

Culture of Safety: A Foundation for Patient Care

KuoJen Tsao MD

Marybeth Browne MD

Lehigh Valley Health Network, Marybeth.Browne@lvhn.org

Follow this and additional works at: <https://scholarlyworks.lvhn.org/pediatrics>



Part of the [Pediatrics Commons](#)

Published In/Presented At

Tsao, K., Browne, M. (2015, August 29). Culture of Safety: A Foundation of Patient Care. *Seminars in Pediatric Surgery*.

This Article is brought to you for free and open access by LVHN Scholarly Works. It has been accepted for inclusion in LVHN Scholarly Works by an authorized administrator. For more information, please contact LibraryServices@lvhn.org.



ELSEVIER

Contents lists available at ScienceDirect

Seminars in Pediatric Surgery

journal homepage: www.elsevier.com/locate/sempedsurg

Culture of safety: A foundation for patient care

Kuojen Tsao, MD^{a,*}, Marybeth Browne, MD, MS^b^a Department of Pediatric Surgery, University of Texas Medical School at Houston, 6431 Fannin St, Suite 5.256 Houston, TX 77030^b Division of Pediatric Surgery and Urology, Children's Hospital of the Lehigh Valley Health Network, Allentown, PA

ARTICLE INFO

Keywords:

High-reliability organization

Patient safety culture

Medical error

Crew resource management

ABSTRACT

The 1999 IOM report on patient safety identified the house of medicine as a culture that tolerated injury at a frightening level. Identifying other industries that had cultures that would not tolerate such levels of error has begun to change the culture of healthcare to a more “high-reliability” culture. Various organizational and standardized communication tools have been imported from the military, airline, and energy industries to flatten the hierarchy and improve the reliability of communication and handoffs in healthcare. Reporting structures that focus on the effectiveness of the team and the system, more than blaming the individual, have demonstrated noticeable improvements in safety and changed culture. Further sustained efforts in developing a culture focused on safety as a priority is needed for sustainable reduction of harm, and improve the reliability of care.

© 2015 Elsevier Inc. All rights reserved.

A 2-year-old boy presents to same-day surgery for an elective circumcision. The bedside nurse sees him for his preoperative evaluation. The anesthesiologist evaluates him and discusses anesthetic risks as well as caudal analgesia for the procedure. The surgeon visits with the family to confirm the surgical consent and answer any questions. Without any concerns, the patient is taken to the operating room, undergoes anesthesia, and has his caudal analgesia performed. In preparing to prep the surgical site, the circulating nurse removes the patient's diaper and discovers a significant diaper rash of the perineum encompassing his penis. The surgeon is notified, evaluates the surgical site, and cancels the elective circumcision. Serious safety event? Near-miss? Good catch?

Introduction

In 2000, the Institute of Medicine (IOM) released a groundbreaking report, *To Err is Human*,¹ which suggested that as many as 98,000 deaths annually in the United States were due to medical error. Although multifactorial, the IOM concluded that healthcare needed a paradigm shift in response to errors from individual blame to a systems-based approach. Drawing upon principles of other high-risk industries, the IOM advocated for a “culture of safety,” in which errors and near misses are an opportunity to learn and improve. Safe healthcare should be the guiding force for all healthcare providers and institutions.

Since then, significant efforts have been made at national and local levels to decrease the incidence of healthcare errors. However, despite tremendous investments, healthcare has not achieved the error-free success seen in other industries, such as aviation or the nuclear industry. The Institute for Healthcare Improvement (IHI) estimates that there are 40–50 incidents of patient harm per 100 admissions.² In order to achieve effective changes through patient safety initiatives, a culture of safety must be the foundation to create sustainable vigilance to patient safety.

Characteristics of a safety culture

A culture of safety that provides highly reliable and safe care relies on three overarching principles: trust, reporting, and improvement.³ Workers demonstrate trust in their peers and organization when they routinely report errors and unsafe events in order to learn (more than judge), and continuously improve. According to the Joint Commission, safety culture in healthcare is “the summary of knowledge, attitudes, behaviors, and beliefs that staff shares about the primary importance of the well-being and care of the patients they serve, supported by systems and structures that reinforce the focus on patient safety.”⁴ Although the cultural emphasis is on systems of safe care, individual attitudes, knowledge, beliefs and behaviors are the safety culture foundations. According to the Joint Commission, a safety culture promotes trust and empowers staff to report errors, near misses, and risks.

