Patient Safety and Communication in the Operating Room

By Derek Owens

November 8, 2015

Presented to the Faculty at the University of Michigan-Flint
In partial fulfillment of the requirements for the
Doctor of Anesthesia Practice Program
Summer 2015

Primary Advisor/First Reader:

Name Jane Motz
Signature [signature], CRNA Date 04/20/16

Second Reader:

Name Thomas W. Fackler, DHA
Signature [signature], DHA Date 12/14/15

Contents

Abstract

Hospitals, and in particular the operating room, have not universally adopted a checklist system as a way to increase communications and decrease errors. Analyses showed that communication at Navy Hospital Twenty-nine Palms was less than optimal, leading to errors, such as delayed surgical start times and equipment errors, although patient safety was not affected. After thorough research, including a comprehensive literature review, and investigation by the author and operating room director, it was decided that the World Health Organization/The Joint Commission comprehensive surgical checklist and the Team STEPPS communication technique would be adapted and implemented to increase communication. Implementation of these programs would undergo evaluation through monitoring and staff interviews on a continual basis by committee members and process adjustments if needed after committee member agreement. This checklist would flatten the hierarchy and improve the operating room process, increasing patient safety. This checklist to increase communication in the operating room is not expected to prevent all errors but could increase safety by creating a shared mental model and increased distribution of responsibility to all health care personnel involved. By empowering every team member, from technicians to surgeons, the ability to raise concerns raises the standards for patient safety.

Key words: Checklist, Culture of safety, Error management, Operating Room procedure, Operating room teamwork, Swiss cheese model, Team STEPPS

Introduction

In 1999, the Institute of Medicine reported that as many as 98,000 people die each year as a result of medical errors.[1] This equates to more people dying from medical errors than from motor vehicle accidents, breast cancer, or AIDS.[1] The total national cost of preventable adverse events caused by this great loss is estimated to be between $17 and $29 billion dollars. The group stated that today's large, multifaceted health care system would require a comprehensive approach to improve patient safety. Human error is inevitable; its presence would greatly affect any multistep, complex system. Research by NASA into aviation accidents found that 70% of accidents involved human error.[2]

One area of possible improvement is communication. In a report released over 35 years ago, it was suggested that 15% of human error was attributable to communication.[3,4] However, as more recently reported by The Joint Commission, communication errors have been reported to cause over 60% of errors.[1] A large percentage of hospital errors occur in the operating room. Increased communication and subsequently increased teamwork can reduce patient risk and increase the chances of a successful operating room experience.

Naval Hospital Twenty-nine Palms is not unlike other hospitals that have been studied. On multiple occasions, it was shown that a culture of patient safety was not present in the operating room. Several patients arrived on the day of surgery without orders from surgeons or medical histories documented in the computer charting system. On a few occasions, patients were taken into the operating room without markings on the surgical site, the proper equipment was not prepared for the surgical procedure, or the

technicians did not know the procedure being performed. After a thorough review of the system, it was decided that a complete redesign was needed, including implementation of new work flow and communication processes.

Although there have been previous initiatives to address these issues by improving communication and reducing interruptions, these initiatives failed to be integrated as a culture in the operating room and were not sustainable. Multiple reasons may have contributed to this problem, including being implemented by an outside source or systems that were too complex. The intrinsic value of these initiatives was also difficult to identify by the nurses, technicians, and doctors, who were seemingly slowed by the process. These systems were also introduced as rigid processes, which did not allow for modification by those using the system. To be successful in implementing a culture of safety, it was imperative to avoid these pitfalls.

The purpose of this project was to determine whether implementation of a patient safety-oriented system of checklist usage and increased communication would lead to a decrease in errors such as incorrect equipment or nonworking equipment, delays in surgical care, or delays in the preoperative process.

Materials and Methods

Literature review

Because of advances in research and new technology, the medical system has become extremely complex and intricate; it has exceeded the ability of doctors, nurses, and other health care workers to deliver its benefits safely, effectively, and reliably.[5] Many medical

errors occur in the operating room. In 2010, the World Health Organization performed a study in 10 different countries, which included both high-income and low-income hospitals, and found that by increasing communication through the use of a checklist, errors in the operating room were reduced by 10.6%.[5]

The field of medicine begins with the education model. Medical training is a long and arduous process. Throughout this education, health care workers are taught that the current system is the best possible. Subsequently, when problems arise, the system is not blamed; rather the same highly educated doctors, nurses, and other health care personnel are implicated. Placing blame on a single person creates a person-centered analysis; in this approach, the focus is on the ever-present human factor. The errors are then classified as knowledge-based, rule-based, or skill-based.[6]

An opposing model is the system-centered approach, which assumes that humans are fallible and systems must be designed to prevent mistakes. To focus on a solution, researchers began investigating outside the hospital to find other industries with similar maladies that they immulate.[7] Aviation was one comparable industry; with its ability to increase and maintain safety over the past 35 years, aviation can be considered an excellent role model.

It is well documented that human deficiencies, particularly poor teamwork, contribute to > 50% of accidents in aviation. Therefore, teamwork and error management programs are mandatory in aviation. Crew Resource Management teaches aviators to communicate and coordinate as a team, reducing errors by making better use of human resources available.[8,9]

The largest crash in aviation history, the collision of two Boeing 747s in Tenerife, Spain in 1977, illustrates what can happen when these techniques are not used. This accident was different from others not only due to the number of fatalities, but also because of the cause. The pilot of a Dutch 747, under pressure to complete the flight within certain time limits, began to accelerate for takeoff. Based on audiotapes, it was clear that the copilot and flight engineer knew that permission had not been given by the tower to takeoff.[7] The Dutch 747 and another Boeing 747 collided at a speed of 250 miles/h shortly thereafter, killing 583 people.

Largely because of this accident, human interactions inside the cockpit were examined and changed. Flight engineers and copilots were taught that not only could they voice their concerns, but it was also their duty to do so. Hierarchy was flattened, and the power distance was decreased. The major changes in aviation were not in technology or equipment; the innovations were in the interpersonal relationship of the crew in which simple communication techniques and a checklist were used.[5]

Hospitals, in particular the operating room, have not been as quick to adopt such a simple innovation as the checklist. Of all departments in the hospital, none are more similar to aviation than the operating room. Both the operating room and the airplane cockpit are highly technical and complex; even the names of surgical instruments and how to use them compare with a cockpit's flight information management system; that is, someone without extensive training would find each one useless.[5,7,9] To complicate matters, operating rooms can also be high-pressure environments where good teamwork and communication are vital. Studies have estimated that one-half to two-thirds of all adverse events in the hospital are attributable to surgical care.[10] In one study almost 45%

of all patient errors occurred in the operating room of a hospital.[11] In a Harvard medical practice study, 48% of adverse events were associated with a surgical procedure.[12] Of these errors, 43% could be directly attributed to communication.[13] In fact, communication failures are the cause of over 63% of sentinel events reported to The Joint Commission.[14]

Safety and communication have been shown to be correlative and increased by the use of a checklist. In 2008, The Joint Commission and the World Health Organization began promoting a checklist for increased communication in the operating room. In 2010, the *New England Journal of Medicine* published a landmark WHO study, which, among other things, showed that the use of a surgical checklist reduced the total number of complications from 27.3% to 16.7% in over 3,500 cases.[15]

The same study showed that a checklist in the operating room would reduce mortality by 0.7% and total complications by 10.6%.[15] These studies resulted in the Joint Commission, World Health Organization, and Association of Perioperative Registered nurses checklist (Appendix B) being adopted in more than 4,900 hospitals in 122 different counties, with 25 countries adopting the checklist on a national level.[16] The importance of a medical checklist was highlighted with the introduction of a bill into the House of Representatives. This bill requires the Agency for Healthcare Research and Quality, acting through the Center for Quality Improvement and Patient Safety, to conduct a study on the development and efficacy of medical checklists. This charge specifically includes the following requirements: the testing of different models of medical checklists, an examination of checklist development and use in other industries, and a measurement of the effects of the use of medical checklists on patient safety and

health outcomes. The bill further defines "medical checklist" as a predetermined, evidence-based, well-defined set of steps that should be completed during a designated medical clinical encounter or medical procedure.[17]

Around the same time as the WHO study, another study showed that patients whose surgical teams exhibited less teamwork behaviors were at a higher risk for death or complications.[18] It must be noted that, the use of a checklist does not imply that a pilot, nurse, or physician require assistance in performing their job responsibilities. Checklists are meant to serve as a reminder for personnel to perform the mundane tasks that are so easily forgotten.[10] Checklists and crew resource management have become standards for how good pilots performs their duties. This same culture needs to be developed in medicine.

