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**HIGH RELIABILITY ORGANIZATION THEORY**

The public expects that health care, like a number of other human endeavors, should be a high reliability undertaking with little risk of preventable harm. Years ago, when medicine had few therapies to offer patients, the risks of harm due to care were low. In the current era, and increasingly over time, the processes of health care have become intrinsically hazardous, wielding powerful technologies and medications. If used improperly or in error they have the power to injure, maim, or kill. Other industries have come to grips with the routine conduct of other activities that bear intrinsic hazard. At their best, organizations in these domains have been described as High Reliability Organizations (HRO). The theory of HROs has evolved over nearly 20 years.

Many of these industries share key features with health care that make them useful, if approximate models. In these endeavors:

- Intrinsic hazards are always present
- Continuous operations 24 hours a day, seven days a week are the norm
- There is extensive decentralization
- Operations involve complex and dynamic work with complex materials
- Multiple personnel from different backgrounds work together in complex units and teams

Even more so than other industries, health care, including the perioperative setting, is not yet perfectly reliable and safe. It is difficult to measure precisely the rate of injury or death from the processes of care, and there has been considerable debate particularly about the anesthesia-related death or injury rate. There is wide agreement that death or serious injury is a very rare event for healthy patients having routine anesthesia and surgery in accredited facilities. Yet even this very low death rate per operation is an order of magnitude higher than the fatal accident rate per departure of airliners (see [www.nts.gov/aviation/Stats.htm](http://www.nts.gov/aviation/Stats.htm)). Rates of apparently preventable injury and death are much higher for sicker patients or those having more complex surgery.

Of course, perioperative health care is not the same as generating electricity, flying airliners, or building a space station. For one thing, unlike nuclear power plants or airplanes, we do not design or manufacture human beings, nor do we receive an official instruction manual. Also, unlike some other industries in which the activities are relatively “elective” (the airliner doesn’t have to fly from New York to Chicago tonight) in health care there are situations in which procedures must be performed even if the hazards are particularly high. Nonetheless, perioperative health care still has much to accomplish to qualify as a high reliability undertaking, and we have much to learn from HRO theory.

**WHAT SPECIFIC LESSONS CAN WE LEARN FROM HRO THEORY?**

Although HRO Theory (HROT) is now a complex amalgam of approaches and viewpoints, some of the most relevant elements of HROT applicable to perioperative health care are discussed below. In general terms, HROT states that appropriate organizational control can yield nearly failure free results despite high hazard and high tempo, if the organization (and overall industry) embodies characteristics listed in Table 1. These characteristics are taken from several different sources including the work of Roberts, et al., Weick and Suttcliffe, Sagan, and myself. In the remainder of this paper these principles are discussed more fully as they apply to perioperative health care .

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**TABLE 1: KEY ELEMENTS OF A HIGH RELIABILITY ORGANIZATION**

<b>A culture of safety permeates the organization</b>
Commitment to safety as primary priority
Preoccupation with failure
Sensitivity to operations
<b>Systems, structures, and procedures conducive to safety and reliability are in place</b>
Deference to expertise
Command and control
Resilience
<b>Intensive training of personnel and teams takes place</b>
Continual; independent of rank or prior experience
Simulations and drills
During routine operations
<b>Organizational learning is pursued aggressively to improve safety</b>
Prospective (e.g. HFMEA, Process auditing)
Retrospective (e.g. incident/accident reporting and analysis)

#### **SAFETY CULTURE**

What makes an organization safe and reliable is the way that its people behave. The norms and routines of behavior based on shared values, beliefs, and expectations is termed “culture”. HROs create and maintain cultures in which safety and reliability are the most important values and norms. Some of these cultural elements that are important for an HRO are a commitment to safety as the dominant organizational priority, a preoccupation with failure (focusing on how things can go wrong rather than resting on the laurels of how things have gone well in the past), and a sensitivity to operations (“sweating the small stuff” so to speak).