Trust is established with workers in an organization when the intimidating behaviors that suppress error reporting and near

* Corresponding author.

E-mail address: Kuojen.Tsao@uth.tmc.edu (K. Tsao).<http://dx.doi.org/10.1053/j.sempedsurg.2015.08.005>

1055-8586/© 2015 Elsevier Inc. All rights reserved.

misses are eliminated. In the 2013, the National Healthcare Quality Report found that most healthcare workers believe making mistakes would be held against them.⁵ With greater than 50% of healthcare workers reporting no adverse events at their facility in the last 12 months,⁵ under-reporting is likely, considering known rates of healthcare error.

Trust is a mutual compact between organizations and their workers. This compact encourages transparency and processes that recognize blameless errors due to human factors, and then address unsafe, purposeful, and blameworthy actions separately. Trust in a safety culture mandates a clear understanding of how errors are evaluated and reconciled, engages healthcare workers in training when unsafe, or punishing when negligent and blame-worthy actions are present. Learning how and why blameless errors occur provides an opportunity for the organization to evolve and improve. Recognizing and acknowledging the appropriate organizational response to blameworthy events strengthens trust in maintaining a safety culture. Organizations must hold all workers, regardless of level, accountable to the adherence of safety protocols and procedures in order to maintain a high degree of reliability and trust. Frankel describes accountability as a key element of a safety culture.⁶

Organizations with highly reliable safety cultures continually identify and assess the strengths and weaknesses of their safety systems in order to prevent minor error from escalating to harm. Unfortunately, healthcare is still predominately reactive to errors, rather than proactive in identifying deviations from care. Too often, incidents are investigated after patient harm has occurred through event review or root cause analysis. Corrective actions are implemented in order to prevent future events. Imagine the airline industry only establishing new and improved safety protocols after catastrophic occurrences. Becoming highly reliable in patient safety requires frontline workers to recognize and be willing to report close calls and near misses with the same vigilance as sentinel events. The following are characteristics of high-reliability organizations (HROs).

Principles of high-reliability organizations

The US mortality rate from hospital-associated preventable harm has been estimated to be as high as 400,000 people annually,⁷ equal to two 747 jets crashing every day.⁸ A situation like this would be untenable and subject to public outcry with overwhelming government scrutiny. The aviation industry and other HROs (i.e., nuclear energy, naval aircraft carriers) function on a daily basis with lower than expected adverse events.⁸ Cultural changes have occurred in all the systems mentioned, moving them from dangerous endeavors to exemplary organization, that are highly trusted. Meanwhile, healthcare continues to have a sub-optimal safety record.

A culture of safety that permeates the organization is what sets HROs apart from less-safe institutions. Safety is taught, managed, and promoted in the workplace and reflects the attitudes, beliefs, perceptions, and values that is collectively shared by all employees at all levels. HROs successfully avoid or mitigate catastrophes in a complex and risky environment where accidents would be expected. Weick identifies HROs as successful organizations in high-risk environments that learn in a continual state of self-assessment and reinvention.⁸ He describes a state of “collective mindfulness” where all workers are constantly looking for and reporting problems or unsafe conditions. Thus, significant accidents are rarely seen in the organization, or are easily fixed before they escalate and cause significant harm. Because of human factors, failure inevitably happens in all organizations. However, HRO culture leans on organizational structure, training,

experience, and creativity as a reliable means to recover from “failure” before failure progresses to “accidents.”

What would the most appropriate organization response be to unnecessary anesthesia and caudal procedure for the 2-year-old boy? Clearly, there were opportunities to identify the diaper rash prior to the operating room. Perhaps under “normal” conditions, the surgical site is always inspected, but today there were three children ready for the operating room at once assigned to the same nurse. When asked, the parents stated everything was fine and the baby was healthy. Surgical sites are usually marked and visualized but only for cases of laterality, which would not apply for circumcision. Instead, an incision diagram is marked and signed without requisite site visualization.

