ORGANISATIONAL MATTERS

A case of the birth and death of a high reliability healthcare organisation

K H Roberts, P Madsen, V Desai, D Van Stralen

High reliability organisations (HROs) are those in which errors rarely occur. To accomplish this they conduct relatively error-free operations over long periods of time and make consistently good decisions resulting in high quality and reliability. Some organisational processes that characterise HROs are process auditing, implementing appropriate reward systems, avoiding quality degradation, appropriately perceiving that risk exists and developing strategies to deal with it, and command and control. Command and control processes include migrating decision making, redundancy in people or hardware, developing situational awareness, formal rules and procedures, and training. These processes must be tailored to the specific organisation implementing them. These processes were applied to a paediatric intensive care unit (PICU) where care was derived from problem solving methodology rather than protocol. After a leadership change, the unit returned to the hierarchical medical model of care. Important outcome variables such as infant mortality, patient return to the PICU after discharge, days on the PICU, air transports, degraded. Implications for clinical practice include providing caregivers with sufficient flexibility to meet changing situations, encouraging teamwork, and avoiding shaming, naming, and blaming.

High reliability organisations (HROs) are organisations in which errors can have catastrophic consequences but which consistently seem to avoid such errors. To accomplish this they conduct relatively error-free operations over a long period of time, and make consistently good decisions, resulting in high quality and reliability. Examples of such organisations include many commercial nuclear power plants, commercial aviation, the operation of the US Navy’s carrier aviation program, Kaiser Permanente’s western region neonatal program, and the US Federal Aviation Administration’s air traffic control system. These organisations rarely find themselves in trouble but, when they do, they engage in rigorous searches to ascertain what went wrong.1


“In a generation or two, the world will likely need thousands of high reliability organisations, running not just nuclear power plants, space flights, and air traffic control, but also chemical plants, electrical grids, computer and telecommunication networks, financial networks, genetic engineering, nuclear waste storage, and many other complex, hazardous technologies. Our ability to manage a technology, rather than our ability to conceive and build it, may be the limiting factor in many cases.”

Here we describe the components of high reliability, present a case study of the processes involved in building an HRO and the benefits realised in doing so, and examine the reversal of these processes and their consequences. The causes of the reversal and lessons for other organisations are addressed.

While HROs have many unique characteristics including their functions, hierarchies, and complexities, they all engage in similar processes towards meeting their common goal of reliability enhancement.

ELEMENTS OF A HIGH RELIABILITY ORGANISATION (HRO)

In her research in financial institutions, Carolyn Libuser identified the following five elements of HROs (box 1):3

- Process auditing or an established system for ongoing checks designed to identify expected as well as unexpected safety problems. Safety drills and equipment testing fall into this category. Follow up of problems revealed in prior audits is critical.
- The reward system is the payoff an individual or organisation receives for behaving one way or another. Organisational theory shows that organisational reward systems have powerful influences on the behaviour of people in them. Similarly, inter-organisational reward systems influence behaviour in organisations.
- Avoiding degradation of quality and/or avoiding development of inferior quality. This refers to the essential quality of the system compared with the referent generally regarded as the standard of quality in the industry.
- Risk perception: (1) whether or not there is knowledge of risk and (2) if there is knowledge that risk exists, the extent to which it is acknowledged and appropriately mitigated. Part 2 is the logical outgrowth of part 1.
- Command and control which consists of five elements:

Abbreviations: HRO, high reliability organisation; PICU, paediatric intensive care unit; RCP, respiratory care practitioner
A HIGHLY RELIABLE HEALTHCARE UNIT

The setting

Back Bay Children’s Hospital (BBCH) has 250 beds and is the tertiary children’s hospital for a geographical area more than three times the size of the state of Vermont (box 2). During the period that the paediatric intensive care unit (PICU) operated under the principles of HRO, 2.5 million people populated the locality with 500,000 under the age of 15. The region includes urban, rural and wilderness areas, with a large number of desert and mountain communities.

