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NEUROSURGERY COMMUNICATION INITIATIVE STUDY

A Major Qualifying Project Report

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ABSTRACT

A number of recent studies have demonstrated that the implementation of a WHO pre-operative checklist reduces complications, patient morbidity and mortality, as well as health care expenditures. The purpose of this study was to determine the applicability of these findings and trends to a neurosurgical service at a major academic medical center in Massachusetts, with a particular focus on communication and operating room efficiency. To further this quality improvement initiative, 10 anesthesiologists were assigned to be part of the core neuroanesthesia team including the 8 neurosurgical OR personnel. The data indicate that the proper use of a checklist can improve operating room performance, however, compliance with the checklist needs to be improved.

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ACKNOWLEDGEMENTS

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INTRODUCTION

UMASS Neurosurgery OR

Dr. Julie Pilitsis is an attending neurosurgeon and quality officer for neurosurgery at UMass Memorial Medical Center (UMMHC). As part of a quality improvement project looking at Spine surgery in January 2010, Dr. Pilitsis led the effort to implement a survey assessing efficiency in neurosurgical and orthopedic spine surgeries (SSQI) at the two campuses of UMMHC. The survey investigated preventable delays in several areas: boarding, scheduling, getting a patient into the operating room, delays between patient entry and incision, delays during the case, and delays after closure. Circulating nurses during each surgery filled out the SSQI surveys. Surveys were completed for seventy-eight out of ninety-three cases, a combined response rate of 84% for Memorial and University.

The results of the January 2010 study showed that the University campus operating room experienced delays in 73% of their cases, whereas Memorial experienced delays in 69% of their cases (unpublished observations from SSQI survey). It was found that all of the first cases of the day at memorial started late by an average of 12.6 minutes. At the University OR, 50% of first starts were late by an average of 3.6 minutes. One significant delay was found between patient entry and surgery start time, an average of 44.4 minutes at Memorial and 54.4 minutes at University. Included in those times are: patient preparation, preparation of the area of surgery, administration of anesthesia, any monitoring set up, and radiology set up. It was found that Memorial had a mean of 72.6

minutes of non-operative time per case, and University experienced a mean of 75.4 minutes of non-operative time. The question of how to reduce this time was then explored.

The delays at Memorial were more concrete and seemed to revolve around a lack of advanced preparation in terms of having the necessary equipment and instrumentation pulled in advance of the case. Solutions such as the development of "case carts" that contained all instrumentation from the sterile processing department assembled the night before, and a further assessment of needs, were explored and are currently being implemented. The issues causing delays at University campus were not as straightforward, and the general consensus was that institutional cultural barriers prevented efficiency. A number of committees were developed to optimize patient flow, yet delays continued. The lack of a clear or single problem suggests that there may be a lack of established processes and/or established expectations that lead to inefficiencies.

Of the patients whose data was assessed using the survey, prospective data was also collected in terms of antibiotic administration, complications, and financial outcomes. Five of the cases had an associated complication. Three infections were documented. Further quality data was collected outside the initial survey to explore the incidence of spine infections as well as neurosurgical infections. In approximately 50% of the infections documented, the timing of pre-operative antibiotic administration could be improved upon as discussed and recommended by our institutional surgical site infection committee (unpublished data). Furthermore, turnover times were identified as another large issue, and two months of data collection in neurosurgical cases at UMass revealed a median turnover time of 45 $\pm$ 18 minutes between cases. Thus, there were a variety of issues identified in the January 2010 study that could be improved upon to facilitate efficiency.

A cursory analysis of the causes of delays, increased turnover times, and timing of antibiotic administration, suggests that improvements in communication is the first step, specifically by standardizing interactions and information transferred between surgeons, anesthesiologists, nurses in the operating room, and nurses in the peri-operative area.

BACKGROUND

WHO "Safe Surgery Saves Lives"

Even in the most developed countries, surgery has posed serious risks to patients: "In industrialized countries, studies suggest that major complications are reported to occur in 3–16% of inpatient surgical procedures" (Safe Surgery, 2010). The World Health Organization (WHO) formed the World Alliance for Patient Safety in 2004 to address the need for worldwide improvement in patient safety. The alliance brings together policy-makers, agency leaders, and specialists from around the world to discover solutions for patient safety (Gawande & Weiser, 2008). In order to achieve the goals of the Alliance, campaigns called "Global Patient Safety Challenges" are selected based on specific areas of patient safety. The first challenge focused on infection associated with health care (Gawande & Weiser, 2008). Safety of Surgical Care was chosen as the focus of the second Global Patient Safety Challenge.