Research on communication in medicine has shown the same communication principles that aviation learned 30 years ago.[5,7,19] A large number of errors are shown to occur due to a simple lack of communication.[5,7] In 2007, innovators used these data to transform institutions. One was Dr. Marty Makary, a pancreatic cancer surgeon who helped change Johns Hopkins Hospital. The results of his study showed that surgeons believe good communication occurs in the operating room 85% of the time, whereas nurses cited good communication only 45% of the time.[11] This evidence illustrates a disparity between team members' communication observances in the operating room. Increased communication, checklist usage, and flattening of the hierarchy led to a dramatic improvement in patient safety in the operating room and the hospital as a whole.

Communication failures in the operating room occur in approximately 30% of team exchanges, causing wasted resources, delays, interruptions in routine, procedural

errors, and increased tension.[21] Use of the aviation industry's crew resource management, based on effective communication and teamwork skills, could be modified and translated to the hospital and operating room environment,[9] with the goal of preventing medical errors and reducing negative outcomes.[22] In Team Strategies and Tools to Enhance Performance and Patient Safety (Team STEPPS) communication techniques , many techniques have been used to facilitate teamwork and communication, including situational awareness and mutual support. Team STEPPS has been shown to increase health care morale and perceived patient safety.[23]

In an extremely famous study named "Gorillas in Our Midst," Neisser and colleagues studied what they termed inattentive blindness. They asked people to watch a video and perform a task, such as count how many times a basketball bounces. They then had a man in a gorilla costume walk into the middle of the screen and make obvious gestures. Of 192 observers, 46% of people failed to notice the gorilla. When participants were told before the video that the gorilla would be present, 26% still failed to notice.[24] Inattentive blindness and lack of situational awareness, defined as *the primary basis for subsequent decision making and performance in the operation of complex, dynamic systems*, are the same phenomenon.[25] At its lowest level, the operator needs to perceive relevant information (in the environment, system, self, and so forth), followed by the integration of the data in conjunction with task goals. At its highest level, operators must predict future events and system states based on this understanding.[25] The use of communication techniques such as Team STEPPS have resulted in increased teamwork, communication, and a shared mental model and thus increased situational awareness and decreased inattentive blindness.[26] By increasing communication, decreasing hierarchy,

and increasing situational awareness, patient safety is increased. Medical team training has also increased operating room team function, as shown in a study of 4,862 cases, decreasing surgical delays. Impressively, these changes were found to be sustained at 24 months.[27]

The low mortality rate shown with hospital procedures (as low as 1.5%) has made it difficult to statistically measure intervention results in any but the largest institutions; even then, it would be a complex study involving long amounts of time. To elicit the effectiveness of interventions, the Safety Attitudes Questionnaire, created by the University of Texas and the Center for Healthcare Quality and Safety, was investigated.[28] The Safety Attitudes Questionnaire is a refinement of a questionnaire derived from a commercial aviation survey, The Flight Management Attitudes Questionnaire.[29] The Safety Attitudes Questionnaire was deemed to be a psychometrically sound device for eliciting the safety climate of any hospital area.[30] In addition, it can be used to measure teamwork, identify disconnects between or within disciplines, and evaluate interventions aimed at improving patient safety.[30-39] Because many of the patients at Naval Hospital Twenty-nine Palms are ambulatory (same day discharge), it was also confirmed that the survey was applicable to the ambulatory setting.[40,41]

Methods

A system for patient safety has not been utilized continually at Navy Hospital Twenty-nine Palms. This created a tendency to rely on individual practitioners, not the system, to intercept errors. A checklist, which was not individualized for the operating room, was felt to be burdensome and ineffective by the staff. The preoperative "timeout" was

performed per The Joint Commission standards; however, the staff reported that they only performed this to meet requirements. There was no morning huddle performed, as recommended by Team STEPPS, and situational awareness suffered, as evidenced by the lack of appropriate equipment for certain surgeries or scheduling changes. The operating rooms consist of several functional areas, including the preoperative clinic, where the patient is seen 1 week before surgery; the preoperative area, where a patient is prepared on the day of surgery; the intraoperative area or operating room; and the post anesthesia recovery unit. Each of these environments has areas that could benefit from system improvement. Because of their complex interrelatedness, it is impossible to address any one area without addressing all of them.

The Association of Perioperative Registered Nurses/World Health Organization/The Joint Commission combined surgical checklist (Appendix A) was utilized as the cornerstone of the changes. This checklist was validated in the Safe Surgery Saves Lives campaign, which included almost 4,000 surgical patients and had shown a decline of mortality after surgery from 1.5% to 0.8%.[41] In his book *The Checklist Manifesto*, Atul Gawande recommended adjustment of this checklist to meet local hospital requirements. Gawande further explained, "Even organizations that perform identical tasks have different personalities. Interpersonal relationships are different, local requirements are not the same and different objectives are required to satiate local needs."[5]

Therefore, the involved personnel, which included a general surgeon, obstetrician, 2 operating room technologist, and a nurse anesthetist, adjusted the Association of Perioperative Registered Nurses/The Joint Commission checklist to meet suggested

safety requirements and to fit the military medical model (Appendix B).[42] The checklist was adjusted to include corpsman and other specific military considerations. Because of the multiple differences between military and civilian medicine, it is prudent to discuss the military medical model. Care providers such as surgeons, obstetricians, nurses, and anesthesia providers receive the same primary training as civilians, with some physicians having civilian residencies and some having military-based residencies. All have completed military officer training. Some have received specialized training, which could include trauma training or training with different techniques or equipment.

The providers are of varying levels of seniority, beginning with O-1 and with decreasing amounts of clinical duties once O-5 or O-6 is reached. Hospital corpsmen are enlisted personnel without a college degree but with specialized training. Corpsmen begin their training with basic medical care and basic field medical care. Depending on multiple factors, some obtain further training in areas such as operating room techniques, radiology techniques, and different levels of medical assistance. These individuals also have multiple ranks of seniority (E2-E5 or E6), with higher ranks performing less clinical and more administrative work.

The created checklist was then bought to the Surgical Teamwork Readiness Initiative to Prevent Errors and Ensure Safety (STRIPES) team for adjustments. After a 1-month trial, it was adjusted to reflect staff concerns and reworked to include items that were previously neglected. The final checklist (Appendix C) is version 13. This new checklist is utilized in a left to right fashion, beginning with the initial preoperative visit with the surgeon. The most efficient way to fix some of the internal processes was to place items on the checklist. Some of these errors were patient arrival on the morning of

surgery without surgeon orders being placed, postoperative visits not being scheduled, and not having the proper antibiotics prepared for the day of surgery.

Results

Creation of the checklist at Twenty-nine Palms

The implementation of an improved physician ordering system was created to increase standardization and to streamline the system to reduce errors. By making the checklist a working document, following the patient throughout the perioperative process, many dilemmas have been relieved (Figure 1).

The new process begins when the surgeon visits with the patient preoperatively, placing orders on the checklist, and attaches the checklist to the chart. The nurse then places these orders into the computerized ordering system during their preoperative visit. Once the patient arrives on the day of surgery, the corpsman, nurses, and other providers continue to use the checklist during every phase of surgery.

To address communication techniques and flatten the hierarchy, the Team STEPPS communication techniques are utilized during a 7:00 morning meeting that is held between all staff, including surgeons, nurses, surgical technologists, and anesthesia providers, in a centralized location in the operating room. During the perioperative process, The Joint Commission standards and the Team STEPPS model are used during a more robust timeout process, again utilizing the checklist.

At the end of a surgical procedure, a procedural debrief is implemented. A debrief is defined as a process that allows discussion of individual and team performance,

identification of errors made, and development of plans to improve the next performance.[43] An effective debrief is defined as containing the following: the appropriate approach, an established learning environment, learner engagement, a managed learner reaction, reflection, analyses, diagnoses, and application to real clinical practice.[44] The debriefing timing was difficult to plan in the operative setting. It is desirable to minimize the amount of time a patient is under anesthesia and for operating room teams to be efficient to reduce cost. It is also important to perform the debriefing immediately as information is still close at hand.[45] It was decided, to meet all criteria, that staff would perform the debrief before the surgical drapes were removed and while the patient was still under anesthesia. This timing allowed for the uninterrupted attention of everyone in the room during a period of calm and during a period of low surgical workload. To maintain efficiency and to keep this surgical pause short and purposeful, staff utilized the same surgical checklist; the debrief was also documented on the checklist.