Medical care was provided by the intensivist who saw each patient twice daily on rounds. Morning rounds were for teaching and the group consisted of all residents, the fellow if on service, lead respiratory care practitioner (RCP), charge nurse, pharmacist, social worker, and the patient’s bedside nurse and respiratory therapist. Students from nursing, respiratory care, medicine, social work, and paramedic training colleges also accompanied the team. Afternoon rounds reviewed the day’s progress, the patient’s response to treatment, and discussed the plan for the night.

The PICU had 1704 admissions in 1996 making it one of the largest PICUs in the country, both in number of beds and admissions. Pollack and colleagues found mortality rates of 7.8 (0.8)% for PICUs with more than 18 beds. The PICU at BBCH had a 5.2% mortality rate in 1996.

About half the admissions came through the paediatric critical care transport system at BBCH, now one of the larger transport services in the country. Most (75%) paediatric specialised transport systems carry less than 400 patients per year, with the largest transporting 720 patients. The year of the McCloskey study, BBCH paediatric critical care transport brought 599 children to the PICU. This did not include neonates transported to the neonatal intensive care unit. In 1996 BBCH transported 871 children to that unit.

HRO as process

Before BBCH adopted HRO processes, children transported to it had about twice the mortality rate of those admitted from within the institution (via emergency department, operating room, or acute care ward). McNab found post-transport mortality of 11.5% when he reviewed 130 charts of children with a decreased level of consciousness. BBCH had one deterioration due to cardiac arrest in 1991 which did not result in death. In the spring of 1993 three children died during transport in a 6 month period.

Following these three problems, the transport medical director changed the approach towards moribund children being transported from distant referral facilities (mostly emergency departments). Any child with the potential for airway instability or deterioration would receive endotracheal intubation before leaving the emergency department. Rather than using blood gas measurements and chest radiographs, a clinical five-point respiratory examination was developed. After implementation of this program and while high reliability efforts were in place, no child deteriorated during transport. In 1996 there were no adverse events during transport.

The PICU had more long term employees (more than 5 years) than other ICUs at Back Bay Medical Center (BBMC) or BBCH. Attrition was about 5%, which was lower than adult ICUs. Institutional stress was lower than in other units, although there tended to be greater stress from the nature of the patients cared for in the PICU. When nurses left it tended to be for personal reasons or for academic and/or professional advancement.

Philosophy of the PICU

The philosophy of the PICU was to support the bedside caregiver, particularly the nurse, in an environment that had
numerous social and psychological hazards. Teamwork and
goal directed team formation were fostered rather than team
formation by status and role. Shaming, naming and
blaming—particularly after a bad outcome—were not
accepted. There were many ways to approach care in the
PICU; no one method was touted above the rest. Care was
derived from problem solving methodology rather than
protocol, policy, or algorithm. This allowed various services
to pursue their own unique philosophies.

The centre of care was the team and support for the team
leader and bedside caregiver. Objectives were developed for
each patient and problem. Freedom to try interventions to
identify what would work for a particular patient was
allowed. Attending physician support was always available,
either immediately by telephone or within 20 minutes in
person. Because blame and guilt were not used, caregivers
felt free to discuss problems early in their course. Deficiencies
in care were used as teaching opportunities as every caregiver
was valued as a long term member of the team.

**APPLICATION OF HRO ELEMENTS TO BBCH PICU**

Each organisation must apply the basic tenets of HROs in
whatever way it sees as best. This is how the BBCH PICU
adopted those tenets.

**Process auditing**

The process provided critical care medicine in an
environment of physiological uncertainty and instability. Staff
constantly entertained the thought that they missed some-
thing. They encouraged questioning and the presentation of
data that supported or refuted their working hypotheses. Any
team member could question care at any time. Questions
were dealt with through education of all members. This led to
immediate changes in patient care.

**Appropriate reward system**

Appropriate awards were given to encourage participation in
patient care. These were often intrinsic. Any team member
may have had information (per cep tient or opinion) that led to a
solution. As members demonstrated knowledge, insight
and discretion in patient care, they tended to play a greater
role in tactical and strategic management. Their opinions
were more frequently sought and incorporated into care
plans. Through participation of all disciplines, the team
sought to lower accidents and stress levels and improve
morale of the caregivers.