The complexity of surgery is such that one single solution cannot be expected to significantly improve surgical safety. Working groups of experts came together to work on this Safety Challenge, and identified four aspects of surgical safety that could be significantly improved: safe surgical teams, surgical site infection prevention, safe anesthesia, and measurement of surgical services. One of the most common surgical complications is surgical site infection. Measures that have been proven to decrease the incidence of infection need to be systemized to increase their effectiveness. Increased patient monitoring, and identification of potential problems in advance, could improve anesthesia safety. Teamwork is essential for creating a safe surgical team. Promoting communication among team members ensures that essential steps are taking place to

increase the safety of the patient. The final aspect to be improved is the metrics provided to monitor outcomes of surgical procedures.

The solutions provided for these four areas of safety improvement need to abide by three principles to achieve successful implementation: simplicity, wide applicability, and measurability (Gawande & Weiser, 2008). In order to decrease resistance from surgeons and maximize their time, the selected solutions had to be simple enough to understand quickly and easy to use. Also, the impact of the selected solutions had to be easily measurable to show effectiveness (Gawande & Weiser, 2008). It would not be enough to provide surgeons with extra training while providing them with no way to measure whether the training is improving patient safety. Two main solutions were developed as a result of this challenge: the WHO Safe Surgery Checklist and a set of recommended 'surgical vital statistics' to be measured (Gawande & Weiser, 2008).

The WHO Surgical Safety Checklist was designed to include ten essential aspects of surgery that should be met by every team to improve surgical safety (Safe Surgery, 2010). The items that the team should try to accomplish include: effective communication of critical patient information, operating at the correct site, successful administration of anesthesia, preparing for loss of respiratory function or high blood loss, minimizing risk of surgical site infection, and avoiding leaving objects in surgical wounds. These were identified as the main preventable issues that cause complications during surgery. A copy of the WHO Checklist can be found in Appendix A. The checklist is a simple one-page form that can be quickly and efficiently filled out. The items that comprise the checklist are easy to understand, and can be applied to many different types of surgery. The checklist is organized into three sections: "Sign In" before administration of anesthesia, "Time Out"

before skin incision, and "Sign out" before patient leaves the operating room. Each section contains a sequence of steps that should be taken to ensure patient safety.

In order to assess the success or failure of the checklist there should be routine surveillance of certain 'vital statistics' of surgeries at each location. The WHO Surgical Safety task force came up with specific types of data that should be collected at each location where the checklist is used. Some of the statistical data that should be collected include: "number of surgical procedures performed in an OR, day of surgery mortality rate, post-operative in-hospital mortality rate, surgical site infection rate" (Gawande & Weiser, 2008). These statistical results provide an indication of the overall surgical safety of these locations.

The results of the pilot study of the effectiveness of the "WHO Surgical Safety Checklist" showed that the use of the checklist in eight cities around the world lowered the incidence of surgery-related deaths and complications (Haynes et al., 2009). The study found that the rate of major surgery complications fell from 11% to 7%, and that inpatient deaths fell from 1.5% to 0.8% after implementation of the checklist.

A study determining whether a surgical safety checklist improves patient safety culture and outcomes was also conducted at the Stanford University. Patient outcomes were examined from the quarter before and after implementation of the Safe Surgery Checklist. Observed mortality for surgical patients declined from 0.88 to 0.80 (Tsai et al., 2010).

Safety Attitudes Questionnaire

Safety culture is defined as "group values, attitudes, perceptions, competencies, and patterns of behavior that determine the commitment to… an organization's health and

safety management" (Sorra & Nieva, 2004). Bryan Sexton, Eric Thomas, and Bob Helmreich developed the Safety Attitudes Questionnaire (SAQ) at the University of Texas Center for Healthcare Quality and Safety (Sexton et al., 2006). The survey aims to measure the safety culture of all members of the team.

