Creating a Systems Approach to Patient Safety Through Better Teamwork

Stephen M. Powell

In June of 2005, the Institute of Medicine and National Academy of Sciences released their latest in a series of healthcare process improvement studies entitled *Building a Better Delivery System: A New Engineering/Health Care Partnership*. System engineering methods have been successfully applied to many other industries, including the aviation industry, manufacturing, and the nuclear power industry, just to name a few.

The study convened a group of engineers and healthcare professionals to develop engineering tools and technologies for the creation of a systems engineering solution to "deliver safe, effective, timely, patient-centered, efficient, and equitable care."[1] These goals were developed following the disclosure of estimated patient deaths due to preventable medical errors—a number equivalent to losing a jumbo jet full of passengers every day in this nation.[2]

The costs associated with "overuse, underuse, misuse, duplication, systems failures, unnecessary repetition, poor communication, and inefficiency" range from 30 to 40% of every healthcare dollar spent.[1] The model for a reengineered healthcare delivery system has four levels: the individual patient, the care team, the organization, and the political and economic environment.[1] This model was developed using systems engineering techniques that identified leadership, an organizational culture of learning, effective teams, and better use of information technology as the core elements that must be addressed across multilayered healthcare systems.[3]

Through your professions as clinical engineers and biomedical technicians, you will function on the care team or at organizational system levels. Let's examine some specific strategies to train the associated core elements that will result in improved patient safety and quality of care, as well as in exceeding regulatory and compliance standards.

Check Points

The aviation industry has adopted a process called crew resource management. What can the healthcare industry learn from this process?

- ✓ CRM views human error as inevitable and as a result embraces error management tools.
- ✓ The process helps foster safety values and a preoccupation with failure.

The Care Team

The care team consists of doctors, nurses, biomedical equipment technicians, pharmacists, and clinical engineers who provide expert healthcare services. Many hospital departments work autonomously or as "silos" instead of as a traditional, unified group working toward a common goal.[1] You may find a team of nurses or of physicians, but rarely do you see a team that is truly unified within its own department or across other departments, much less the hospital system as a whole. Systems thinking would have teams depending on and influencing other teams to optimize performance across the care continuum.[1]

In aviation and recently in healthcare, highly skilled individuals are trained as teams through a process known as crew resource management (CRM). Aviation CRM has been extremely effective in changing behaviors and attitudes in the cockpit.[4] The steep hierarchal structure of the captain as "king" of the aircraft began to flatten with the introduction of CRM. The captain of the aircraft is now also captain of the team. CRM views human error as inevitable, but embraces error management tools, including checklists, briefings, and standard operating procedures to prevent and to mitigate errors before they become adverse outcomes.[4] These behavioral or nontechnical knowledge, skills, and attitudes are at the heart of high reliability teams (HRTs).[5]

HRTs are able to safely and consistently deliver high quality patient care in a high risk environment. An exam-

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High Reliability Values	High Reliability Examples
Sensitivity to Operations	*OR team completes pre-procedure brief*
Commitment to Resilience	*Feedback and assistance are regularly offered and accepted to ensure steps of a procedure are never omitted*
Deference to Expertise	*Use all available resources (experienced staff) for better decision making with better information*
Reluctance to Simplify	*Assigning of roles and responsibilities prior to a crisis event so that a plan is in place to handle the unexpected then modifying the plan based on the situation*
Preoccupation with Failure	*Voluntarily report errors without punitive action and openly discuss errors so that others can learn from the errors*

Figure 1. *Examples of the values exhibited by high reliability teams.[6]*

ple of this kind of team is an aircraft carrier crew. Even though the environment in which they operate is extremely dangerous, these high reliability organizations (HRO) successfully manage risk, resulting in low accident rates and enviable safety records.[6] One path (system) for healthcare organizations to achieve HRO status would be realized by creating an HRT in every department throughout the hospital, then linking these teams of teams together to create a reliable care team.

Clinicians must provide the leadership required to embrace team-based healthcare.[7] Their historically autonomous nature as "independent agents" may lead them to believe that their only responsibility is to their patients, when a systems view would add fellow team members and their hospital organization to their charge.[1] These HRTs create an organization-wide culture of learning, resulting in safety values including sensitivity to operations, commitment to resilience, deference to expertise, reluctance to simplify, and a preoccupation with failure (see Figure 1).[6]

The Organization

The organization is the hospital, clinic, or nursing home that provides the infrastructure for the care teams to carry out their care duties. Organizations are responsible for acquiring the necessary resources, including equipment, technology, and personnel, to allow for successful outcomes. Organizations also must manage this complex delivery system by leading and managing their HRTs. Management also has the task of creating the safety culture that forms the nucleus of energy for coordinated patient-centered care (see Figure 2).[8]

The organizational "culture is analogous to the soil and water and heat and light needed to grow anything. If we try to grow things, such as safety programs, without the proper culture…they will die."[9] Management must look to the teams for the answers to system problems. Technology and equipment acquisition planning must include the end user if we are to use a systems analysis solution.[10] When designing new technology such as patient controlled analgesia pumps and computer physician order entry systems, the tasks, boundaries, and sequences are fixed with user needs remaining static. When the new systems are deployed at the patient bedside, the tasks, boundaries, sequences, and user needs are dynamic and currently less predictable.[11] This highlights the need for systems engineering in technology acquisition.

Figure 2. *Patient safety culture as the nucleus for the health care delivery system.[9]*

The front line must be engaged at the design, development, and prototype stages of a new device and not just at implementation. In July, I accompanied Dr. John Bookwalter as he traveled to Landstuhl Regional Medical to meet with U.S. Army Forward Surgical Team members to receive direct input regarding a modification of his retractor medical device. Within a short period of time, frontline users were able to systematically refine design specifications and modifications due to their daily expert use of medical instruments on the battlefield.

Lots of time and design capital were preserved, while increasing the likelihood of device success through the development and prototype stage. The same was not true of an infusion pump where the layout of the buttons was confusing and counterintuitive, resulting in human errors occurring in the pump program and subsequent patient deaths. In this case and others like it, it was easy to blame the individual for the resultant drug concentration errors. It was later found that by redesigning the buttons and providing a more logical programming sequence, the errors were not repeated. This evaluation process led to a more systemic view of errors.[10]

Summary

Using a systems engineering approach for the delivery of safe, reliable, consistently high quality healthcare is possible, based on the successes in other industries. To realize the level of reengineering required in healthcare, teams must function across disciplines and departments as a unified organization. By creating and maintaining HRTs, existing hierarchies will flatten and HROs will become part of the healthcare delivery system.

The organization must support these teams with the proper tools, technology, and culture in order for the HRTs to complete their patient care missions successfully, consistently, efficiently, and most of all, safely. Government/compliance agencies must partner with organizations for the systems engineering approach to succeed in healthcare, so that policy ultimately originates from the consumer/patient through the care team and the organization, as opposed to a top-down mandate. ■

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