In their study of high reliability, Weick and Sutcliffe⁸ identified that HROs maintain structure and function in times of uncertainty where the potential for error can lead to significant harm. In addition to a unique and resilient structure, HROs think and act differently from other organizations, having organized for the expected and unexpected. They described **mindfulness** as the mentality that continually evaluates the environment regardless of intervening circumstances. In contrast, “mindlessness” is the approach where simple assessments exist only during the duration in which their plans were enacted.

The foundation of this “mindfulness” includes five high-reliability principles that allow HROs to respond appropriately when facing unexpected situations (Table 1).⁸ The first three characteristics allow HROs to sustain high levels of safety through **anticipation**, while the second two characteristics achieve **containment** of unexpected events. The state of “Anticipation” allows early identification of events, but also includes the efforts to stop the progression of unexpected ones. Because all events cannot be anticipated, practices of containment exist for the unanticipated or unexpected events that may occur. Where anticipation directs initiatives before unexpected events occur, containment addresses unexpected event after they occur (Table 2).

An HRO culture of “anticipation” has three principles: (1) HROs have a **preoccupation with failure**. They are never satisfied with zero events for any duration. The longer the period of harm-free interval exists, the more vulnerable an organization becomes due to complacency and inattention to detail. To avoid failure, HROs are highly aware of all errors and potential for error. The smallest deviations may lead to new threats to safety. *In review of this case, no other similar events had occurred in this hospital before. However, wrong-site surgery had occurred which launched new policies for cases of laterality. However, in establishing the procedures, site marking for all surgical sites regardless of laterality was considered but eventually determined to be unnecessary.* (2) Personnel in HROs

Table 1
Five principles of high reliability organizations.

Principle	Explanation
Three principles of anticipation	
(1) Preoccupation with failure	Do not ignore failure; even small deviations from expected results can escalate
(2) Reluctance to simplify	Organizations and errors are complex; identify root causes; reject simple explanations
(3) Sensitivity to operations	Frontline workers understand all aspects of the expected outcomes and better at identifying failure and opportunities for improvement
Two principles of containment	
(4) Commitment to resilience	Anticipate errors, adapt, and improve; errors do not cripple an organization
(5) Deference to expertise	Authority does not define expertise; solutions may come from those with most intimate knowledge of process/situation

Table 2
Accountability of behaviors in a just culture.

Type of error	Human error	At-risk behavior	Reckless behavior
Definition	Slips, lapses, mistakes; Inadvertent actions	Conscious decision; unrecognized risk; actions justified	Conscious action; accepting unreasonable risk; disregard known risk
Example	Scheduled medication is missed because nurse received new admission and attending another patient	High-risk medication is administered without standard two-person check because second person not readily available	Surgeon knowingly performs operations without administering appropriately indicated prophylactic antibiotics
Approach	Acknowledge and reassure	Coach and educate	Discipline and punish
Response	Creating/fixing processes and procedures Education and training	Remove motivators of at-risk behaviors Provide incentives for safe behaviors Increase situational awareness	Remediation Punitive action

have a **reluctance to simplify** events. Healthcare and human interactions are complex. Events often occur through a multitude of smaller failures. As such, the ability to recognize subtle deviations is the difference between anticipation and containment of unexpected events. *Would potential events be prevented if all surgical sites were required to be visualized prior to proceeding to the operating room? Yet, in this case, it would be routine practice for the preoperative nurse to take down the diaper. However, this did not happen because too many patients needed to be ready for the operating room at once. Understaffing has been a constant issue in this unit that has been intermittently addressed.* (3) HROs rely on **sensitivity to operations**. Threats to organizational performance usually appear through early and small deviations to organizational operations. HROs take great efforts to train all workers at all levels, ensuring understanding of the intimate details of process, and the reporting of the earliest deviation from expected performance. In healthcare, this requires all team members have the freedom to “speak up” regarding concerns. Having co-workers “speak up” must be expected, non-punitive, celebrated, and highly-valued as a core component of patient safety. *Although this variable is not part of the routine hand-off, the circulating nurse notices that the patient is still in the baby’s personal clothing. As part of the preoperative preparation, sites are usually visualized and patients are changed into hospital garments. Maybe this patient did not want to change clothes, which happens occasionally. The circulating nurse wonders if the site has been visualized, but decides that this must have been done despite not changing clothes.*

