Review Article

Improving Communication and Teamwork in the Operating Room

Louise Kertesz[1*], Christina Walker[2] and Bernadette Maliwat-Bandigan[2]

[1]Clinical Nurse Specialist Operating Room, New York Presbyterian Hospital/Columbia University, New York.

[2]New York Eye and Ear Infirmary of Mount Sinai, New York, New York.

*Correspondence:
Louise Kertesz Clinical Nurse Specialist, Perioperative Department/Columbia, Presbyterian Hospital, New York, Tel: 212 305 5828; E-mail: lok9010@nyp.org.

ABSTRACT

Communication and teamwork are essential components of safe patient care. This research project evaluated the communication and teamwork the operating room staff engaged in during 30 surgical procedures. This descriptive project utilized a convenience sample consisting of approximately fifty interdisciplinary staff members. To evaluate the quality of communication the Communication and Teamwork Skills (CATS) Assessment Tool was used. From 2012 to 2014, improvement in CATS scores was marked: for example, the score for the communication category went from 91.60% to 99.5% and that for the coordination category from 93.50% to 97.6%. Study findings suggest that education and quality monitoring with teaching moments improve team-based outcomes and, ultimately, increase patient safety. All operative team members should not only be competent in their individual roles but should also work together in a structure exhibiting the expertise of team members functioning synergistically as team members.

Keywords

Communication, Teamwork, Implementation, CATS Assessment Tool, Quality monitoring, Surgery.

Introduction

The perioperative environment is fast paced and production driven --- pressing time constraints and highly complex procedures foster medical errors and these medical errors contribute to patient harm and death [1]. It is well established that patient safety is optimized when caregivers function as an effective team. According to Frankel, Gardner, Maynard & Kelly, 2007, effective teamwork and communication skills are cornerstones of safe, reliable, and high-quality health care [2]. Once embedded into the daily routine, efficient teamwork and efficient communication skills enhance staff and patient satisfaction while at the same time facilitating optimal clinical outcomes [2]. When these behaviors are not vigorously practiced, failures in teamwork and communication may significantly contribute to so-called sentinel events, which include wrong-site and wrong-patient procedures [3]. Guimond & Sole (2009) place emphasis on the point of view that patient care is enhanced when there is quality teamwork among perioperative professionals [4].

Statement of Purpose

The first purpose of this research was to determine the sustainability of the efficacy of education for the operating room nurses and surgical technicians in communication and teamwork. The second purpose of the research was to evaluate the current quality of communication and teamwork of the entire operating room team during surgical procedures based on the identified needs of the Communication and Teamwork Skills (CATS) Assessment Tool score.

Research Question

Does the use of an observational measure provide information related to the sustainability of an effective training program to improve communication in the operating room and does such use of an observational measure also promote patient safety?

P=Population: Operating Room Team (all members who care for patients in the operating room)
I=Intervention: Observation of communication and teamwork skills using the Communication and Teamwork Skills (CATS) assessment measure
C=Comparison: Prior nurses and surgical observation of nurses

and surgical technicians in Spring, 2012
O=Outcome: Provide data for teamwork and communication for all Operating Room staff.
T=Time Eight weeks

Significance to Nursing (Need to change)

The goal was to assess the effectiveness of the surgical team's ability to work cohesively in providing optimal patient care. The overriding purpose of this project is to advance patient safety in the operating room by promoting optimum communication and teamwork among perioperative team members.

The results of this research provided information on areas of communication and behavior that the observations and numerous previous studies have shown to need improvement. This research also sought to determine whether such education promotes patient safety in the operating room at an urban teaching hospital. In addition, this research examines whether the use of an operating-room-specific check list contributes to ensuring effective communication among the staff and whether the time out process contributes positively to patient safety.

Literature Review

There are many studies that have analyzed communication breakdowns in healthcare settings. The overwhelming majority of evidence supports the need for improved communication in the operating room. Some researchers have gone even further and have analyzed the linkages between communication, team performance, and patient outcomes [7].