Twenty-four hours after surgery, the checklist was used for the last time to make postsurgical and anesthesia follow-up visits or phone calls. This utilization ensured review of the surgical data and completion of a postoperative follow-up with the patient. It also presented all surgical data in an easy to read format standardized for all patients.

Before implementation of this new system, permission was received from the Center for Healthcare Quality (Appendix H) to utilize an altered version of the Safety Attitudes Questionnaire.

Feedback and redesign of the checklist and Team STEPPS communication plan

The article "Effective surgical safety checklist implementation," described three ways to implement checklists: the team effort method, the empowering leader, and the laissez faire leader.[16] Of these three, the team effort model was found to be the most successful, whereas the laissez faire leader was the least. On the basis of interviews conducted where checklists have been implemented, staff have distinguished highly effective implementation as including active leadership, deliberate enrollment, extensive discussion and training, piloting, multidisciplinary communication, real-time coaching, and ongoing feedback.[16]

In the team effort model, the multidisciplinary team consists of personnel from each field. These principles were used to form the previously mentioned STRIPES team. The team consisted of one surgeon, one obstetrician, one anesthesia provider, and one operating room technician (Appendix C). This organization spearheaded the communication plan and checklist changes. Team STEPPS communication techniques were selected because of its applicability, current usage in the military health system, and history of creating the environment proven to increase patient safety.

The communication and checklist plan at the operating room of Twenty-nine Palms included the following tasks. The operating room day began with a morning huddle of all team members. Using the checklist as a guide, the morning huddle allowed for a safety pause to realize problems during a time when they can be addressed with minimal changes to schedule or workload. This morning huddle focused less on patients and more on providing every member of the operating team increased situational

awareness of the days' plan. The timing of the surgeries, status of equipment, possible changes to the schedule, and personnel were discussed.

During preparation of the new system patient safety and risk management system, it was investigated whether it was possible to change the operating room procedure and checklist without changing the hospital-wide Invasive Procedure Instruction. Although the Invasive Procedure Instruction contained a checklist and posters (Appendix D), they did not meet current Joint Commission standards and were not user friendly, although deviation from hospital instruction is unacceptable. The Invasive Procedure Instruction has been revised and is now a part of the hospital instruction. A new simplified, user-friendlier poster and checklist were also created (Appendix E). New checklist posters have been placed in treatment rooms throughout the hospital and the operating room. This has provided the additional benefit of not only changing the operating room procedures but also changing the entire hospital.

The Safety Attitudes Questionnaire was adjusted to reflect the complexities of the military environment and differences in military staffing and personnel. As previously discussed, the US Navy utilizes corpsman to perform many functions in the military hospital. This is unique to the military environment and subsequently alterations were needed.

Implementation of the checklist and communication process

To implement the changes, a multistep process was utilized by the STRIPES group (Appendix D). After the team tasked with implementation was assembled, it was soon officially recognized by the hospital (Appendix D). Multiple meetings with the author

and surgical director were completed during the preparation phase to ensure full support. The implementation committee met multiple times to discuss solutions to the various aspects of the program. The members then began talking with their respective colleges to generate interest and excitement about the new system. A meeting with all operating room staff was later convened for dissemination of data on the effectiveness of the communication.

To introduce each of the process improvements, data were presented to all of the operating room staff to justify why changes were imperative and how safety and flow in the operating room could be improved. The staff also watched videos created by the committee illustrating the Team STEPPS communication techniques and received copies of the checklist for review. These videos illustrated how the morning huddle, timeout, and debrief should be performed. This gave staff members a visual idea of how the safety pauses should be completed while allowing for individualism in style. To allow the staff to participate in the changes, they were asked for their input on adjustment of the checklist and process. Input was given verbally to any member of the committee or via survey if the member wanted to remain anonymous.

The main objective of the initiative was a more patient-centered focus of care, but the expected outcome was a change in the safety culture in the operating room at Navy Hospital Twenty-nine Palms. Evaluation by the author was performed on a continual basis, with input from the monitoring committee and entire operating room staff.

Discussion

The survey and communication project was implemented first for a 1-month trial. Adjustments and changes were then made for implementation in the operating room. There was much resistance to changes from operating room personnel, most notably from surgeons and nurses. Staff members with less exposure to the Team STEPPS technique were the most resistant to changes. However, also of note was whether increased time since training, whether surgical residency or nursing school, caused increased resistance. Many meetings and discussions were required, both formal and informal to obtain buy-in from the staff. The director of surgical services also assisted by discussing the project in person and utilizing e-mails with staff.

After 4 months, the morning huddle, the timeouts, and checklist use began to become more integrated as part of the normal working environment at the hospital. Although further changes may be needed as errors are recognized, the now increased communication will assist with reducing consequences from errors.

The survey results showed increased caregiver attitude toward patient safety in the hospital. In the survey, each staff member ranked the level of communication of all other staff members. The average of these scores was then tallied and compared. Before implementation, 18 surveys were returned; after implementation, 19 surveys were returned. Because of rapid staff changes inherent in a military hospital, all general surgeons and one of two orthopedic surgeons changed during implementation of the initiatives. This created a weakness in the study, although it is a weakness that cannot be controlled. The survey showed, however, that overall the communication score increased from an average of 3.59 to 3.73 (Figure 2).

Attitudes of staff regrading communication before and after implementation are shown in Figures 3 and 4. As shown in Figures 3 and 4, perceived communication of surgeons decreased from an average of 3.89 to 3.29. It is possible that implementation of the checklist decreased communication between surgeons and other specialties, although that is the opposite of the desired outcome and not thought to be the impetus in this situation. During implementation of the checklist procedure, all staff surgeons left except for two. This created two new general surgeons, two new obstetricians, and one new orthopedic surgeon, with 5 of 7 replaced during the study. It is possible that new staff surgeons did not communicate as effectively as previous surgeons. There was also a short period between new surgeon arrival and postchange survey distribution. A longer introductory period could have resulted in increased communication scores.

The original goal was to make patient-centered safety, communication, and checklist use part of the operating room culture at Navy Hospital Twenty-nine Palms. Team STEPPS communication, the morning huddle, the preoperative timeout, and checklist use have been implemented and are still being used for 1 year since first implemented. It is unclear whether these interventions have now become part of the hospital culture. However, checklist data, medical team management. and Team STEPPS have allowed greater patient safety at Naval Hospital Twenty-nine Palms compared with before intervention. As more studies are completed, improved interventions will be found and, based on the creation of the patient safety culture, will be implemented without hesitation.

References

1. Institute of Medicine. To Err is Human: Building a safer health system. 1999

2. Helmreich RL, Foushee HC. Why crew resource management? Empirical and theoretical bases of human factors training in aviation. In: Wiener E, Kanki B, Helmreich R, eds. Cockpit Resource Management. San Diego, CA: Academic Press; 1993:3-45.

3. Abramson NS, Wald KS, Grenvik AN, Robinson D, Snyder JV. Adverse occurrences in intensive care units. JAMA 1980; 244(14): 1582-4.

4. Alvarez G1, Coiera E. Interdisciplinary communication: an uncharted source of medical error? J Crit Care 2006; 21(3): 236-42.

5. Gawande AA. The Checklist Manifesto: How to Get Things Right. New York: Metropolitan Books; 2010.

6. Beuzekam ME, Boer F, Hudson P. Patient safety: latent risk factors. Br J Anesth 2010; 105: 52-9.

7. Nance JJ. Why Hospitals Should Fly: The Ultimate Flight Plan to Patient Safety and Quality Care. Bozeman, MT: Second River Healthcare Press; 2009.

8. Haller G, Garnerin P, Morales MA, Pfister R, Berner M, Irion O, Clergue F, Kern C. Effect of crew resource management training in a multidisciplinary obstetrical setting. Int J Qual Health Care 2008; 20(4): 254-63.