My group, in conjunction with the Center for Health Policy at Stanford, has studied elements of safety culture in hospitals. Based on a rigorous survey methodology we demonstrated that safety cultures in hospitals are not as uniformly held as would be expected from a HRO. Moreover, when the answers to matched questions were assessed between naval aviators (an acknowledged HRO) and hospital personnel, there was a major gap between the extent of safety culture in the aviation group compared to that in health care. We attribute much of the gap to structural and organizational differences between these endeavors, although some could be due to methodological differences between survey administration in these disparate venues (and in fact this was a “natural experiment” in which similar questions appeared on surveys done at different times and for different reasons).

In health care a prime challenge to a culture of safety is “production pressure” – the overt or covert pressure to put production (as in throughput and efficiency) ahead of safety, despite lip service to the contrary. This has been shown to be a real problem in the operating room. All complex human activities have pressure to work quickly, efficiently and with few delays. There is an intrinsic asymmetry between production & safety such that signals about production are inherently stronger than signals about safety. Yet HROs have established mechanisms to ensure that these pressures do not overcome real safety concerns. They have evolved formal mission rules, checklists, milestones and a system whereby even the most junior person feels empowered and obligated to halt production for a credible safety threat. Developing such mechanisms will be important for health care.

#### **SYSTEMS, STRUCTURES AND PROCEDURES**

The structures of health care institutions and organizations may not be well-suited to achieve optimum safety or reliability. The industry is massively decentralized and poorly integrated. For example, while commercial aviation has thousands of departures per day – seemingly similar to the number of anesthetics and surgical procedures – the industry is structured very differently. Only ten organizations (airlines) handle more than 95% of passenger miles whereas in health care there are on the order of 6,000 hospitals owned probably by more than 1,000 firms.

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There is little standardization – each organization, indeed each work unit or each clinician – has a completely different approach to common problems. Excessive or slavish reliance on standard operating procedures can be detrimental to reliability and safety. Health care of human beings clearly requires more flexibility than does flying very uniform airliners. Still, the pendulum in health care is currently so far from the use of standard procedures that we probably have much to gain by increasing such standardization. Indeed the whole thrust of evidence-based medicine is to disseminate and standardize proven best practices.

There are few economies of scale, and little integration between facilities, or between firms. Financial incentives are not aligned fully with goals of reliability and safety. The public plays a role in this misalignment, as it largely wishes (irrationally) to “save money on everyone else’s health care, but not on their own or that of their family’s (this is Wildavsky’s corollary to his own “Law of Medical Money” that states that “Health care costs will rise to meet the funds available.”). In High Reliability Organizations safety and reliability are accepted as properties of the system, which needs to be resilient in the face of individual failures. Appropriate redundancies in equipment and procedures along with safety-oriented teamwork are two of the ways this can be accomplished.

At the operational level, HROs create structures to ensure the types of command and control that are appropriate to their different processes. HROs often involve a fascinating combination of centralized controls and dispersed expertise. Especially in times of crisis decision-making devolves to those in the best position to do so, regardless of rank or hierarchy. Similarly, while HROs usually use strict standard operating procedures they have embedded sufficient resilience and flexibility to adapt to unusual circumstances for which the SOPs would themselves be sub-optimal or even dangerous.

#### **COGNITION, TEAMWORK, AND TRAINING**

The emphasis on systems does not mean that individual skills are unimportant. The dynamism, complexity and risk in industries of high intrinsic hazard requires special attention to decision making processes of individual personnel and the teams they work in. In fact, it appears that well-functioning clinical “microsystems” within health care institutions may be the best current examples of HROs in health care although they are still found only sporadically.

The literature on cognition in dynamic team-based environments is already large and is growing rapidly. Nonetheless, a few key points can be summarized here.