Carney, West, Neily, Mills, & Bagian investigated the disparity in the perceptions of communication between surgeons and perioperative nurses [8]. Their study made use of an operating room version of the Safety Attitudes Questionnaire, a survey developed and validated over several years in different healthcare settings [8]. A total of 2, 204 surveys were returned. Perioperative nurses had the highest group response rate. According to Carney et al., perioperative nurses rated the quality of teamwork they engaged in with other nurses as being higher than the quality of teamwork they engaged in with surgeons, but surgeons rated teamwork as being high both with other surgeons and with nurses – a gap possibly, according to Carney et al., attributable to differences in perception related to educational preparation and definitions of teamwork [8]. This perceptual difference can result in [and deflect] poor communication because the surgeon or nurse may assume that the perioperative team is in agreement or understands the communication when in fact, critical information is being lost. The authors concluded that the Safety Attitudes Questionnaire was a helpful tool in identifying suboptimal levels of communication, levels that members of the perioperative team might not have otherwise recognized.

Lingard et al. examined the events leading up to communication failures, with the goal of developing a team checklist that would lead to improved communications in the operating room [9]. This study involved direct observation of communication in the operating room, in contrast to most other studies as most studies involve no more than questionnaires or a literature review. They observed 421 communication events and 129 of these were considered communication failures. The authors concluded that the use of a structured checklist communication system in the operating room would likely help reduce the number of communication failures.

Conrardy, Brenek, & Myers investigated the current state of knowledge regarding the implementation of the Universal Protocol and its relationship to the occurrence of wrong-site, wrong-procedure, and wrong-person surgery [10]. Like Carney et al., Conrardy et al. found that 14 of 34 documents in the literature review cited communication as a chief concern in the operating room, a finding that substantiates the viewpoint that communication continues to be a concern in relation to patient safety during surgical procedures [10].

Using on a comprehensive, prospective insurance database of 27,370 physician-self-reported adverse occurrences in Colorado from January 1, 2002 through June 1, 2008, Stahel et al., analyzed the frequency, root causes, and outcomes of wrong-site and wrong-patient procedures [6]. The study's final analysis included a high frequency of never events, these totaling 107 wrong-site and 25 wrong-patient cases. A significant difference was seen in the time-out not having been performed properly, with this lack being a root cause for wrong-site surgery. In addition, the root cause analysis revealed a greater than 56% incidence of diagnosis errors that lead to a wrong-patient procedure. For example, in one case an outcome involving significant harm occurred in a wrong-patient procedure because two patients had identical names and this led to one of them having the wrong surgery; an incident that could have been avoided had a formal preoperative patient identity check been implemented, as recommended in the Universal Protocol.

Weaver, Rosen, Diaz Granados, Lazzara, Lyons, Salas, Knych, McKeever, Adler, Barker, & King described the results of an evaluation study conducted as part of a quality improvement project aimed at optimizing teamwork behavior among operating room teams within a large community-hospital health system [11]. The evaluation was a mixed-model design with one perioperative team receiving TeamSTEPPS training while the control perioperative team did not have any specific training. The authors concluded that the results of this study provide empirical support for the effectiveness of the TeamSTEPPS program in all four levels of evaluation, these being: reactions, learning, behavior in the operating room, and proxy organizational result. The trainees reported that the training was useful, achieved the learning benchmarks that had been specified previously, increased the quality of teamwork, and demonstrated some positive changes in patient safety culture. This study differed from the aforementioned studies in that the researchers did not initiate team training in response to communication or team behavior deficiencies. Rather, a quality improvement project was the driving impetus for this study - based on the premise that medical care is a team effort, and that this has become especially true as patient care has become more complex.

Nurses who are part of the perioperative team should take the lead in evaluating communication and teamwork in the operating room –for numerous reasons including the fact that surgeons themselves must be so focused on technical and physiological aspects of the procedure that they are often unable to give much attention to the important task of monitoring the quality of communication. The human factor may be a challenge in the operating room; but when strong congruent operative teams are in place and mutual goals are agreed upon, communication among members of the team can actually become one of its strengths. When optimal teamwork is in place, patients benefit as they are more likely to receive safe, quality care.

It is important that each member of the team be a clinical expert in his/her own practice domain, but it is perhaps even more vital that all members of the team function as an expert team that provides safe patient care – with a synergistic interaction among members of the team contributing to the provision of such care.

Conceptual Framework
The conceptual model chosen for this study is the Iowa Model [12]. The Iowa Model assists nurses in the application of evidence-based practice; the model considers the impact on evidence - based practice of the specific characteristics of the organization in which the procedure is performed. This model addresses the key components of evidence-based practice: as these key components are defined by Titler et al., develop a PICO question, search and evaluate the evidence, utilize the evidence, and evaluate the practice change [12].