Several types of SAQs are available for use in different settings such as: ICU, Pharmacy, Ambulatory, and others. The SAQ version used in this study is the "Safety Attitudes Questionnaire- Operating Room Version." The questionnaire is a set of 59 questions that falls under six areas of focus that determine the safety culture of the respondents. The first of the six areas of the safety culture is "Job Satisfaction"; questions under this area will determine the individual's positivity about their work experience. "Teamwork climate" is a second aspect of safety culture that is measured with the SAQ; the questions determine the perceived quality of collaboration between personnel. Approval of managerial action is determined with the questions that fall under the "Perceptions of Management" area. "Stress Recognition" is another aspect of the safety culture that determines the amount of stress perceived by individuals and how that affects their performance. The perception of a strong commitment to patient safety is determined from the responses to the "Safety Climate" questions. Finally, the "Working Conditions" questions aim to determine the perceived quality of the work environment (Pronovost and Sexton, 2005). The responses to the questions in these six areas of focus measure the safety culture of the surgical team. A copy of this questionnaire can be found in Appendix B.

PROJECT PURPOSE

The aim of this MQP project is to assess the effectiveness of a safety checklist modified from the World Health Organization Checklist by the Neurosurgery Department at the University of Massachusetts Medical School (UMMS), termed the "Neurosurgery Communication Initiative Study" (NCIS), in improving communication and consequently patient safety at UMMS. Concurrently with NCIS checklist administration, the "NCIS post-operative survey similar to the January 2010 SSQI assessment will be taken for every case from October 4th to December 1st ,2010, to collect data on delays. Quality metrics will be tracked on patients. Prior to and after administration of the NCIS, anesthesiologists, neurosurgeons, surgical acute care unit (SACU) nurses, and operating room nurses will take the Safety Attitudes Questionnaire (SAQ) OR Version created by Bryan Sexton, Eric Thomas, and Bob Helmreich at the University of Texas Center for Healthcare Quality and Safety (Sexton et al., 2006). We will use this questionnaire to assess the effect of NCIS on teamwork and the perception of safety culture.

METHODOLOGY

The UMMS neurosurgical quality officer (Dr. Julie Pilitsis) developed a modified WHO checklist to address issues relevant to neurosurgery at the institution. This modified checklist was then circulated to all surgeons in the practice, the resource RN in the surgical acute care unit, the neurosurgical OR coordinator, and two key neurosurgical anesthesia providers. Once a mutually agreed upon document had been created, meetings were arranged with each of the groups involved in the process: neurosurgeons, neuroanesthesia providers, OR nursing and SACU nurses. The neurosurgical quality officer and I made a presentation to all members of the surgical team explaining the purpose and goals of the study. The purpose of these meetings and the presentation was not only for information purposes, but also to gain the support of all members involved. Input and opinions were gathered at these meetings so that all parties involved were included, and the checklist and implementation was adjusted to accommodate this input (Appendix D). In the hope of furthering this quality improvement, the anesthesia providers designated a team of 10 anesthesiologists to be part of the core neuroanesthesia team including the 8 neurosurgical OR personnel.

Data was collected prospectively by administering the NCIS post-operative survey (Appendix E) in conjunction with the NCIS checklist for surgical cases over a period of two months. The survey was constructed to gather information about complications and delays in neurosurgery procedures over the course of two months at the UMASS neurosurgery operating rooms. The survey consists of one question to describe the type of procedure taking place, and a series of time values such as time boarded for and time of OR entry.

These were followed by eight yes/no questions about any possible delays or complications that occurred during the case, with room to provide comments on the causes of the delays. The specific delays we are interested in include: the differences in time boarded for and time of OR entry, the difference between time of anesthesia administration and incision, the time difference between operation close and OR exit, and finally the turnover time between cases. The final question of the survey asked how well the checklist was used throughout the case.

