cycle of error, lessons learned, improved performance, fewer errors.[18]

The Veterans Health Administration (VHA) provides an example of various methods that can be used to create a culture of safety. This approach includes:[19]

- Partnering with other safety related organizations to demonstrate a public commitment to patient safety.
- Establishing centers to direct safety efforts.
- Instituting reporting systems, including mandatory reporting of adverse events, as well as close calls and voluntary reporting, which allows for anonymity.
- Providing incentives to healthcare team members in the form of a monetary award for individuals and teams that develop approaches to safety issues and a performance expectation imposed on leaders to improve patient safety.

From the Power Plant to the Patient

The Importance of Leadership

At first glance, it would appear that patient safety is entirely in the hands of those that provide care. However, investigations into accidents in nuclear power plants reveal that a key factor in maintaining safety in high risk industries is the quality of management. [20] In fact, many healthcare organizations employ patient safety officers or other personnel with the knowledge and technical skills required to address safety concerns, yet they lack the vision needed to drive a cultural transformation that can have far more wide-ranging effects.[21]

One leadership theory that lends itself to healthcare is the transformational leadership model, because it encourages employees to subscribe to organizational goals rather than immediate personal gain.[22] Transformational leaders encourage employee involvement in safety initiatives, emphasize safety over productivity, demonstrate a consistent commitment to safety and encourage participatory styles in workers at all levels.[23]

More important than the style of leadership is the idea that improved safety performance is linked to a concern for safety starting at the highest level of management. At Sentara Healthcare, for instance, the short- and long-term strategic plans of every senior executive include goals around patient safety and the board of trustees reviews quality and safety updates on a monthly basis; in fact, it appears before finance on the agenda. In addition, the CEO meets with quality/patient safety leaders each month to discuss best practices and target next steps for improvement. Senior leaders participate

daily in rounds of selected clinical units in order see firsthand the problems they face, reinforce patient safety messages and commend units that have performed well. Like many high reliability organizations, Sentara strives to create safety habits in caregivers across the organization in order to create a questioning frame of mind that paves the way for anticipating errors before they occur.[24]

Incident Reporting

Incident reporting is an important tool utilized by the nuclear power industry that can successfully be applied to healthcare. It is a relatively inexpensive means of capturing data on errors and adverse events in medicine.[25] Incident reports may target events in three categories: adverse events, events that could have caused harm but didn't, and close calls or near misses in which an action that could have resulted in an adverse event is corrected before harm occurs. The advantage of reporting no harm events and near misses is that they occur up to 300 times more often than adverse events, are less likely to provoke guilt or other psychological barriers to reporting, and involve little legal risk.[26] In non-medical industries, incident reporting systems typically focus on near misses, provide incentives for voluntary reporting, ensure confidentiality and emphasize systems approaches to error analysis.[27] In medicine, incident reporting systems have been used in single institution settings, regional settings and for national surveillance (such as the Joint Commission on the Accreditation of Healthcare Organizations Sentinel Event database), but are thought to be vastly underreported.[28,29] Hospitals may need to consider following the example of the nuclear industry and adopt incident reporting systems that are anonymous in order to increase the rates of reporting.

Root Cause Analysis

Root cause analysis (RCA) is a retrospective approach to error analysis that is widely used to investigate major industrial accidents. It is generally used to uncover errors related to system design and provides a structured framework for carrying out sentinel event analysis. Like other methods used to ensure safety in nuclear power plants, RCA avoids the culture of blame. It helps identify system and organizational issues, acknowledging errors so that they can be corrected. The use of RCA may help uncover common root causes that link seemingly unrelated accidents (such as serious adverse events occurring at shift change) that when analyzed, may suggest changes designed to prevent future incidents. RCA can be time consuming and is a team effort. It requires extensive data collection through interviews, document review and/or field observation. This is generally followed by data analysis to examine the sequence of events in order to determine common underlying factors. Once the team

summarizes the underlying causes and their contributions, it can identify areas that need to be modified.[30]

Red Rules

In the nuclear power industry, red rules are non-negotiable rules that should always be followed. They communicate to everyone involved in a process the importance of that process and the fact that the organization values performance of the process. In healthcare, red rules ensure that proper care is always given and that preventable errors are avoided. Sentara Healthcare utilizes red rules – both hospital-wide and in individual departments - around procedures that have the highest level of consequence or risk to safety. For example, one rule requires that before any action is taken with a patient, staff must verify and match the patient's identity using name and social security number.[31]

In order to be effective, red rules must be developed collaboratively and enforced consistently. Every staff member must be aware that red rules are not judgment calls; they are a requirement and there should be immediate consequences if they are not followed. They should also be used sparingly; too many red rules diminish their importance and increases the likelihood that compliance will decrease.[32]

Conclusion

Healthcare has much to learn from high reliability organizations, such as nuclear power plants, that also risk causing grave injuries when errors occur. Creating a culture of safety that starts at the highest levels of the organization, developing systems to identify the potential for error, tracking and analyzing errors and their cause and developing non-negotiable rules are examples of safety practices from the nuclear power industry that are applicable to healthcare. These approaches can be adapted to the unique demands of individual healthcare organizations to reduce medical errors.

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Founded by a team of consulting veterans, DIVURGENT is a national health care consulting firm focused solely on the business of hospitals and other healthcare providers. DIVURGENT provides advisory, interim management, revenue cycle management, project management, and modeling and simulation services to help improve patients' lives.

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