Description of Study
In this research project, the investigator observed and evaluated teamwork skills and communication interactions during 60 real-time surgical procedures. This research project was conducted at an urban teaching hospital in New York City, NY.

Institutional Review Boards
Prior to initiating this evidence-based project, the Institutional Review Boards for both Saint Peter's University and New York Eyes and Ears Infirmary approved this protocol via expedited review process. The investigators also completed the National Institutes of Health (NIH) Office of Extramural Research certification training course "Protecting Human Research Participants".

Description of Study Procedures/Methods
The investigator observed 60 real-time surgical procedures performed in the operating room while evaluating interactions and communication among the surgical team members. This helped assess the effectiveness of the surgical team's ability to work cohesively while providing optimal patient care. The investigator observed communication and team behaviors using the Communication and Teamwork Skills Assessment Instrument (CATS) (Appendix A). Feedback from the series of observation(s) assisted the investigator in identifying and evaluating behaviors aimed at improving team skills; furthermore, this approach provided data on whether or not the education on communication

provided to registered nurses and surgical technologists in August, 2012 was sustained by a follow-up study in 2014.

Implementation and Description of Instrument
Following an informational staff meeting, consent to participate in this project was obtained, from all perioperative team members. Perioperative staff (physicians, registered nurses, surgical technologists, certified registered nurse anesthetists and residents) were given adequate time to ask questions about the project and the principal investigator of the current project was available via email and telephone to answer any questions of the staff should they arise. Operating room team members were asked to sign consent forms, which were valid for the entire duration of the project. Operating team members were identified by their role title. The principal investigator described the purpose and benefit of the study to the patient and obtained his/her consent. All data gathered were kept confidential and the confidentiality of each participant was also protected, as no patient identifiers were used.

The observations of real-time surgeries as well as the accompanying evaluations of the interactions and communication of surgical team members took place in the operating room. The principal investigator observed team behaviors using the Communication and Teamwork Skills Assessment Instrument (CATS). CAT scores provided information that helped determine the type of competency that will assist the OR members in improving their teamwork and communication skills.

The CATS Assessment Tool was developed through rapid-cycle improvement and piloted through observation of videotaped simulated clinical scenarios, real-time surgical procedures, and multidisciplinary rounds. The CATS Tool uses specific behavior markers, these being grouped into four categories-coordination, cooperation, situational awareness, and communication.

Each category contains a glossary of terms that are used to observe specific interactions during a particular time of the procedure. The scoring system is designed to allow the observer to mark each time-specific behavior and communication and to grade their quality. Three columns on the assessment tool provide the following: "Observed and Good", "Variation in Quality" (meaning incomplete or of variable quality), and "Expected but not Observed." Observers score behaviors on the degree to which the behavior meets the definition in the glossary. Scoring is based on the total number of observations and the quality of the observed performance. The CATS has been used to assess actual clinical performance of surgical teams in practice.

For each procedure, CATS administration and assessment took approximately two hours (surgical case dependent) over the course of four months to complete. The training curriculum for the principal investigator included video-assisted and case-scenario presentations based on the CATS Assessment Instrument. This training took place in the spring of 2011, in the presence of two other registered nurses who were involved in the initial observation project. Inter-rater reliability was established by

having each of these three registered nurses observe and assign a score to three surgeries. The registered nurse observers then compared their scores and debriefed afterwards while testing the scoring methodology. The nurse observers and the project leader met on five separate occasions during the spring of 2011.

Results

The 60 surgeries were observed across three specialties-ophthalmology, plastics, and otorhinolaryngology; all 60 procedures (100%) were planned (ie, elective). The mean length of surgery time was 57.4 minutes.

Preoperative briefings (ie, "time outs") involving a surgeon, anesthesia provider (anesthesiologist or certified registered nurse anesthetist), registered nurse, and a scrub person were observed in all 60 surgeries. A surgical resident or physician assistant may have also been present for the preoperative briefing (ie, time out). In 2014, two out of the 60 time outs were observed but scored as being 'observed, inadequate,' whether because of interruptions (talking) or because of a missed element (6.6%).