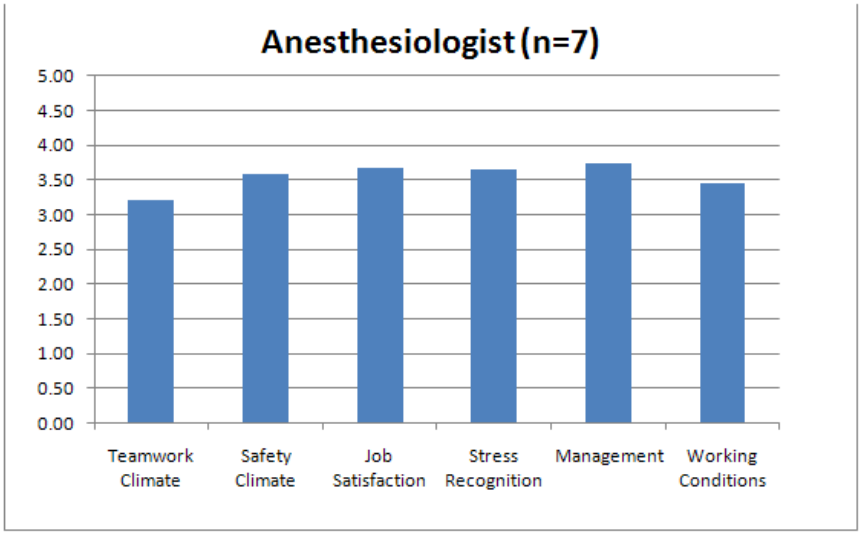
The SAQ was administered by the neurosurgical quality officer to the neurosurgeons, anesthesiologists, SACU and operating room nurses. This questionnaire was administered prior to implementation of the checklist to determine the safety culture at that time. The aspects of safety culture measured included: teamwork climate, safety climate, job satisfaction, stress recognition, and working conditions. All members of the team were asked to fill out the questionnaire in an honest manner and attempt to answer the questions only as they related to neurosurgical procedures. Although information about their position was taken as part of the questionnaire, they were collected without names to maintain a level of anonymity. All questions had multiple choice answers based on a Likert scale, with 1 being strongly disagree and 5 being strongly agree. For example, one question measuring teamwork climate stated: "The physicians and nurses here work together as a well-coordinated team", if a neurosurgeon were in agreement with this statement they would respond with a 5 (strongly agree). The responses to the questionnaire were gathered, and then averaged to find the percent agreement of respondents for each aspect of safety culture. Results were then compared based on whether the respondent was a neurosurgeon, anesthesiologist, or nurse.

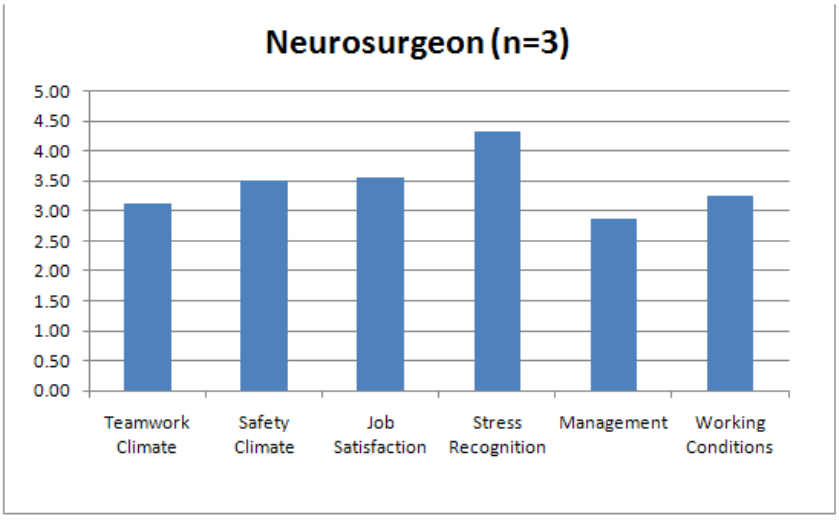
After the two-month period of data collection from the NCIS surveys, the Safety Attitudes Questionnaire was administered to measure the safety culture *after* using the checklist in the operating room. The results of these questionnaires were analyzed using the same methods as before.