**Avoiding quality degradation**

Quality review was performed to ensure the PICU had the
lowest rate of potentially preventable mortality and morbidity.
When possible, this review occurred during or as soon
after an event as possible. Close involvement of attending
physicians improved information flow between bedside
caregivers and attending physicians. Quality improvement
reviews were prepared. When an event produced consequen-
tial injury, the administration (medical centre and medical
staff) became involved. This was after the fact, but with the
intention of using such a situation as a marker of deficiency that
needed to be reviewed. Quality referent levels for quality
improvement were adopted from nationally accepted norms
and the medical, respiratory care, and nursing literature.

**Risk perception**

Risk awareness was a more significant problem early in the
growth of the PICU. As the team brought some control over
the deranged physiology of critical illness or injury, the child
often appeared physiologically quiet. Some caregivers mis-
took this for a recovering state rather than one of latent
danger. Risk awareness remained an issue as the PICU
introduced new high risk treatments.

Risk awareness increased over the first several years and
the goal was to identify a child in the covert state of
compensated physiological dysfunction. To do this the PICU
began a program of in-service lectures specific to the various
disciplines (nursing, respiratory care, resident physicians)
and specific to the child and disease process. These bedside
lectures occurred at all hours, lasting long enough for the
staff to feel comfortable providing care. The staff also
developed two regularly scheduled conferences, one directed
at emergency medical service providers and the other directed
at nurses in emergency departments and intensive care units.
By 1997 it was the exception for a patient to deteriorate on the
hospital ward, and it was also a rarity for a patient to
unexpectedly deteriorate in the PICU. Few if any patients
were re-admitted to the PICU after discharge.

**Command and control**

Command and control played a major part of care and gave
the PICU its greatest successes. Decisions migrated to the best
qualified team member. At the interface with the patient
emergency, the most qualified person to make or guide
decisions is the bedside caregiver. Frequently, caregivers
could not predict what would work in a specific situation.
They observed responses to treatment and often quickly
made decisions which brought stability to rapidly changing
situations. Responses to treatment guided further treatment
and helped make the diagnosis. In that sense, there was no
wrong decision as any decision and its action generated
knowledge that could be used in treating the patient.

The authority gradient that frequently occurs between the
physician or surgeon and other team members can lead to
tragedy. There were times when particular services received
bad news by returning anger, indifference, or failure to
respond. To ameliorate this, nursing staff made greater use of
a form for professional interactions. These forms went up the
chain of command from the nurse to administration. They
then moved downward to the physician involved through his/
hers chain of command. This insulated nurses from reprisal.
Anger and intimidation—tools used to maintain the author-
ity gradient—became seen as a form of fight response of the
familiar “fight or flight” fear reaction. People learned how to
avoid using these tools.

Redundancy ensured thoroughness in evaluating the patient
and in choosing a treatment. Many of the signs caregivers
monitored were measured by two methods and during
resuscitations several team members monitored the same
vital sign.

Rules and procedures allowed RCPs and nurses to influence
the medical care to a greater degree and with a quicker
response to changes. Therapist-driven protocols allowed RCPs
to take into consideration the patient’s past response and
expected response while deciding on treatment.

As a teaching institution and one that develops new
treatments, the PICU at BBCH had the goal of always
considering themselves in training. Consequently, they
watched each other’s performance and gave assistance
through mutual teaching and learning.

**For 11 years BBCH was an HRO**

During the 11 years the PICU operated as an HRO, in
addition to the improvements discussed above, a number of
other indicators of success changed in the right direction.
Over that time period admissions went up as did the daily
census and the use of ventilators. Mortality and consequen-
tial events went down. Transportation went up and refused
transport requests went down. The unit was clearly a
successful HRO.
THE DEMISE OF THE PICU
After 11 years of successful operation, the two attending physicians who advocated for HRO left the PICU within a year of each other. They were replaced by several more intensive care attending physicians bringing the attending staff to six with two fellows. The service expanded to assist cardiothoracic surgeons in ICU care and a sedation service was developed.