In 2012, 15 time outs were observed and inadequate with missing elements and one incident in which no time out was performed. There were 12 additional preoperative briefings in which relevant information was shared prior to surgery in 2014. The surgeon spoke aloud to the perioperative team (anesthesia provider, registered nurse, scrub person and/or resident and physician assistant) and described the next steps for the procedure and/or care of the patient. These additional 12 preoperative briefings were all scored as being 'observed, adequate.'

The cross monitoring by team members, reflecting awareness of each other's actions and the resulting activity of giving voice to concerns, was scored as being 99.1%. In 2012, the overall score for cooperation was scored at 99%. In relation to the 2014 cross monitoring, there was an incident during which the foot pedal for the electrocautery unit was required but it had not been placed within reach of the surgeon and so it was not available when needed. This element was scored as being 'observed, inadequate;' the situation was quickly remedied but it should have been taken care of earlier since the surgeon requested the foot pedal prior to the start of surgery. Receptive to assertion and ideas was scored at being 99.3%. One incident was scored as being 'observed, but inadequate' – what happened was that the registered nurse announced that she was leaving the room with a frozen section specimen but there was no acknowledgment from the surgeon or other operative team members that they had heard what she said.

Overall, the category of communication had the most assigned points (998) during the observation of the surgeries, the total 2014 score being 99.5% and in 2012; the total score was 91.6%. Closed loop communication achieved a total of 99.7% (2014) and 91.6% (2012) and the category of SBAR achieved a total of 100% in 2014 and 94% in 2012. Using names of team members scored the lowest, at 96.5% in 2014 and 94.4% in 2012; while verbal updates finished at 99.1% in 2014 and 96.5% in 2012.

Behaviors during crisis situations were relevant only during one otorhinolaryngology case in 2014: a patient received a wrong antibiotic pre-incision. Once discovered by the surgeon intra-operatively, the situation was de-escalated when the anesthesiologist discussed appropriate precautionary care to prevent an adverse event. The patient's vital signs were stable and it was decided that these vital signs would be closely monitored intra- and post-operatively by the anesthesia team. The entire situation was handled in a professional manner and the patient had no adverse outcome. The surgery continued and was completed without further incident.

Data Analysis

The Communication and Teamwork Skills Assessment Instrument (CATS) is organized around four categories, each with a specific type of content; and each of these categories is focused on a behavior that is observed and scored according to the quality of the communication.

- "Observed Adequate" column =1 point
- "Observed Inadequate" = .5 point
- "Expected but not Observed" =0 point

Scores are added together to achieve a weighted total. Thereafter, a second total is obtained by adding up the total numbers of points. The quality score of a behavior equals the weighted-total divided by the total number of points, which is then expressed in a hundred-point scale. In this manner, a quality score is established for each behavior and such a score may be determined for each observation period.

In the current project, scores were obtained for coordination which includes briefing and debriefing; awareness including visually scanning environment and verbalizing adjustments in plan as changes occur; cooperation incorporating the sub elements requesting external resources, cross monitoring, verbally asserting and being receptive to assertions and ideas; and communication with the sub categories of closed loop, SBAR, verbal updating, using names, communicating with patient/family and using appropriate tone of voice.

Behaviors during crisis situations were also scored on the basis of what was observed; and for this purpose the following three categories were used: 'adequate,' 'observed inadequate,' or 'expected but not observed.' Scores were also obtained for coordination (event manager establishes adequate coordination); cooperation (escalates asserted concern) and communication (critical language).

Table 2 presents a 2-sample z-test (2-tailed) to compare differences in sample proportions between CATS summary variables. The 2-sample z-test to compare differences in sample proportions is effective for testing the null hypothesis that there is no difference between two group proportions or more formally that the difference is zero (H0: p1 - p2 = 0, where p1 is the proportion from the first group and p2 is the proportion from the second group).