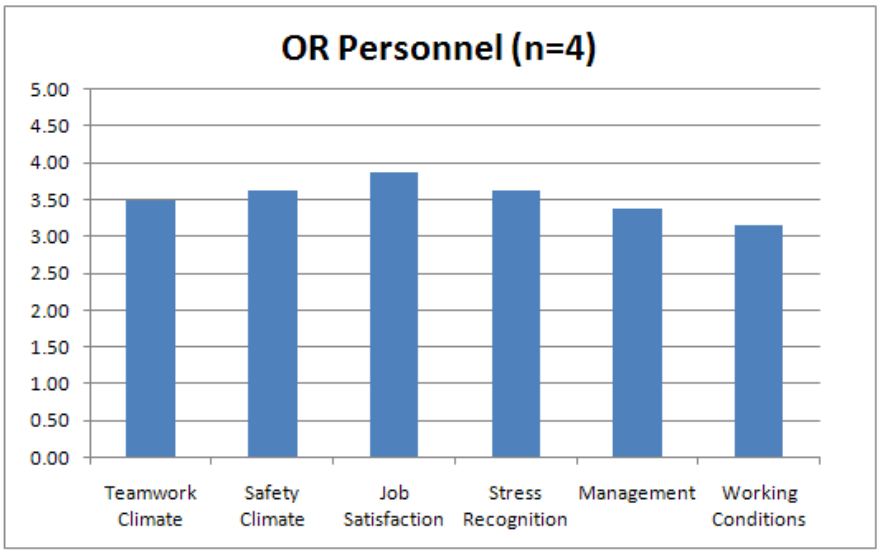
RESULTS

SAQ Responses Before Checklist Implementation

Responses to the Safety Attitudes Questionnaire (SAQ) administered *before* implementation of the checklist were collected and the percent agreement for each area of focus was calculated (**Figure 1**).







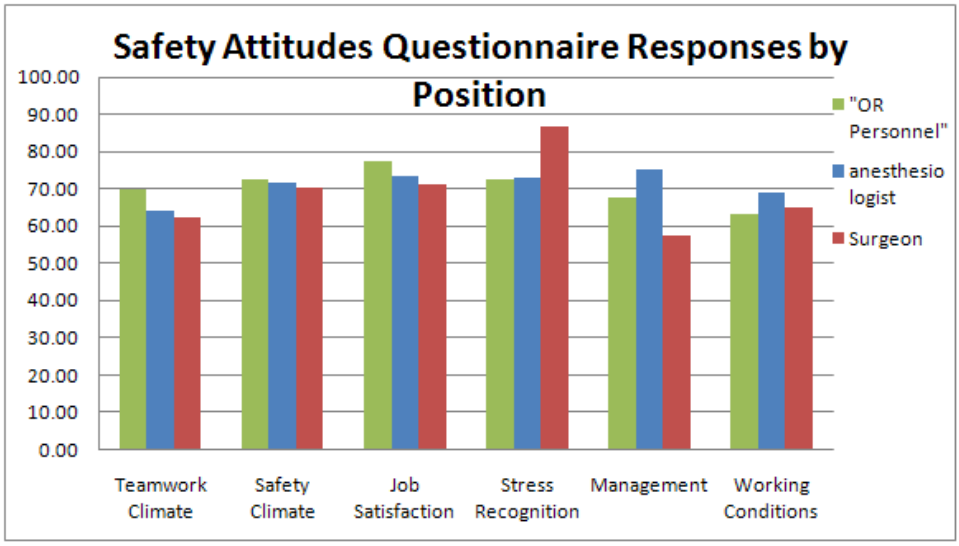


Figure-1: Summary of the Responses to the Safety Attitudes Questionnaire Before Implementation of the Safety Checklist. Shown are the responses of the Anesthesiologists, Neurosurgeons, and OR Personnel to various safety questions. Also shown is a summary chart based on percent agreement.

Overall, anesthesiologists were in 71% agreement with the general safety climate of the surgery team, surgeons were in 69% agreement, and OR nurses and scrub technicians were in 70% agreement. When all three groups were averaged together for each response, stress recognition was the highest rated aspect of safety attitude for all members of the

neurosurgical team. Surgeons especially rated stress recognition their highest concern. This indicates that all members of the team are aware of the stress associated with complex neurosurgery procedures and the need to manage it to function as a team. Another highly rated aspect of the safety attitude of the team was Safety Climate at 71%. The group acknowledges that safety is a priority, and that measures should be taken to ensure the safety of the patient. Anesthesiologists reported the highest openness to managing safety, with a 75% agreement with the statements about the OR management, as opposed to the surgeons who were only in 58% agreement. All members of the team rated "Working conditions" the lowest. This indicates a perceived problem with employee training or the medical equipment in the ORs.