None of the remaining staff had experience in other HROs outside medicine. Several had worked in this PICU while it was an HRO. They reverted to a medical model with the physician as leader, team by status and role, following of protocols and algorithms for safety, and maintaining central authority by the physician. Evidence-based medicine became the basis for treatment of critically ill unstable patients. These physicians considered the previous HRO model of decision migration unsafe. Loop decision making techniques to identify what works through action—for example, the Boyd OODA loop (Observe, Orient, Decide, Act)—were rejected as unknown and confusing.

RCPs could no longer suggest treatments—in fact, some were criticized for making any suggestions. Attending staff provided more assistance through telephone consultations and distant evaluation. Bedside staff felt unsupported with unstable or deteriorating patients. Refusing ICU transfer requests confused physicians in the hospital and community who had become accustomed to the previous HRO model and concept that “the indication for PICU admission is the request by a physician”. Patients discharged from the PICU were beginning to be readmitted within 48 hours.

Initially, only the physician culture changed from HRO to the standard medical model. Actions by nurses and RCPs continued but were beginning to be met with resistance, sometimes strongly worded. RCP attrition increased. New graduates began staffing the ICU—for example, while previous RCPs needed 1 year of ICU experience to transfer into the PICU, new graduates were now being taken.

What made this change of service acceptable? Why was it not identified? Because it follows the medical model so prevalent in health care and taught in healthcare training. People accepted as appropriate what they had always done. The medical model uses the physician as team leader and the team consists of positions determined by status and role. The physician evaluates the pertinent findings and comes to a conclusion—the diagnosis. The physician then generates a management plan. The more specific the diagnosis, the more specific the treatment. This is thought to increase safety and allow for more accurate risk-benefit assessment. The plan follows a logical progression of evaluation–treatment–re-evaluation–more specific treatment. Such progressions easily fit into open tree decision schemata or algorithms. Central authority is maintained by prior approval of protocols or by waiting for consultation with the treating physician.

This perspective does not allow flexible decisions based on inadequate, uncertain, or ambiguous data. It is inconsistent with the frequent time constraints required in a situation of rapidly evolving deterioration in the condition of the patient. We can see here that the medical model does not fit emergency medical situations, is in many respects diametrically opposite to the HRO model, and can contribute to patient mortality.

MANAGING HROs FOR SAFE OPERATIONS
As evidenced by several reports from the Institute of Medicine, safety in the US healthcare industry needs close attention. It should be clear to managers in the industry that, in situations in which conditions rapidly change, the evidence-based medical model of how to diagnose and manage does not work and is harmful. Department heads and their staffs need to develop true teamwork based on the problems they are likely to confront instead of the roles and status of team members. The unrecognised problem here is that often existing evidence is not very helpful, particularly in situations of tight time constraints. Caregivers often learn by doing, and they must be given sufficient flexibility to do so.

They need to assess their units and organisations to make sure HRO processes are in place and that, when they need to be used, the people using them will not be punished. Teams may need to practice in simulations of the difficult problems that can come their way. Practice builds familiarity with interpersonal styles and skill levels and helps develop the flexibility required in these situations.

Our example shows that the application of Libuser’s five principles resulted in improved care in a PICU. Each organisation must tailor its application to its own needs and maintain constant vigilance on reliability.

As evidenced from our example, HROs can easily turn into LROs (low reliability organisations). Thus, constant attention needs to be given to making sure the reliability glue is always in place. As we look at avoidable health related catastrophes, it seems the cost of avoiding failure is worth every penny.

Key messages
- High reliability organisations reduce errors and other negative outcomes.
- High reliability processes are easy to understand.
- Application of high reliability processes resulted in improved patient outcomes in a PICU.
- Implementation of high reliability processes require constant attention.
- Evidence based medical model of care does not work in situations where the patient’s condition is rapidly deteriorating.

Implications for clinical practice
- If healthcare organisations are serious about reducing negative outcomes, they need to consider adopting high reliability processes.
- These processes can easily fail.
- They are costly in time, effort, and energy, but the cost is worth it when the organisation avoids unwanted outcomes.

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