9. LaPoint JL. The effects of Aviation Error Managment Training on Preoperative Safety Attitudes. Int J Business Soc Sci 2012; 3: 77-86.

10. Thomas EJ, Studdert EM, Burstin HR, Zbar BI, Orav EJ, Brennan TA. Negligent care and malpractice claiming behavior in Utah and Colorado. Med Care 2000; 38(3): 261-71.

11. Makary MA, Sexton JB, Freischlag JA, Holzmueller CG, Millman EA, Rowen L, Pronovost PJ. Operating room teamwork among physicians and nurses: teamwork in the eye of the beholder. Am Coll Surg 2006; 202(5): 746-52.

12. Leape LL, Brennan TA, Laird N, Lawthers AG, Localio AR, Barnes BA, Hebert L, Newhouse JP, Weiler PC, Hiatt H. The nature of adverse events in hospitalized patients. Results of the Harvard Medical Practice Study II. N Engl J Med 1991; 324: 377-84.

13. Gawande AA, Zinner MJ, Studdert DM, Brennan TA. Analysis of errors reported by surgeons at three teaching hospitals. Surgery 2003; 133: 614-21.

14. The Joint Commission. Sentinel Event Statistics: 2014, http://www.jointcommission.org/Sentinel_Event_Statistics/.

15. De Vries EN, Crolla R, Van Andel G, Schlack WS, Gourma DJ, Smorenburg SM. Effect of a comprehensive surgical safety system on patient outcomes. N Engl J Med 2010; 363: 1928-37.

16. Conley DM, Edmonson L, Berry WR, Gawande AA. Effective surgical safety checklist implementation. J Am Coll Surg 2011; 212: 873-9.

17. Holt, HR 116 (2013). Retrieved from http://thomas.loc.gov/home/thomas.php.

18. Mazzocco K, Petitti DB, Fong KT, Bonacum D, Brookey J, Graham S, Lasky RE, Sexton JB, Thomas EJ. Surgical team behaviors and patient outcomes. Am J Surg 2009; 197(5): 678-85.

19. O'Reilly KB. Patient safety: What can medicine learn from aviation? Am Med News. June 14, 2010.

20. Makary M, Unaccountable: What Hospitals Won't Tell You and How Transparency Can Revolutionize Health Care. New York: Bloomsbury Press; 2013.

21. Lingard L, Espin S, Whyte S, Regenhr G, Baker GR, Reznick R, Bohnen J, Orser B, Doran D, Grober E. Communication failures in the operating room: an observational classification of recurrent types and effects. Qual Saf Health Care 2004; 13(5): 330-4.

22. Haynes J, Strickler J. Team STEPPS makes strides for better communication. Nursing 2014: 62-3.

23. Stead K, Kumar S, Schultz TJ. Teams communicating through STEPPS. MJA 2009; 190: S128-32.

24. Simons DJ, Chabris CF. Gorillas in our midst: sustained inattentional blindness for dynamic events. Perception 1999, 28: 1059-74.

25. Endsley MR. Measurement of situation awareness in dynamic systems. Hum Factors 1995; 37: 65-84.

26. AHRQ Agency for Healthcare Research and Quality. http://www.ahrq.gov/professionals/education/curriculum-tools/teamstepps/. Accessed July 1, 2014.

27. Wolf FA, Way LW, Stewart L. The efficacy of medical team training: improved team performance and decreased operating room delays: a detailed analysis of 4863 cases. Ann Surg 2010; 252(3): 477-83; discussion 483-5.

28. Center for Healthcare Quality and Safety. The Safety Attitudes Questionnaire. https://med.uth.edu/chqs/surveys/safety-attitudes-and-safety-climate-questionnaire/. Accessed July 1, 2014.

29. Helmreich RL, Merritt AC, Sherman PJ, Gregorich SE, Weiner EL. The Flight Management Attitudes Questionnaire (FMAQ). NASA/UT/FAA Technical Report 93-4. Austin, TX: The University of Texas; 1993.

30. Sexton JB, Helmreich RL, Neilands TB, Rowan K, Vella K, Boyden J, Roberts PR, Thomas EJ. The Safety Attitudes Questionnaire: Psychometric Properties, Benchmarking Data, and Emerging Research. BMC Health Serv Res 2006; 6: 44.

31. Makary MA1, Sexton JB, Freischlag JA, Holzmueller CG, Millman EA, Rowen L, Pronovost PJ. Operating room teamwork among physicians and nurses: teamwork in the eye of the beholder. J Am Coll Surg 2006; 202(5): 746-52.

32. Mills P1, Neily J, Dunn E. Teamwork and communication in surgical teams: implications for patient safety. J Am Coll Surg 2008; 206(1): 107-12.

33. Haynes AB, Weiser TG, Berry WR, Lipsitz SR, Breizat AH, Dellinger EP, Dziekan G, Herbosa T, Kibatala PL, Lapitan MC, Merry AF, Reznick RK, Taylor B, Vats A, Gawande AA. Changes in safety attitude and relationship to decreased postoperative

morbidity and mortality following implementation of a checklist-based surgical safety intervention. BMJ Quality Safety 2011; 20(1): 102-7.

34. Sexton JB, Makary MA, Tersigni AR, Pryor D, Hendrich A, Thomas EJ, Holzmueller CG, Wu Y, Pronovost PJ. Teamwork in the operating room: frontline perspectives among hospitals and operating room personnel. Anesthesia 2006; 105: 877-84.

35. Pronovost P, Holzmueller CG, Needham DM, Sexton JB, Miller M, Berenholtz S, Wu AW, Perl TM, Davis R, Baker D, Winner L, Morlock L. How will we know patients are safer? An organization-wide approach to measuring and improving safety. Crit Care Med 2006; 34(7): 1988-95.

36. Sexton JB, Holzmueller CG, Pronovost PJ, Thomas EJ, McFerran S, Nunes J, Thompson DA, Knight AP, Penning DH, Fox HE. Variation in caregiver perceptions of teamwork climate in labor and delivery units. J Perinatol 2006; 26(8): 463-70.

37. Speroff T, Nwosu S, Greevy R, Weinger MB, Talbot TR, Wall RJ, Deshpande JK, France DJ, Ely EW, Burgess H, Englebright J, Williams MV, Dittus RS. Organisational culture: variation across hospitals and connection to patient safety climate. Quality Safety Health Care 2010; 19(6): 592-6.

38. Pronovost PJ, Berenholtz SM, Goeschel C, Thom I, Watson SR, Holzmueller CG, Lyon JS, Lubomski LH, Thompson DA, Needham D, Hyzy R, Welsh R, Roth G, Bander

J, Morlock L, Sexton JB. Improving patient safety in intensive care units in Michigan. J Crit Care 2008; 23(2): 207-21.

39. Modak I, Sexton JB, Lux TR, Helmreich RL, Thomas EJ. Measuring safety culture in the ambulatory setting: The Safety Attitudes Questionnaire – Ambulatory Version. J Gen Int Med 2007; 22: 1-5. Editorial comments pages 155-6.

40. The Universal Protocol for preventing wrong site, wrong procedure and wrong person surgery. http://www.jointcommission.org/assets/1/18/UP_Poster1.PDF Accessed July 1, 2014.

41. Haynes AB, Weiser TG, Berry WR, Lipsitz SR, Breizat AH, Dellinger EP, Herbosa T, Joseph S, Kibatala PL, Lapitan MC, Merry AF, Moorthy K, Reznick RK, Taylor B, Gawande AA; Safe Surgery Saves Lives Study Group. A surgical safety checklist to reduce morbidity and mortality in a global population. N Engl J Med 2009; 360(5): 491-9.

42. Association of Perioperative Registered Nurses and The Joint Commission. Comprehensive Surgical Checklist Web Site. http://www.aorn.org/Clinical_Practice/ToolKits/Correct_Site_Surgery_Tool_Kit/Comprehensive_checklist.aspx. Accessed July 1, 2014.

43. Zuckerman SL, France DJ, Green BS, Leming-Lee S, Anders S, Mocco J. Surgical debriefing: a reliable roadmap to completing the patient safety cycle. Neurosurg Focus 2012; 33(5): E4.

44. Ahmed M, Sevdalis N, Paige J, Paragi-Gururaja R, Nestel D, Arora S. Identifying best practice guidelines for debriefing in surgery: a tri-continental study. Am J Surg 2012; 203(4): 523-9.