2014 Results Category	Behavior	Observed, Adequate	Observed, Inadequate	Expected but not observed	Total	%
Coordination					42/43	97.6%
	Briefing- Verbalize plan; Time Out	40	2/1		41/42	97.6%
	Debriefing	1			1/1	100%
Awareness					81/81	100%
	Visually scan environment	44			44/44	100%
	Verbalize adjustments in plan as changes occur	37			37/37	100%
Cooperation					173/174	99.4%
	Request external resources, ask for help as needed	26			26/26	100%
	Cross monitoring	56	1/0.5		56.5/57	99.1%
	Verbal assertion	12			12/12	100%
	Receptive to assertion and ideas	78	1/0.5		78.5/79	99.3%
Communication					994/998	99.5%
	Closed loop	421	2/1		422/423	99.7%
	SBAR	22			22/22	100%
	Verbal updates	173	3/1.5		174.5/176	99.1%
	Use names of team members	41	3/1.5		42.5/44	96.5%
	Communicate with patient/family	122			122/122	100%
	Appropriate tone of voice	217			217/217	100%
Totals 2014		1284	12/6		1290/1296	99.5%
Crisis Situation Behaviors 2014						
Coordination	Event manager established	1			1/1	100%
Cooperation	Escalates asserted concern	1			1/1	100%
Communication	Critical language	1			1/1	100%
2012 Results Category	Behavior	Observed,				
Adequate	Observed,					
Inadequate	Expected but not observed	Totals	%			
Coordination					123.5/132	93.5%
	Briefing- Verbalize plan; Time Out	116	15/7.5	1	123.5/132	93.5%
Awareness					133.5/140	95.3%
Cooperation					516/521	99%
Communication					1455.5/1588	91.6%
	Closed loop	454	150/75	20/0	529/624	85%
	SBAR	53	5/2.5	1/0	55.5/59	94%
	Verbal updates	330	10/5	7/0	335/347	96.5%
	Use names of team members	184	21/10.5	1/0	194.5/206	94.4%
	Communicate with patient/family	81	2/1		82/83	98.8%
	Appropriate tone of voice	235	2/1		236/237	99.6%
Totals 2012		2104	219/109.5	34/0	2213.5/2357	93.9%

CATS	2012		2014			
Summary	**Sample**	**Sample**	**Sample**	**Sample**	**Proportion**	**Z**
Variable	**Proportion**	**Size**	**Proportion**	**Size**	**Difference**	
Coordination	93.5%	132	97.6%	43	0.0410	1.0
Briefing/Time Out	93.5%	132	97.6%	42	0.0410	1.0
Awareness	95.3%	140	100.0%	81	0.0470	2.0*
Cooperation	99.0%	521	99.4%	174	0.0004	0.5
Communication	91.6%	1588	99.5%	998	0.0790	8.7*
Closed loop	85.0%	624	99.7%	423	0.1470	8.1****
SBAR	94.0%	59	100.0%	22	0.0600	1.2

Table 2: Results of a 2-Sample Z-Test to Compare Differences in Sample Proportion between CATS Summary Variables.

Discussion

The overall aim of this evidence-based project was to describe whether an educational in-service presented in August, 2012 to operative registered nurses and surgical technicians effected the communication and team-work skills of the operating room staff in such a way as to ultimately lead to improved safety in patient care. Marked improvement was seen in CATS scores from 2012 to 2014 (Appendix B). These improved scores could reflect communication and teamwork skills that are now enractured into practice. This increase in CATS score could also be attributed to the ongoing quality monitoring of surgical time outs and the accompanied teaching moments.

A more detailed cross comparison of the CATS scores for both 2012 and 2014 notes the improvement in all areas of communication and teamwork skills. In this study, quality monitoring was random and included all surgical specialties. In the hospital where the study was conducted, this same type of quality monitoring continues to this day, now being conducted by assigned operating room nurses; the reason for this continuing activity is that the hospital's administration has concluded that it is imperative if quality is to be maintained to continue to assess the knowledge and skills of an operative team. Further, monitoring quality can itself serve an educational function in that staff may come to inquire how to improve their outcomes. In addition, it is telling that re- learning takes place on the spot and becomes a way to foster positive reinforcement and a sense of accomplishment.

Limitations of the Study

There are several limitations to this study. First, the measures used to evaluate behaviors may, because they are dependent on the observer's ability to interpret events, be considered as being somewhat subjective. However, the same person served as the observer in all thirty cases; has extensive experience; is a perioperative nurse who currently practices as an advanced practice nurse in the operating room; and is familiar with the subtle nuances of the environment. Furthermore, inter-rater reliability was established in the 2012 study with the observer and two other registered nurses; these three nurses compared scores on the same surgery and the following debriefing, while testing the scoring methodology. Thus, in 2014 it was concluded that having the single nurse be the observer in all the cases would yield reliable data. Additionally, in measuring the constructs used in this project, the observer used definitions underpinned by the previous study, the 2012 study; and the behaviors these definitions referred to are directly observable.