The characteristic of “containment” in HROs includes two elements. (4) HROs demonstrate a **commitment to resilience**. HRO recognize that despite vigilant preparation and previous success in safety, errors are inevitable. The organization must maintain function and performance when the system is stressed. Weick asserts that HROs are not error-free, but **resilient**, so that errors do not disable it.⁸ Organizational resilience is the ability to recognize error early and quickly, but also to contain it before significant harm develops. Resilience has the ability to “absorb strain and preserve function despite adversity,” maintaining the ability to function normally after untoward events (because the state of normal is one of high safety), and to learn from previous experiences. *In response to this event, the organization decides to implement visualization of all surgical sites that require marking on patients, signature by surgeon on the incision diagram, confirmation by the preoperative and circulating nurse, hard stops prior to moving the operating room, and a handoff requiring the presence of the surgeon, both nurses, and the anesthesiologist to confirm the appropriateness of the surgical site. Consequently, organizational efficiency decreases and significant delays between the operations occur.* (5) HROs contain unexpected events through **deference to expertise**. This includes deference to higher authority, unique expertise, as well as deference downward to lower ranking, frontline workers who are “content experts.” When analyzing threats to safety, HROs

identify individuals with the greatest knowledge, experience and understanding of a process and its expected outcome. Credibility lies with those most effective in dealing with the deviation, not from organizational hierarchy. *Frontline nurses voiced their concern that the new policy and procedures has hindered their ability to care for other patients. Surgeons complain that their physical presence at the handoff for this safety initiative is a “waste of time” when they have already seen the surgical site. In response, the nurses integrated surgical site visualization into their preoperative checklist, develop an educational program to properly identify concerning sites, and initiate a hard stop prior moving to the operating room if this not done.*

Organizational learning: Identifying, understanding, and reporting errors

Obsession with avoiding failure is a trait of a HRO, including a hospital system. Recently, the mentality of “what happens when a medical error occurs” and not “what if a medical error occurs” has driven the healthcare field to look for improvements in an imperfect system. This shift in thinking has changed the approach to patient safety. There has been a shift from the old school Morbidity and Mortality approach of “blame and shame” to thinking about systems errors or “systems thinking.” This new approach acknowledges human error and concludes that safety depends on creating systems that anticipate and prevent errors, as well as learning from them by consistent “reporting.”

Commonly, the initial reaction to an error is to blame one act or an individual; however, most errors are due to a convergence of multiple factors. In order to truly analyze an error, we must understand the definitions of variation and error. Event reporting with effective organizational response provides the capacity to eliminate or minimize risk. In addition, rather than focusing and reacting to single events with blame, the culture of safety emphasizes a systematic approach to identify common short-comings (harms and close calls) within hospitals that threaten safety systems and defenses. The Joint Commission advocates for the delineation of variation from common cause to special cause.⁹ Common cause variation (CCV) is the “noise” within the process itself, produced from the variables of that process, and can be minimized by corrections to the process. Special cause variation (SCV) is intermittent and unpredictable, and can be assigned to a behavior or decision that introduces variation in a process or a system and often results in sentinel events. Improvement should focus on the proactive elimination of common cause events that become significant risk to patients. An example of SCV is missing a preoperative dose of antibiotics that causes a subsequent wound infection.

British psychologist, Reason’s¹⁰ work has focused on the definition of errors, how they occur, and how they can be prevented.

Reason separates human error into slips and mistakes. Slips are unconscious lapses in automatic acts. Mistakes are the results of incorrect choices due to the lack of knowledge, education, or training. Both unintentional and can cause devastating complications. Reason also described a human's role in errors with further categories of active and latent errors. An active error occurs at the point of contact between the human and the system. Such errors are noticed first and have the most impact (i.e., the surgeon who operates on the wrong site). Latent errors are failures in the systems that predispose to error (i.e., no site marking protocol).¹⁰

Reason developed the “Swiss Cheese Model” which has been widely used to describe how errors occur in a complex system. A single active error is rarely the sole cause of devastating harm. Instead, several holes (or latent errors) in the multiple layers of protection, or “Swiss cheese,” need to line up, for these errors to occur. The Swiss Cheese model emphasizes that analysis of medical errors needs to focus on all the underlying conditions or “root causes” that lead to the error not just the sharp end. The goal of improvement or prevention should be on shrinking the holes and increasing the layers of protection instead of perfecting human error.