45. Makary MA, Holzmueller CG, Sexton JB, Thompson DA, Martinez EA, Freischlag JA, Ulatowski JA, Heitmiller ES, Rowen L, Pronovost PJ. Operating room debriefings. JT Commm J Qual Patient Saf. 2006; 32(7): 407-10.

Figure 1. Patient Flow from Time of Initial Appointment Through Post-Op

Figure 2. Pre and Post Implementation Overall staff Scoring

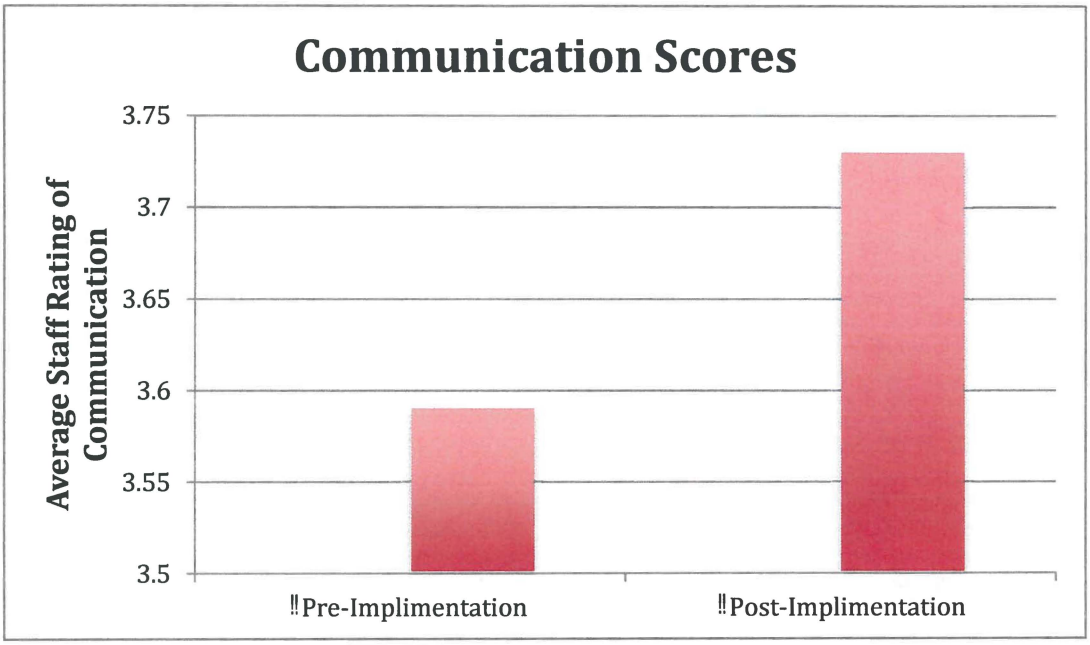


Figure 3. Prior to Changes Staff Communication Scoring.

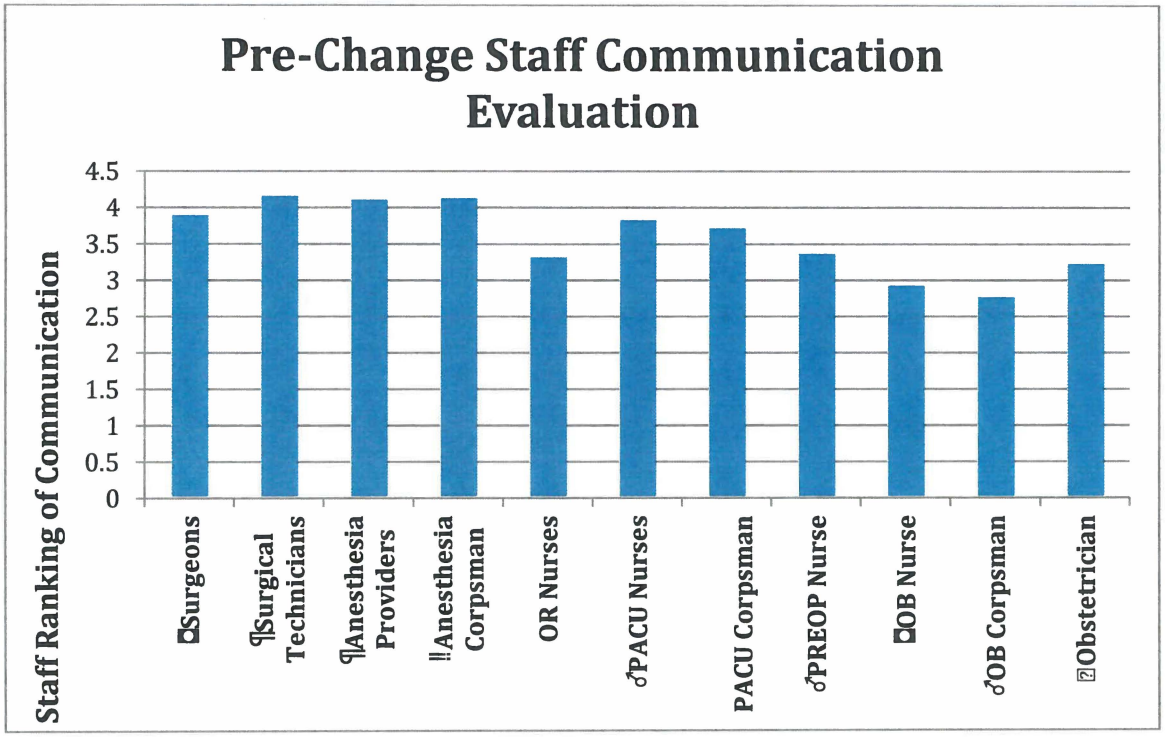
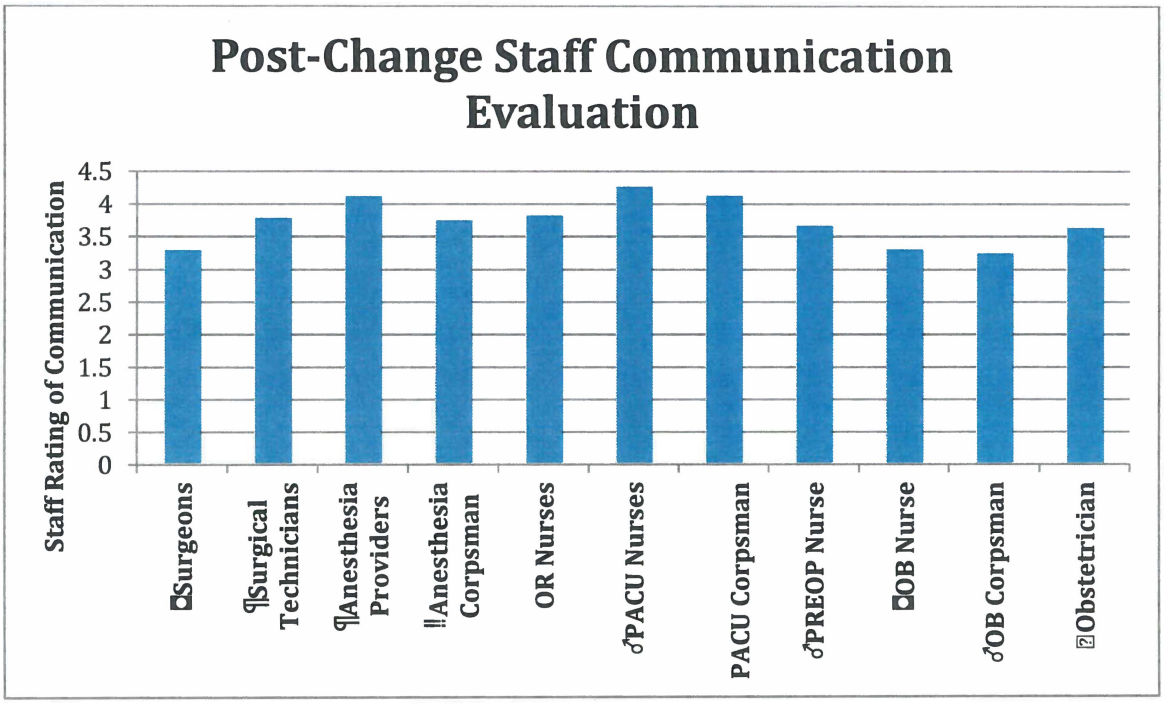
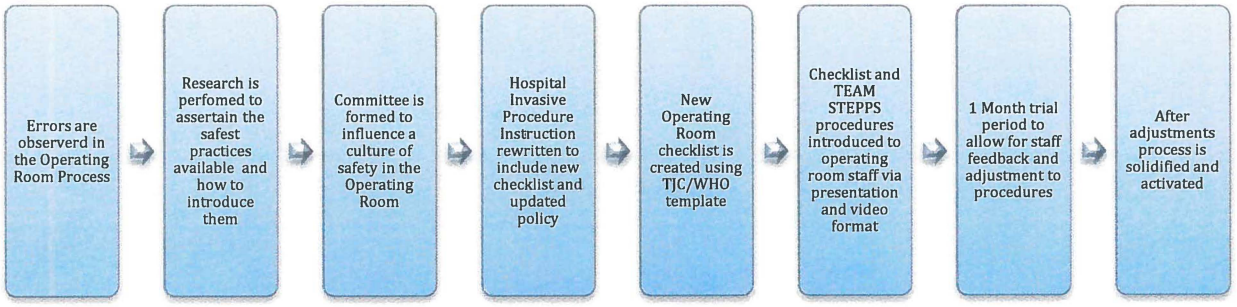