Lastly, the sample of 60 surgeries may be considered too small and not representative of such more complex specialty surgeries such as cardiac and neurologic surgery. Those usually last many hours and may even require multiple team changes. Also, the surgeries studied in this investigation were drawn from a single hospital site, and this site may differ in known and unknown ways from other larger hospitals. In spite of this, the sample used in this study was representative of the types of typical cases in the operating room of the selected hospital.

Recommendations for Clinical Practice

The true measure of success for any training intervention is to create a highly reliable team in which learned communication and teamwork behaviors are sustained over time? In order to achieve sustainability, there must be administrative support and action at all levels in the organization. Further, there must be "buy-in" from the staff directly affected by any change that is implemented in the clinical milieu. This can be achieved by having select staff actively involved as "team champions" who support and mentor other team members. This research project started as a single-session education event and later extended into daily quality monitoring by team champions who incorporated "teachable moments" for staff, teachable moments in which communication and teamwork behaviors were reinforced. The perioperative nursing care coordinator also held weekly meetings in which numerous topics, including the WHO checklist, the time out process, and standardized communication techniques were discussed and reinforced.

Recommendations for Future Research

As noted by the results, areas for improvement continue in Coordination and Cooperation. This led to research on Social Capital. The term Social Capital emphasizes that investment in interpersonal relationships are needed to produce returns. The next steps are to have the perioperative team complete a Team Trust Survey in order to grow and develop as a team from a culture of trust.

Conclusion

The operating room is a dynamic, highly technical, and stressful environment where a patient may be at increased risk for harm. To avoid harms, communication and teamwork behaviors in the operating room must be standardized through use of checklists, structured by the event at hand and carefully orchestrated in relation to each team member's role. The introduction and consistent reinforcement of team training interventions does improve team communication and ultimately increases patient safety, as evidenced in this project. It is important that all operative team members not only be competent in their individual roles, but that they also work together exhibiting expertise as team members.

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Appendices

Appendix A

Communication and Team Skills (CATS) Assessment Instrument – Updated version

Observation Start Time: _____   Observation End Time: _____

Case ID: _____   Procedure: _____

Category	Behavior	Observed, Adequate	Observed, Inadequate	Expected but not observed	Comments
Coordination	Briefing – Verbalize plan				
	Debriefing				
Awareness	Visually scan environment				
	Verbalize adjustments in plan as changes occur				
Cooperation	Request external resources, ask for help as needed				
	Cross Monitoring				
	Verbal Assertion				
	Receptive to assertion and ideas				
Communication	Closed loop				
	SBAR				
	Verbal updates – think aloud				
	Use Names – team members				
	Communicate with patient/family				
	Appropriate tone of voice				

Category	Behavior	Observed, Adequate	Observed, Inadequate	Expected But Not Observed	Comments
Coordination	Event Manager Established				
Cooperation	Escalates asserted concern				
Communication	Critical language				

Crisis Situation Behaviors – please complete if crisis arises.

Definition of Communication and Team Skills Behavior Markers – Updated version

Briefing - Verbalize Plan - A conversation and two-way dialogue of concise and relevant information shared prior to a procedure or activity. Surgical "time out" may be a briefing. Elements: Get the person's attention; Make eye contact; Introduce yourself; Use names; Use SBAR; Supply explicitly asked for information; Talk about next steps; Encourage ongoing monitoring and cross-monitoring. Speak aloud next steps for the procedure and/or care of patient. **Anticipate procedure eg: "frozen section for this case, make sure pathology aware"**

Debriefing - A conversation and two-way dialogue of concise and relevant information shared after the procedure or activity is completed. Debriefing identifies what went well, what could have been done differently, and what was learned.

Visually Scan Environment – Clinicians look up, look at one another, look at equipment, look around the room. **Especially before incision- surgeon/staff scan room to make sure all equipment is there and set up right.**

Verbalize Adjustments in Plan as Changes Occur – Speak aloud new plans, changes in strategy or intervention, and new timelines as procedure progresses. **Change in procedure once it is started- "We need a frozen, this looks suspicious."**

Request additional external resources, ask for help if needed - Speak aloud asking for help from outside the team—other clinicians, rooms, equipment, consults, etc.