SAQ Post Implementation of NCIS Comparison to Pre-implementation

Few significant differences occurred between responses pre-implementation of the NCIS checklist versus after implementation (**Figure 2**). One important difference found is that teamwork climate was rated higher by both anesthesiologists and neurosurgeons after implementation of the NCIS checklist (although not by OR personnel). Surprisingly the surgeons indicated a decrease in awareness of stress recognition after the NCIS survey, while anesthesiologists and OR personnel indicted an increase. Neurosurgeons and OR personnel also indicated an apparent decrease in job satisfaction. With n values as low as 3, it is difficult to get an accurate representation of the safety climate because individual responses can vary greatly. Although the questions are very specific, they are also based on individual perception. It would be interesting to investigate whether responses are different between gender, or whether there is an alteration of the responses if the

questionnaire is taken at different times during the day, or how long the employee has been working in the operating room, because there is a chance that these factors have an effect on the responses.

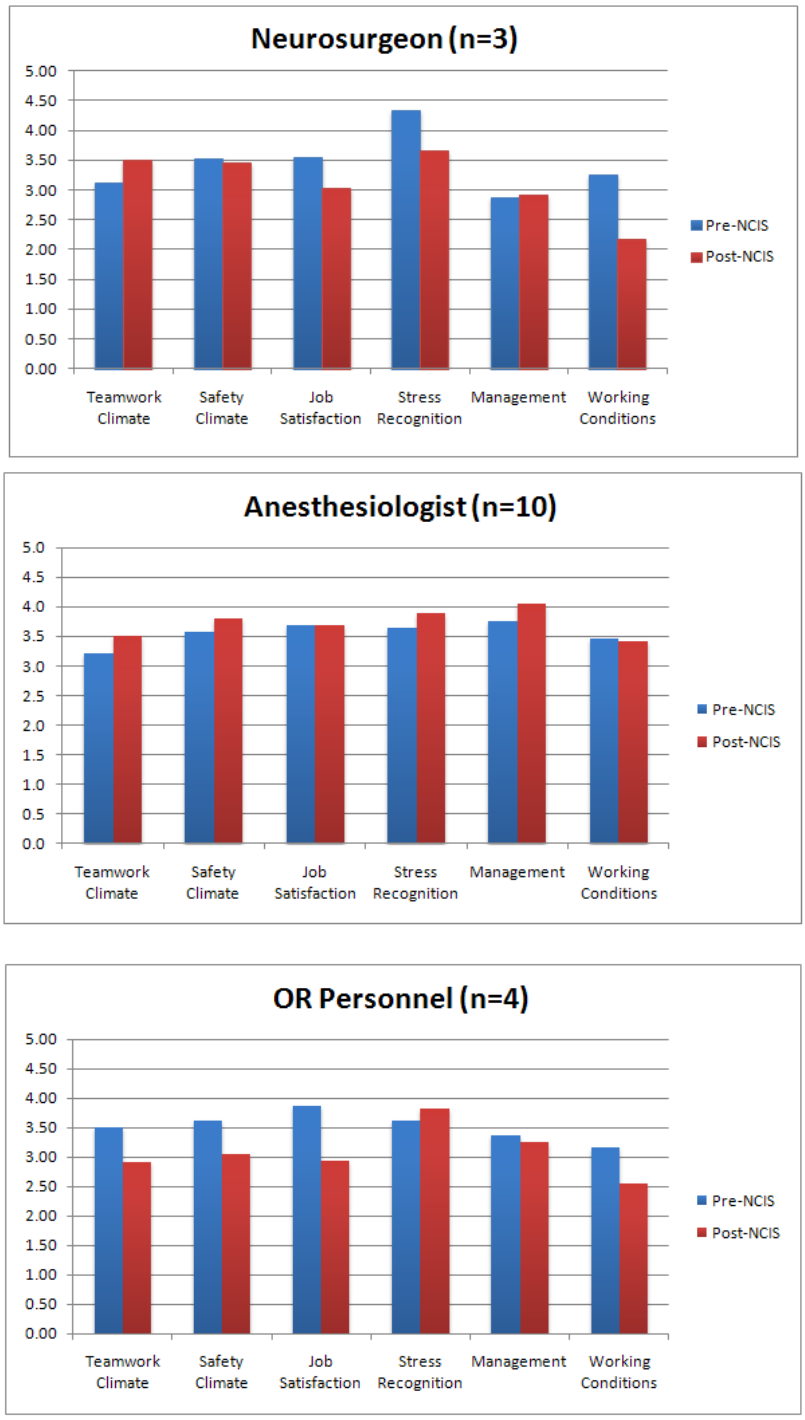


Figure 2: Comparison of SAQ Results Before and After NCIS Administration. Shown are the average responses for neuro-surgeons, anesthesiologists and OR personnel to the Safety Attitudes Questionnaire, pre-NCIS (blue), and post-NCIS (red).