Figure 4. Post Implementation Staff Communication Scoring





Appendix A. Project flow chart

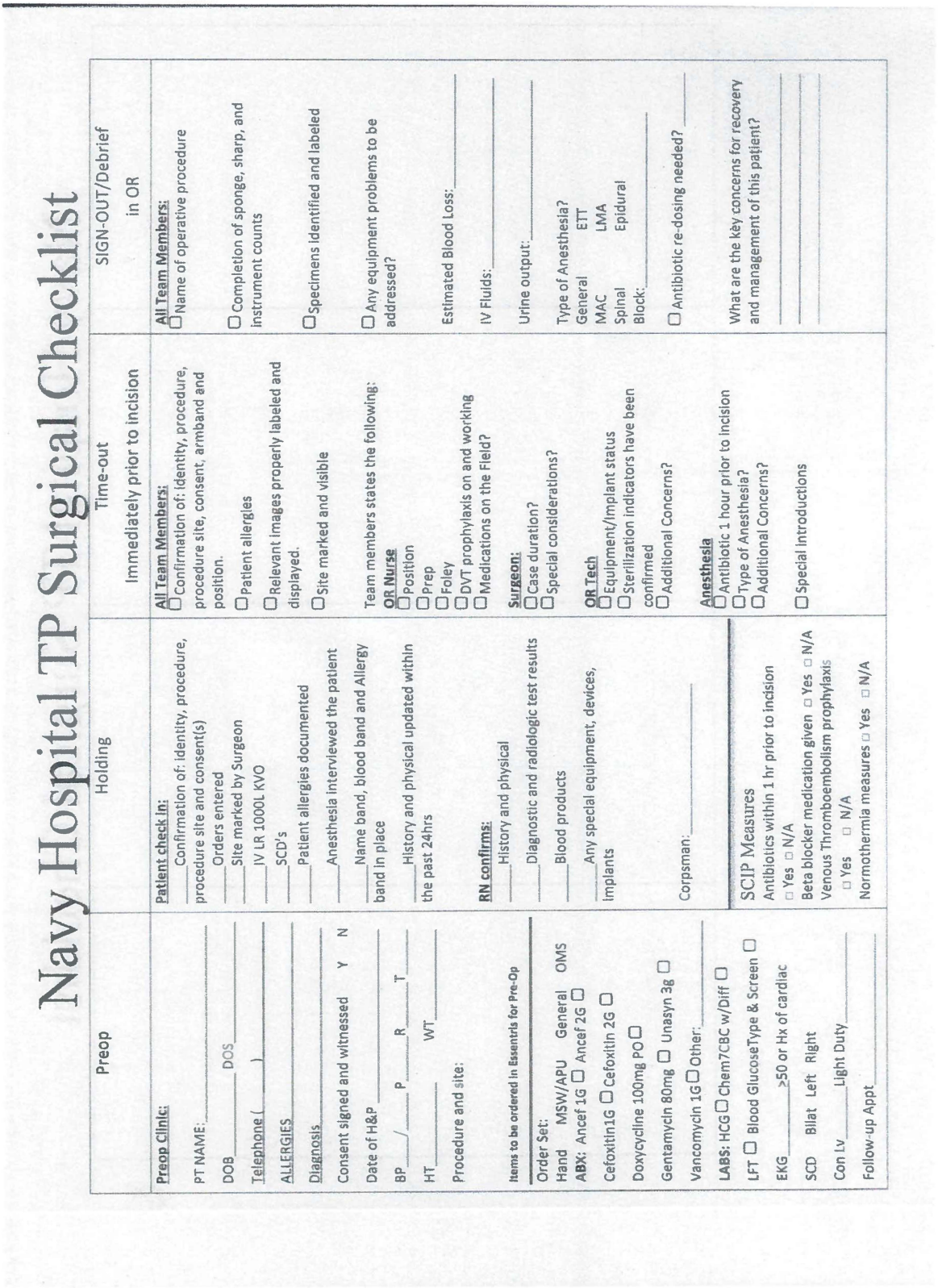
COMPREHENSIVE SURGICAL CHECKLIST

Blue = World Health Organization (WHO) Green = The Joint Commission - Universal Protocol (JC) 2013 National Patient Safety Goals Orange = JC and WHO

PREPROCEDURE CHECK-IN	SIGN-IN	TIME-OUT	SIGN-OUT
In Holding Area	**Before Induction of Anesthesia**	**Before Skin Incision**	**Before the Patient Leaves the Operating Room**
Patient/patient representative actively confirms with Registered Nurse (RN):	**RN and anesthesia care provider confirm:**	**Initiated by designated team member** All other activities to be suspended (unless a life-threatening emergency)	**RN confirms:**
Identity □ Yes Procedure and procedure site □ Yes Consent(s) □ Yes Site marked □ Yes □ N/A by person performing the procedure **RN confirms presence of:** History and physical □ Yes Preanesthesia assessment □ Yes Diagnostic and radiologic test results □ Yes □ N/A Blood products □ Yes □ N/A Any special equipment, devices, implants □ Yes □ N/A Include in Preprocedure check-in as per institutional custom: Beta blocker medication given (SCIP) □ Yes □ N/A Venous thromboembolism prophylaxis ordered (SCIP) □Yes □ N/A Normothermia measures (SCIP) □ Yes □ N/A	Confirmation of: identity, procedure, procedure site and consent(s) □ Yes Site marked □ Yes □ N/A by person performing the procedure Patient allergies □ Yes □ N/A Difficult airway or aspiration risk? □ No □ Yes (preparation confirmed) Risk of blood loss (> 500 ml) □ Yes □ N/A # of units available _____ Anesthesia safety check completed □ Yes **Briefing:** All members of the team have discussed care plan and addressed concerns □ Yes	Introduction of team members □ Yes **All:** Confirmation of the following: identity, procedure, incision site, consent(s) □ Yes Site is marked and visible □ Yes □ N/A Relevant images properly labeled and displayed □ Yes □ N/A Any equipment concerns? **Anticipated Critical Events** **Surgeon:** States the following: □ critical or nonroutine steps □ case duration □ anticipated blood loss **Anesthesia Provider:** □ Antibiotic prophylaxis within one hour before incision □ Yes □ N/A □ Additional concerns? **Scrub and circulating nurse:** □ Sterilization indicators have been confirmed □ Additional concerns?	Name of operative procedure Completion of sponge, sharp, and instrument counts □ Yes □ N/A Specimens identified and labeled □ Yes □ N/A Any equipment problems to be addressed? □ Yes □ N/A **To all team members:** What are the key concerns for recovery and management of this patient? _____ _____ _____ _____ _____ _____ _____ _____ June 2013 AORN

The JC does not stipulate which team member initiates any section of the checklist except for site marking.
The Joint Commission also does not stipulate where these activities occur. See the Universal Protocol for details on the Joint Commission requirements.