Cross Monitoring– Team members have an awareness of each other's actions, verbally stating concerns, sharing workload, verbally updating others in a manner less formal than briefing, Speak aloud timeframes for particular interventions: "We'll give this another two minutes and if there's no change we'll try X." Ask aloud for team's suggestions, opinions, comments or ideas. **"Please put on a sleeve, you may have touched the wall." "I gave the scrub a 2-0chromic while you stepped out with the frozen." "Can you please check to make sure that I set this up correctly?"**

Verbal assertion -Speak up, - **If team members are uncomfortable or unclear, they speak aloud their concerns and state an alternative viewpoint or suggest an alternative course of action. Individuals are sufficiently persistent to clearly state their opinion. If team members perceive something as unsafe, they speak aloud to indicate that.** "Counts are not correct- hold off on closing"

Receptive to assertion and ideas – Team members respond in a positive, non-hostile manner to the concerns and ideas of fellow team members. **"Are the counts correct yet? Can we close?"**

Closed loop communication – When a request is made of team members, someone specifically affirms aloud that they will complete the task and state aloud when the task has been completed.

SBAR – Use of specific structured communication that states the Situation, Background, Assessment and Recommendation. **Use during relief.**

Verbal updates of situation – think aloud – Team members verbally state their perceptions, actions, and plans as the procedure progresses. **Keeping abreast of the procedure, anticipate needs, including counts and specimens. "We'll be closing as soon as we get the frozen margins" or "Do you want the suture on the specimen to designate short superior/long lateral?" "That looks like a tiny space, do you want Dr. Smith's retractor?"**

Use Names - team members – Use team members' names.
Communicate with patient/family – Team members speak to and respond to the patient and their family-if present

Use appropriate tone of voice – Team members use a tone of voice that is calm, professional, and not unnecessarily loud.

Establish Event Manager if Crisis Arises - Verbally identify who's in charge if situation becomes a crisis; event manager does not participate in active interventions but maintains situational awareness and verbalizes plans, needs, and timeframes.

Escalate asserted concerns – Teammates initiate chain of command if their expressed, asserted concerns are not addressed

Critical Language – Use of key phrases understood by all team members to mean "stop and listen, we have a potential problem". Specific phrases may differ from one institution or work unit to another.