With the IOMs report in the late 1990s, there became an increase in public awareness of medical errors and a demand for more transparency about error rates and types. The hope was that transparency would incentivize organizations to prioritize their focus on safety, and develop better reporting systems. Most of the developed systems are hospital specific and the results can be skewed by local culture. It is important to remember that, though reporting systems are an attractive way for identification of errors, their build must be thoughtful in order for them to be effective. Incident reporting (IR) systems are the most common and are considered a passive form of surveillance as they rely on the involved parties to self-report. IR systems are successful when they are easy to use and assessable, non-punitive, and monitored by people who can use and manage the information in a constructive way. These systems must be complimented by analytical reviews such as Failure Mode and Effects Analysis (FMEA) and the findings shared within the organization through structured communications, mandatory training, and conferences such as Morbidity and Mortality. Over the last decade, many states have implemented mandatory state-wide reporting systems. Pennsylvania, for example, has a system that requires hospitals to report all serious events, incidents, and hospital-acquired infections. This has led to hundreds of thousands of reports being filed; a substantial burden on an overwhelmed governmental system. Other states have limited reports to never events, so they may focus on a lower number leading to higher yield.

Reporting is a vital part of a patient safety program, but how the institution handles reports is what leads to safer care. Most institutions have a patient safety officer that is charged with analyzing the data and determining the necessity of further action. The success of any reporting and safety system relies on the belief amongst the frontline workers that their reports are being reviewed and taken seriously. Other strategies to improve the patient safety culture are to have leaders connect with frontline staff in the clinical arena. Executive walk rounds are the healthcare version of the business strategy of MBWA, (“Managing by Walking Around”).¹¹ During these walk rounds, the safety officer will accompany a member of the leadership team (i.e., chief medical officer) to a unit for a discussion with the staff. At some institutions, the discussion is structured and includes a dialogue regarding problems on the unit as well as possible solutions designed by the frontline staff. Another method, developed at Johns Hopkins, is “Adopt-a-unit,” where one leader is affiliated with one unit. This has the advantage of a more sustained engagement and consistent follow through.¹²

A systematic team approach to healthcare

With the advent of new technology and the increasing in the complexity of surgical techniques, the importance of teamwork cannot be understated. Best outcomes in trauma care, stroke, and critical care can be attributed to team protocols. As medicine has realized the importance of teamwork, researchers have looked to aviation for lessons learned, like flattening the hierarchy. The example of the 1977 collision of two 747s on the runway at Tenerife airport in the Canary Islands is instructive. The investigation of this tragedy, demonstrated that the co-pilot and flight engineer did not feel comfortable speaking up about safety concerns with their well-known captain, resulting in a collision where 583 people died.¹³

In response to this accident, considered the worst in aviation history, a series of training programs were instituted to address communication and teamwork. These were called Crew Resource Management (CRM). Through CRM programs, the crew has learned to speak up regarding safety concerns. The programs have emphasized creating an environment that allows personal to discuss their concerns. As a result, the industry has a remarkable safety record attributed, by most in the field, to this “culture of safety.”

A culture of safety is the goal of many healthcare institutions; unfortunately, surgery has a lot to learn. Sexton et al. demonstrated the struggle with hierarchy in the operating room. When asked about the perception of teamwork in the operating room, surgeons believed it was good, while other members strongly disagreed.¹⁴ When surgeons were asked if they would welcome being questioned in the operating room, the overwhelming answer was no. This was in direct contradiction to nearly 50% of pilots after the CRM programs.¹⁴ These attitudes are important to recognize and address when attempting to change them. Many pilots did not accept the culture of safety overnight and healthcare has learned a lot from their transition and struggles.