- One cannot assume that individual workers are “interchangeable parts” who can be automatically slotted into teams based on their formal credentials with equivalent results. Health care often makes this assumption in staffing. To the extent that HROs have been successful in doing this (in commercial aviation it is common for flight crew members to have never flown with each other before) it is because of the detailed structuring of work procedures and extensive training of crew members in techniques of team-building and working together. Health care workers need intensive training about working in teams as well as high-intensity training of their “crews” and “teams.” See below for more on training
- There may also be benefits from having teams that regularly work and train together. There is conjecture that these kinds of organizational features underlie results suggesting that centers that perform a high volume of specific surgical procedures have (on average) better outcomes than those that do not. The high volume favors the creation of dedicated organizations and teams, which may be the true explanation for the difference.
- Work units in HROs “flatten the hierarchy” when it comes to safety-related information. Hierarchy effects can degrade the apparent redundancy offered by multi-person teams. One factor is called “social shirking” – assuming that someone else is already doing the job. Another factor is called “cue giving & cue taking” – personnel lower in the hierarchy do not act independently because they take their cues from the decisions and behaviors of higher-status individuals, regardless of the facts as they see them.

#### **TRAINING**

HROs recognize that intensive training and performance assessment in both routine work and in simulations and drills pays off. HROs ensure that teams and work units hone their skills during routine operations. They debrief themselves routinely and keep track of individual and team performance. For example, every naval aviator – regardless of experience level or seniority - is graded on every carrier landing. HROs also use simulation and drills extensively to ensure maximum readiness for critical but uncommon situations and to optimize team performance. Training is built into the work environment – it is not an add-on for the individual. The emphasis is on training the system, not just individuals. Moreover, training continues for the entirety of one’s career and is not limited to those learning the job.

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In health care the nursing profession adheres to these principles more avidly than does medicine. Physicians rely on a fairly weak and haphazard system of “continuing medical education” to maintain individual abilities. This system is largely at the discretion of the individual and on their own time and expense. There is little systematic training of teams.

Simulation-based training for individuals, crews, and teams in health care is just beginning. This is one of the areas in which health care can most readily adopt lessons from HROs. The Anesthesia Patient Safety Foundation (APSF) was a leader in bringing simulation training to health care. Already there are numerous simulation centers in which such curricula could be applied to perioperative health care teams.

### **ORGANIZATIONAL LEARNING**

HROs aggressively pursue organizational learning about improving safety and reliability. They analyze threats and opportunities in advance. When new programs or activities are proposed they conduct special analyses of the safety implications of such programs, rather than waiting to analyze the problems to occur. Even so, problems will occur and HROs study incidents and accidents aggressively to learn critical lessons. Most importantly, HROs do not rely on individual learning of these lessons. They change the structure or procedures of the organization so that the lessons become embedded in the work.

Unlike many HROs health care still has very weak systems for detecting, assessing, and responding to incidents and adverse events. These are local and isolated and cannot readily share lessons learned. They typically focus on individuals not on systems, and they do not often yield practical and effective changes in work practices.

Root cause analysis and failure modes and effects analysis are techniques used by HROs that are being introduced into health care. Considerable attention has been devoted to “event reporting systems”. There are also projects to upgrade traditional “morbidity and mortality conferences” to become more systems oriented. These are important beginnings. Nonetheless, to date there has been too much attention to issues of “reporting” incidents and accidents, and too little attention to the organizational learning and changes in work practices that should come from the analysis of these reports.

### **CONCLUSIONS**

No organization is a perfect High Reliability Organization. Nor is health care completely devoid of structures and procedures like those of HROs. Yet health care, which is pledged to “first do no harm,” is far behind other industries in adopting the organizational principles needed to strive for high reliability and safety. Many of the lessons of HROs will not be simple to adopt widely. Some of the principles challenge deeply embedded aspects of the current health care system. Most will require the expenditure of resources to yield change and improvement. One thing is certain however. It will be nearly impossible to achieve the nearly error-free results expected by the public without heeding the lessons of High Reliability Organization Theory. Attempting to do so will just be putting “adhesive bandages” on gaping wounds.

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