Appendix B. The combined World Health Organization, Joint Commission checklist produced by the Association of Perioperative Registered Nurses



Navy Hospital TP Surgical Checklist

Preop	Holding	Time-out Immediately prior to incision	SIGN-OUT/Debrief in OR
Preop Clinic: PT NAME:_____ DOB_____ DOS_____ Telephone (___)_____ ALLERGIES_____ Diagnosis_____ Consent signed and witnessed Y N Date of H&P_____ BP___/____ P____ R____ T____ HT_____ WT_____ Procedure and site: **Items to be ordered in Essentris for Pre-Op** Order Set: Hand MSW/APU General OMS **ABX:** Ancef 1G ☐ Ancef 2G ☐ Cefoxitin1G ☐ Cefoxitin 2G ☐ Doxycycline 100mg PO ☐ Gentamycin 80mg ☐ Unasyn 3g ☐ Vancomycin 1G ☐ Other:_____ **LABS:** HCG ☐ Chem7CBC w/Diff ☐ LFT ☐ Blood GlucoseType & Screen ☐ EKG_____ ≥50 or Hx of cardiac SCD Bilat Left Right Con Lv_____ Light Duty_____ Follow-up Appt_____	**Patient check in:** ☐Confirmation of: identity, procedure, procedure site and consent(s) ☐Orders entered ☐Site marked by Surgeon ☐IV LR 1000L KVO ☐SCD's ☐Patient allergies documented ☐Anesthesia interviewed the patient ☐Name band, blood band and Allergy band in place ☐History and physical updated within the past 24hrs **RN confirms:** ☐History and physical ☐Diagnostic and radiologic test results ☐Blood products ☐Any special equipment, devices, implants Corpsman:_____ SCIP Measures Antibiotics within 1 hr prior to incision ☐ Yes ☐ N/A Beta blocker medication given ☐ Yes ☐ N/A Venous Thromboembolism prophylaxis ☐ Yes ☐ N/A Normothermia measures ☐ Yes ☐ N/A	**All Team Members:** ☐Confirmation of: identity, procedure, procedure site, consent, armband and position. ☐Patient allergies ☐Relevant images properly labeled and displayed. ☐Site marked and visible Team members states the following: **OR Nurse** ☐Position ☐Prep ☐Foley ☐DVT prophylaxis on and working ☐Medications on the Field? **Surgeon:** ☐Case duration? ☐Special considerations? **OR Tech** ☐Equipment/Implant status ☐Sterilization indicators have been confirmed ☐Additional Concerns? **Anesthesia** ☐Antibiotic 1 hour prior to incision ☐Type of Anesthesia? ☐Additional Concerns? ☐Special Introductions	**All Team Members:** ☐Name of operative procedure ☐Completion of sponge, sharp, and instrument counts ☐Specimens identified and labeled ☐Any equipment problems to be addressed? Estimated Blood Loss:_____ IV Fluids:_____ Urine output:_____ Type of Anesthesia? General ETT MAC LMA Spinal Epidural Block:_____ ☐Antibiotic re-dosing needed?_____ What are the key concerns for recovery and management of this patient? _____ _____ _____

Appendix C. New Operating Room Checklist

Robert E. Bush Naval Hospital
Medal of Honor Recipient

DEPARTMENT OF THE NAVY
NAVAL HOSPITAL
BOX 788250
MARINE CORPS AIR GROUND COMBAT CENTER
TWENTYNINE PALMS, CALIFORNIA 92278-8250

IN REPLY REFER TO:
5420
00F00
11 Apr 14

From: Commanding Officer, Naval Hospital Twenty Nine Palms
To: LT Derek Owens, NC, USN

Subj: APPOINTMENT AS TEAM LEADER, STRATEGIC COMMUNICATIONS TEAM: CHECKLISTS

Ref: (a) NAVHOSP29PALMSINST 5450.1J

1. Effective immediately, you are appointed as Team Leader, Strategic Communications Team: Checklists. This appointment will remain in effect until your detachment, unless you are relieved in writing before that time.

2. You will be guided in the conduct of your duties by reference (a).

3. You will be assisted by a team to include the following members:

a. CDR Ann Williams, NC, USN
b. LCDR Amanda Feigel, MC, USN
c. LT April McGill, MC, USN
d. HM3 Kylie Guest, USN

4. The Strategic Initiative Teams are chartered by the Executive Steering Committee (ESC). The ESC uplinks for the Strategic Communications Team are Executive Committee of the Medical Staff (ECOMS) and Public Affairs Officer (PAO).