Appendix B

CATS Scores
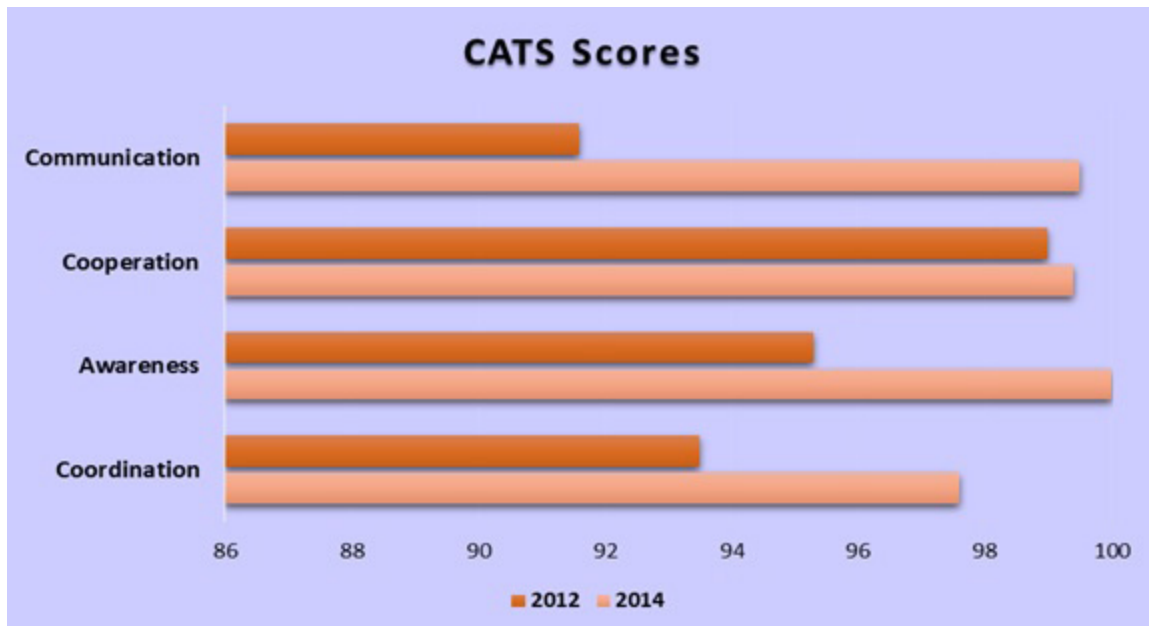
Appendix C

2014 Results Category	Behavior	Observed, Adequate	Observed, Inadequate	Expected but not observed	Total	%
Coordination					42/43	97.6%
	Briefing- Verbalize plan; Time Out	40	2/1		41/42	97.6%
	Debriefing	1			1/1	100%
Awareness					81/81	100%
	Visually scan environment	44			44/44	100%
	Verbalize adjustments in plan as changes occur	37			37/37	100%
Cooperation					173/174	99.4%
	Request external resources, ask for help as needed	26			26/26	100%
	Cross monitoring	56	1/0.5		56.5/57	99.1%
	Verbal assertion	12			12/12	100%
	Receptive to assertion and ideas	78	1/0.5		78.5/79	99.3%
Communication					994/998	99.5%
	Closed loop	421	2/1		422/423	99.7%
	SBAR	22			22/22	100%
	Verbal updates	173	3/1.5		174.5/176	99.1%
	Use names of team members	41	3/1.5		42.5/44	96.5%
	Communicate with patient/family	122			122/122	100%
	Appropriate tone of voice	217			217/217	100%
Totals 2014		1284	12/6		1290/1296	99.5%
Crisis Situation Behaviors 2014						
Category	Behavior	Observed, Adequate	Observed, Inadequate	Expected but not observed	Totals	%
Coordination	Event manager established	1			1/1	100%
Cooperation	Escalates asserted concern	1			1/1	100%
Communication	Critical language	1			1/1	100%

2012 Results Category	Behavior	Observed, Adequate	Observed, Inadequate	Expected but not observed	Totals	%
Coordination					123.5/132	93.5%
	Briefing- Verbalize plan; Time Out	116	15/7.5	1	123.5/132	93.5%
Awareness					133.5/140	95.3%
Cooperation					516/521	99%
Communication					1455.5/1588	91.6%
	Closed loop	454	150/75	20/0	529/624	85%
	SBAR	53	5/2.5	1/0	55.5/59	94%
	Verbal updates	330	10/5	7/0	335/347	96.5%
	Use names of team members	184	21/10.5	1/0	194.5/206	94.4%
	Communicate with patient/family	81	2/1		82/83	98.8%
	Appropriate tone of voice	235	2/1		236/237	99.6%
Totals 2012		2104	219/109.5	34/0	2213.5/2357	93.9%

Appendix D
Close Call
A popular term for a serious medical error that does not result in harm to the patient (Segen's Medical Dictionary, 2012).

Near Miss
A near miss is an unplanned event that did not result in injury, illness, or damage – but had the potential to do so. Only a fortunate break in the chain of events prevented an injury, fatality or damage; in other words, a miss that was nonetheless very near (TJC, 2013).

Retained Surgical Sponge
An error made during surgery in which one or more surgical sponges remains in the operative field after closing the patient, which may become a source for infection (Segen's Medical Dictionary, 2012).

Retained Surgical Item
An error made during surgery in which one or more surgical sponges remains in the operative field after closing the patient, which may become a source for infection (Segen's Medical Dictionary, 2012).

Sentinel Event
A sentinel event is an unexpected occurrence involving death or serious physical or psychological injury, or the risk thereof. Serious injury specifically includes loss of limb or function. The phrase, "or the risk thereof" includes any process variation for which a recurrence would carry a significant chance of a serious adverse outcome. Such events are called "sentinel" because they signal the need for immediate investigation and response. (TJC, 2013).

Surgical Safety Checklist
A simple checklist developed by the World Health Organization which has been shown to reduce surgical morbidity and mortality and sentinel events by such simple exercises as confirming the patient's identity, site, procedure and consent, allergies, airway/aspiration risk, risk of blood loss, sponge counts, etc. (Segen's Medical Dictionary, 2012).

Time Out
The process a surgical team utilizes prior to the start of a surgical procedure to prevent a wrong-site, wrong-side, wrong-procedure or wrong-person surgery (TJC, 2013).

Unintentional Retained Foreign Object (URFO)
URFOs refer to any item or foreign object related to any operative or invasive procedure that is left inside a patient (TJC, 2013).