NCIS Data

The Neurosurgery Communication Initiative Study (NCIS) checklist data was collected over a period of two months (October and November, 2010). Many of the cases used in the data collection were the "first starts" (the first surgery of the day), however, the average turnover time was found to be 56 minutes, compared to data collected in September where the mean was 50 minutes (p-value .091) as seen in **Table 1.** Turnover times include necessary cleanup and set-up of operating room. The problem that has been identified as causing delays is that operations are being scheduled only 30 minutes apart as opposed to the average of 56 minutes necessary for clean up and set up. One potential solution derived from this finding would be to include these times as part of the total time estimate when scheduling operations for the day. The efficiency of the OR clean-up and set-up for new cases is also being assessed and improved upon separately.

Table 1: Patient Turnover Times.

	October/November	September
Mean	56	50
Median	51	45
Std. Dev.	23.3	18.4
T test comparison	0.091	

A summary of the time values collected from the NCIS checklist can be seen in **Table 2** below. The difference between time boarded and OR entry was relatively low with the average being 15 minutes, and the maximum delay was 185 minutes. There was an average of 62 minutes between anesthesia administration and incision, with a maximum of 144 minutes. The average time between the end of surgery and patient exit from the OR was found to be 17 minutes, with a maximum delay of 67 minutes. The large ranges in

"surgery time" and "total time in OR" likely result from the fact that the types of neurosurgical cases differ greatly, and consequently the time necessary for certain procedures will be much longer than others. The negative values in the range seen for "difference between time boarded for and OR entry" are due to cancelled appointments that allow other scheduled operations to begin earlier. Frequency plots for this data can be seen in Appendix F.

Table 2: Summary of the NCIS Checklist Data

	Difference between time boarded and time of entry	Time between anesthesia administration and incision	Surgery Time	Close to OR exit	Total time in OR
Mean	15	62	153	17	239
Median	1	54	136	14	222
Range	-57- 185	21- 144	8- 405	0-67	42-569

These time differences were compared to the data obtained from the earlier January SSQI (**Table 3**) to provide a pre- and post-NCIS comparison. The average time difference between OR entry to incision post-implementation was 59.6 minutes, compared to 47.8 pre-implementation (p=0.054). The average time difference between incision to wound closing was 118 post-implementation, and 154 pre-implementation, although the difference appears to not be significant (p=0.829). The average time between surgical closing and OR exit was slightly lower post-implementation than in January but not statistically significant (p=. 884). Very similar results were found when comparing only the spine cases before and after implementation of NCIS.

Table 3: Comparison of Pre to Post-Implementation Data

	OR Entry to Incision	Incision to Close	Close to OR Exit	Total OR Time
Total data				
January (n=26)	47.8 (15)	118.3 (33)	19.3 (11)	185.5 (44)
Oct/Nov (n=56)	59.9 (26)	154.5 (107)	17.4 (13)	237.4 (134)
P-value	0.054	0.829	0.884	0.435
Spine cases				
January (n=26)	48 (14.7)	118 (33)	19 (11)	185 (44)
Oct/Nov (n=26)	60 (16)	171 (66)	18 (13)	251 (79)
P-value	0.005	0.005	0.830	0.004

The biggest obstacle faced during this project was compliance with the checklist. A neuroanesthesia team of providers, which did not previously exist, was created to further improve communication between providers. This team was assigned to 76% of the cases. When this subset of cases was analyzed (**Table 4**), the presence of a designated core neuroanesthesia provider correlated with significantly shorter surgical times and total OR times (p=0.017, p=0.05 respectively).

A question on the NCIS post-operative survey asked how well the checklist was used for that case on a scale of 1-10 (1 not at all, 10 completely) (**Table 4**). Only twenty out of the fifty-five cases indicated that compliance with the checklist was rated at 7 or higher. A frequent response in the comments section was that the checklist was not used by SACU nurses prior to patient entry to OR. In cases where there was surgeon compliance to the checklist and a neuroanesthesia provider was present, surgical time and total OR time were most significantly reduced (p=0.004, p=0.02 respectively).