J. C. SOURBEER

Copy to:
CDR Williams
LCDR Feigel
LT McGill
HM3 Guest
Ms. Hogan
ECOMS
PAO

Appendix D. Appointment letter: Strategic communications team

Appendix E. Previous Hospital Invasive Procedure Poster

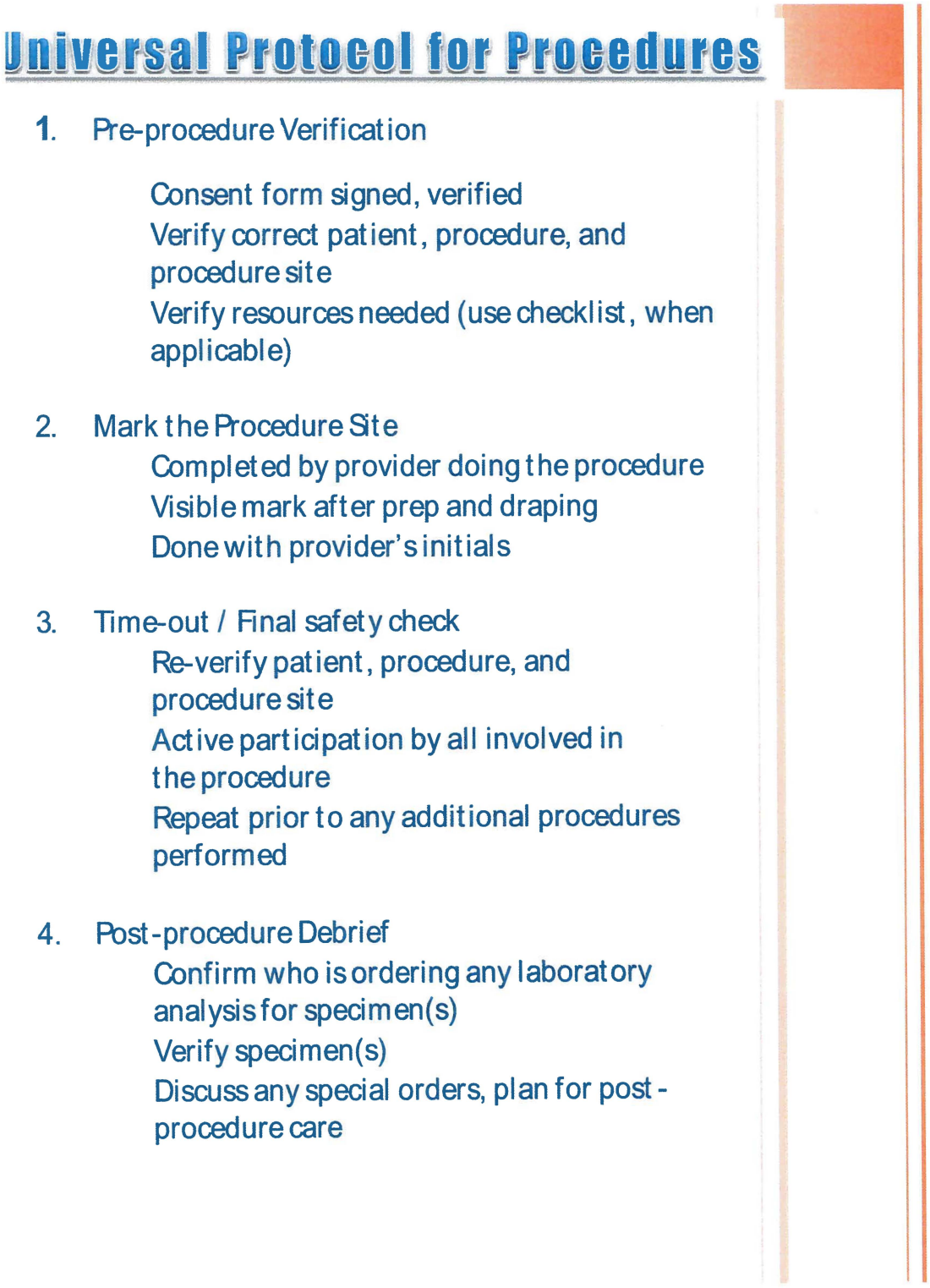
Invasive Procedure Safety Checklist

STEP ONE: PRE-PROCEDURE CHECKLIST W/SITE MARKINGS	STEP TWO: TIME OUT	STEP THREE: POST-PROCEDURE CHECKLIST
❖PATIENT AND PRE-PROCEDURAL - TEAM HAS BEEN CONFIRMED ✓The patient's identity (Two identifiers) ✓Procedure to be performed ✓Side/site of the procedure ✓Procedural consent; completed with: ➢Operation/Procedure ➢Site(s) positioning ➢Risks ➢Patient and Provider signatures (printed/stamps name, date , and time ❖THE PROCEDURALIST HAS PHYSICALLY SEEN THE PATIENT AND: ✓Reviewed relevant documentation to include but not limited to: H&P, consent, nursing assessment, and the anesthesia assessment ✓The procedural site has been marked with the Proceduralist initials: ➢Yes and the initials will be able to be seen after draping ➢No, the procedure is in a location where right/left or upper/lower is not a factor ➢No, patient refused markings and this has been documented in the patient's chart ✓Confirmed: ✓If risk of a blood loss is greater than 600ml, a plan is in place ✓Special treatments, radiography, implants, support personnel or other unique needs have been confirmed ✓If applicable, prophylactic antibiotics confirmed as given and at what time – all is documented in the patient chart ❖THE ANESTHESIOLOGIST/CRNA (WHEN APPLICABLE) HAS SEEN THE PATIENT AND: ✓Reviewed relevant documentation ✓Confirmed: ➢Site Markings pertaining to anesthesiology ➢If a difficult airway – a plan has been documented and the equipment made available. ❖IF HAIR REMOVAL WAS REQUIRED IT WAS DONE ACCORDING TO PROTOCOL	❖THE PROCEDURAL TEAM CONFIRMS: ✓Everyone has stated their name and role ✓The patient's name and date of birth ✓The procedure ✓Side/Site/Position ✓Antibiotics given – if applicable ✓The consent has been completed according to policy. ❖THE PROCEDURALIST HAS: ✓INDICATED ➢Where the incision/procedure will be initiated ➢Any Specific Concerns ➢Duration Expectation ➢Critical Steps ✓CONFIRMED ➢That the site has been marked and is visible after preparation and draping ➢Are relevant images displayed ➢Irrigation fluids are available if needed ➢As needed special safety precautions are in place, which are based on patient history or medication use ➢All diagnostic tests, x-rays and any special equipment are and available for immediate use ❖IF ANESTHESIA IS BEING USED, THE ANESTHESIOLOGIST/CRNA: ✓Confirms all machinery and medication checks have been completed ✓The pulse oximeter is on the patient and functioning properly ✓Indicates any specific concerns ❖IF VENOUS THROMBOSIS PROPHYLAXIS IS NEEDED ✓ the boots are on the patient and functioning	❖PROCEDURALIST HAS CONFIRMED ✓ How the name of the procedure should be recorded ✓The instrument, sponges, and needle counts have been completed ✓Reviewed any special circumstances and/or complications with the procedure.- and they have been documented in the patient's surgical/procedure notes ❖ALL SPECIMENS HAVE BEEN LABELED ACCORDING TO POLICY ❖IF THERE WERE ANY EQUIPMENT PROBLEMS THEY WERE DOCUMENTED AND REPORTED TO THE APPROPRIATE AREAS ❖IF THE PATIENT IS AWAKE: ✓The patient was asked of they had any questions or concerns about the procedure or their recovery.

NAVHOSP29PALMSINST 6320.42A
01 MAY 2013

NAVAL HOSPITAL
MCAGCC, TWENTYNINE PALMS, CALIFORNIA
WE CARE

Enclosure (2)



Appendix F. New Invasive Procedures Poster

SpeakUP™

The Universal Protocol

for Preventing Wrong Site, Wrong Procedure, and Wrong Person Surgery™

Guidance for health care professionals

Conduct a pre-procedure verification process

Address missing information or discrepancies before starting the procedure.

- Verify the correct procedure, for the correct patient, at the correct site.
- When possible, involve the patient in the verification process.
- Identify the items that must be available for the procedure.
- Use a standardized list to verify the availability of items for the procedure. (It is not necessary to document that the list was used for each patient.) At a minimum, these items include:
  - ☐ relevant documentation
    Examples: history and physical, signed consent form, preanesthesia assessment
  - ☐ labeled diagnostic and radiology test results that are properly displayed
    Examples: radiology images and scans, pathology reports, biopsy reports
  - ☐ any required blood products, implants, devices, special equipment
- Match the items that are to be available in the procedure area to the patient.

Mark the procedure site

At a minimum, mark the site when there is more than one possible location for the procedure and when performing the procedure in a different location could harm the patient.

- The site does not need to be marked for bilateral structures.
  Examples: tonsils, ovaries
- For spinal procedures: Mark the general spinal region on the skin. Special intraoperative imaging techniques may be used to locate and mark the exact vertebral level.
- Mark the site before the procedure is performed.
- If possible, involve the patient in the site marking process.
- The site is marked by a licensed independent practitioner who is ultimately accountable for the procedure and will be present when the procedure is performed.*
- Ultimately, the licensed independent practitioner is accountable for the procedure – even when delegating site marking.
  * In limited circumstances, site marking may be delegated to some medical residents, physician assistants (P.A.), or advanced practice registered nurses (A.P.R.N.).
- The mark is unambiguous and is used consistently throughout the organization.
- The mark is made at or near the procedure site.
- The mark is sufficiently permanent to be visible after skin preparation and draping.
- Adhesive markers are not the sole means of marking the site.
- For patients who refuse site marking or when it is technically or anatomically impossible or impractical to mark the site (see examples below): Use your organization's written, alternative process to ensure that the correct site is operated on. Examples of situations that involve alternative processes:
  - ☐ mucosal surfaces or perineum
  - ☐ minimal access procedures treating a lateralized internal organ, whether percutaneous or through a natural orifice
  - ☐ interventional procedure cases for which the catheter or instrument insertion site is not predetermined
    Examples: cardiac catheterization, pacemaker insertion
  - ☐ teeth
  - ☐ premature infants, for whom the mark may cause a permanent tattoo

Perform a time-out

The procedure is not started until all questions or concerns are resolved.

- Conduct a time-out immediately before starting the invasive procedure or making the incision.
- A designated member of the team starts the time-out.
- The time-out is standardized.
- The time-out involves the immediate members of the procedure team: the individual performing the procedure, anesthesia providers, circulating nurse, operating room technician, and other active participants who will be participating in the procedure from the beginning.
- All relevant members of the procedure team actively communicate during the time-out.
- During the time-out, the team members agree, at a minimum, on the following:
  - ☐ correct patient identity
  - ☐ correct site
  - ☐ procedure to be done
- When the same patient has two or more procedures: If the person performing the procedure changes, another time-out needs to be performed before starting each procedure.
- Document the completion of the time-out. The organization determines the amount and type of documentation.

The Joint Commission

This document has been adapted from the full Universal Protocol. For specific requirements of the Universal Protocol, see The Joint Commission standards.

Appendix G. The Joint Commission Universal Protocol Poster

UTHealth
The University of Texas
Health Science Center at Houston

Medical School
University of Texas at Houston-Memorial Hermann
Center for Healthcare Quality and Safety

October 27, 2015

Dear Derek Owens,

You have our permission to use any of the following Safety Attitudes Questionnaires and the corresponding scoring keys:

Safety Attitudes Questionnaire – Short Form
Safety Attitudes Questionnaire – Teamwork and Safety Climate
Safety Attitudes Questionnaire – Ambulatory Version
Safety Attitudes Questionnaire – ICU Version
Safety Attitudes Questionnaire – Labor and Delivery Version
Safety Attitudes Questionnaire – Operating Room Version
Safety Attitudes Questionnaire – Pharmacy Version
Safety Climate Survey

Please note, we do not have editable versions for any of the SAQ surveys but feel free to modify the surveys to meet your research endeavors.

Respectfully,

University of Texas at Houston-Memorial Hermann
Center for Healthcare Quality and Safety Team

[redacted]

Appendix H. Permission to use the Safety Attitudes Questionnaire from the University of Texas Health Science Center at Houston