CRM has been tested in surgical departments and it has shown to improve outcomes.^{5,15} CRM empowers team members without disempowering the leader. In aviation, the key CRM methods responsible for the success of this program is the use of preflight briefings, the regular use of standard operating procedures (SOPs), checklists, and the creation of culture that emphasizes team interaction.¹⁵ The briefings are used to clarify the leader, open lines of communication, prepare the team for the flow of the procedure, and delineate expectations. The debriefings have been shown to create highly effective teams. In aviation, SOPs are routine activities in which procedures are carried out in a standard fashion because they have been proven to result in better outcomes. This is very similar to best-practice protocols, or bundles, in medicine. A checklist is used to reinforce the steps of the SOPs as it ensures the important steps of the process are being completed and allows for members of the team to speak up if concerned. Some of these concepts have been incorporated into field of surgery and has results in decreased mortality, better patient satisfaction, and improved staff morale.¹⁵

Over the past several years, much attention has been paid to the use of checklists in combination with the surgical timeout. This combination has proven beneficiary to the patient including a reduction in surgical complications.¹⁶ The checklist, which includes a pre-procedural briefing, a timeout, and a debriefing, has shown to improve the OR team attitude and communication, leading to improvements in safety and performance.¹⁷

Team training has been demonstrated to improve performance in aviation, military, and other HROs by flattening hierarchy. TeamSTEPPS is an evidence-based, government-sponsored approach to team training designed specifically for healthcare professionals. It engages and trains leadership at several levels, and has shown improvement in trauma team performance¹⁸ and decreased VA mortality by 50%.^{19,20}

Over several years of collecting data, the Joint Commission has identified poor communication as the number one root cause of sentinel events, and established Survey requirements to improve effectiveness of communication. After their National Patient Safety Goal stated that facilities must implement a standardized approach to hand-off communication,²¹ strategies to standardize communication were established. One model, called SBAR,²² standardizes communication between physicians and nurses about a patient's condition, (SBAR is Situation, Background, Assessment, and Recommendation) and has shown a decrease in adverse events.²¹ Another technique, (CUS words) allows caregivers to express escalating levels of safety concerns: "I am Concerned"; "I am Uncomfortable"; "This is a Safety issue." These are effective statements when their meaning is appreciated and responded to appropriately.

Errors in transition in care have increased as patient handoffs have become more abundant, with increased group practices and limited resident work hours. These work force changes have not been accompanied by improved training on Handoffs, and have not decreased errors.²³

To reduce handoff errors, Vidyarthi and colleagues developed a structured process called "ANTICIPATE" which stands for Administrative (i.e., name and location), New Information (i.e., clinical update), Tasks (i.e., to do list), Illness (i.e., how the patient is doing), Contingency plans (i.e., things that have and have not worked in the past).²⁴ This checklist covers possible clinical scenarios and uses "If/then" statements to help discuss course of action for possible occurrences.

Information systems are an essential part of addressing handoff errors. UWCoRes, a web-based computerized rounding and sign out system created for electronic medical records. It was found to enhance patient care, improve rounding efficiency, and quality of the resident sign out,²⁵ by providing standardization, multiple provider use, and automated downloads from the electronic medical record.

Summary

Despite the IOMs call for greater attention to a culture of safety in healthcare, rates of medical error are still unacceptably high and most likely under-reported.²⁶ The ability to achieve high levels of patient safety relies in the struggle to maintain the three pillars of a safety culture (trust, report, and improve). HROs demonstrate the ability to maintain and foster all three components of a safety culture in order to sustain a high level of safety. As hospitals move towards high reliability, codes of conduct are established that are modeled by leaders who champion non-intimidating behaviors, while encouraging and rewarding the reporting of errors and unsafe conditions. Although hierarchal behavior is discouraged, surgeons are still viewed as "Captain of the Ship" and can utilize that role to positively influence safe behaviors that contribute to organizational success. Because culture is a collective, individual behavior, beliefs, and knowledge contribute to that culture. By promoting trust and enhances reporting through a just culture, organizations can continue to learn and improve.

References

1. Institute of Medicine (U.S.). *Committee on Quality of Healthcare in America. Crossing the Quality Chasm: A New Health System for the 21st Century.* Washington, DC: National Academy Press; 2001.
2. McCannon CJ, Hackbarth AD, Griffin FA. Miles to go: an introduction to the 5 Million Lives Campaign. *Jt Comm J Qual Patient Saf.* 2007;33(8):477–484.
3. Reason J, Hobbs A. *Managing Maintenance Error: A Practical Guide.* Burlington, VT: Ashgate Publishing Company; 2003.
4. *The Joint Commission Center for Transforming Healthcare. Facts About the Safety Culture Project.* (http://www.centerfortransforminghealthcare.org/assets/4/6/CTH_SC_Fact_Sheet.pdf); 2014 Accessed 01.05.15.
5. *Agency for Healthcare Research and Quality. Highlights from the 2013 National Healthcare Quality And Disparities Reports.* (<http://www.ahrq.gov/research/findings/nhqrdr/nhqr13/2013highlights.pdf>); 2013 Accessed 01.05.15.
6. Frankel AS, Leonard MW, Denham CR. Fair and just culture, team behavior, and leadership engagement: the tools to achieve high reliability. *Health Serv Res.* 2006;41(4 Pt 2):1690–1709.
7. James JT. A new, evidence-based estimate of patient harms associated with hospital care. *J Patient Saf.* 2013;9(3):122–128.
8. Weick KE, Sutcliffe KM. *Managing the unexpected: assuring high performance in an age of complexity.* 1st ed., San Francisco: Jossey-Bass; 2001.
9. *The Joint Commission. Sentinel Events (SE).* (http://www.jointcommission.org/assets/1/6/CAMH_2012_Update2_24_SE.pdf); 2013 Accessed 01.05.15.
10. Reason JT. *Human Error.* Cambridge England; New York: Cambridge University Press; 1990.
11. Frankel A, Grillo SP, Baker EG, et al. Patient Safety Leadership WalkRounds at Partners Healthcare: learning from implementation. *Jt Comm J Qual Patient Saf.* 2005;31(8):423–437.
12. Pronovost PJ, Weast B, Bishop K, et al. Senior executive adopt-a-work unit: a model for safety improvement. *Jt Comm J Qual Saf.* 2004;30(2):59–68.
13. *Aircraft Accident Digest. Secretary of Aviation (Spain) report on Tenerife crash.* (http://lessonslearned.faa.gov/PanAm1736/Spanish_Findings.pdf); 1978 Accessed 01.05.15.
14. Sexton JB, Thomas EJ, Helmreich RL. Error, stress, and teamwork in medicine and aviation: cross sectional surveys. *Br Med J.* 2000;320(7237):745–749.
15. Healy GB, Barker J, Madonna G. Error reduction through team leadership: the surgeon as a leader. *Bull Am Coll Surg.* 2006;91(11):26–29.
16. Haynes AB, Weiser TG, Berry WR, et al. A surgical safety checklist to reduce morbidity and mortality in a global population. *N Engl J Med.* 2009;360(5):491–499.
17. Haynes AB, Weiser TG, Berry WR, et al. Changes in safety attitude and relationship to decreased postoperative morbidity and mortality following implementation of a checklist-based surgical safety intervention. *Br Med J Qual Saf.* 2011;20(1):102–107.
18. Capella J, Smith S, Philp A, et al. Teamwork training improves the clinical care of trauma patients. *J Surg Educ.* 2010;67(6):439–443.
19. Neily J, Mills PD, Young-Xu Y, et al. Association between implementation of a medical team training program and surgical mortality. *J Am Med Assoc.* 2010;304(15):1693–1700.
20. Armour Forse R, Bramble JD, McQuillan R. Team training can improve operating room performance. *Surgery.* 2011;150(4):771–778.
21. Haig KM, Sutton S, Whittington J. SBAR: a shared mental model for improving communication between clinicians. *Jt Comm J Qual Patient Saf.* 2006;32(3):167–175.
22. Leonard M, Graham S, Bonacum D. The human factor: the critical importance of effective teamwork and communication in providing safe care. *Qual Saf Health Care.* 2004;13(Suppl 1):i85–90.
23. Landrigan CP, Rothschild JM, Cronin JW, et al. Effect of reducing interns' work hours on serious medical errors in intensive care units. *N Engl J Med.* 2004;351(18):1838–1848.
24. Vidyarthi AR, Arora V, Schnipper JL, Wall SD, Wachter RM. Managing discontinuity in academic medical centers: strategies for a safe and effective resident sign-out. *J Hosp Med.* 2006;1(4):257–266.
25. Van Eaton EG, Horvath KD, Lober WB, Rossini AJ, Pellegrini CA. A randomized, controlled trial evaluating the impact of a computerized rounding and sign-out system on continuity of care and resident work hours. *J Am Coll Surg.* 2005;200(4):538–545.
26. Chassin MR, Loeb JM. High-reliability healthcare: getting there from here. *Milbank Q.* 2013;91:459–490.