Table 4: Checklist Compliance

	OR entry to Incision	Incision to close	Close to OR exit	Total OR Time
Checklist compliance				
≤ 7 (n=35)	61 (25)	169 (107)	18 (11)	256 (127)
> 7 (n=20)	59 (27)	134 (96)	16 (14)	213 (130)
p-value	0.73	0.24	0.58	0.25
Surgeon compliance				
Yes (n=29)	59 (27)	116 (90)	16 (13)	203 (130)
No (n=26)	61 (26)	194 (110)	19 (12)	274 (129)
p-value	0.85	0.006	0.52	0.047
Designated core neuroanesthesia provider				
Yes (n=42)	57 (21)	135 (93)	16 (11)	264 (130)
No (n=13)	68 (37)	212 (126)	23 (15)	298 (149)
p-value	0.17	0.017	0.07	0.05
Surgeon compliance and neuroanesthesia				
Yes (n=21)	55 (21)	110 (83)	16 (13)	193 (121)
No (n=34)	65 (30)	191 (112)	19 (13)	276 (133)
p-value	0.15	0.004	0.33	0.02

DISCUSSION

The results of this study indicate that proper use of a checklist can improve operating room performance, but the data also brings us to the question of how to ensure that all providers involved actually use the checklist properly. One main issue found in this project was that providers were unsure who was supposed to be in charge of filling out the checklist. A second implementation meeting was set up with providers to define role clarity, and to address issues of compliance. Based on feedback from these meetings it was determined that motivation was a factor affecting checklist compliance. The creation of a neuroanesthesia team was very helpful in keeping anesthesia providers motivated. However, we failed to maintain motivation with the neurosurgeons and SACU RNs. This was a problem because these two groups were responsible for initiating the checklist, and when they did not, as was observed in many of the cases, the checklist was not used. One possible solution for maintaining motivation is to establish follow up meetings to get feedback from the providers. These meetings would help remind the providers of the purpose of the project and the potential benefits, encourage participation, and also show that there is administrative support for the project. The meetings could also be used to reveal preliminary data that shows that compliance to the checklist is helping in most cases. Team-building strategies could also be employed to help maintain motivation. A simulation setting will allow for roles and expectations to be defined and feedback from all participants in a supportive environment (Aggarwal et al., 2010).

In summary, this study measured the effectiveness of a modified WHO checklist and a neuroanesthesia team on OR efficiency. It provided objective prospective evidence that the presence of a neuroanesthesia provider and improved communication through a checklist can lead to significant improvements in outcome metrics, especially when the checklist is actually followed. The next stage of this work is to evaluate strategies to improve compliance with its use.

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APPENDIX

A: WHO Surgical Safety Checklist

Surgical Safety Checklist

World Health Organization | Patient Safety
A World Alliance for Safer Health Care

Before induction of anaesthesia → **Before skin incision** → **Before patient leaves operating room**

(with at least nurse and anaesthetist)

Has the patient confirmed his/her identity, site, procedure, and consent?
- ☐ Yes

Is the site marked?
- ☐ Yes
- ☐ Not applicable

Is the anaesthesia machine and medication check complete?
- ☐ Yes

Is the pulse oximeter on the patient and functioning?
- ☐ Yes

Does the patient have a:

Known allergy?
- ☐ No
- ☐ Yes

Difficult airway or aspiration risk?
- ☐ No
- ☐ Yes, and equipment/assistance available

Risk of >500ml blood loss (7ml/kg in children)?
- ☐ No
- ☐ Yes, and two IVs/central access and fluids planned

(with nurse, anaesthetist and surgeon)

- ☐ **Confirm all team members have introduced themselves by name and role.**
- ☐ **Confirm the patient's name, procedure, and where the incision will be made.**

Has antibiotic prophylaxis been given within the last 60 minutes?
- ☐ Yes
- ☐ Not applicable

Anticipated Critical Events

To Surgeon:
- ☐ What are the critical or non-routine steps?
- ☐ How long will the case take?
- ☐ What is the anticipated blood loss?

To Anaesthetist:
- ☐ Are there any patient-specific concerns?

To Nursing Team:
- ☐ Has sterility (including indicator results) been confirmed?
- ☐ Are there equipment issues or any concerns?

Is essential imaging displayed?
- ☐ Yes
- ☐ Not applicable

(with nurse, anaesthetist and surgeon)

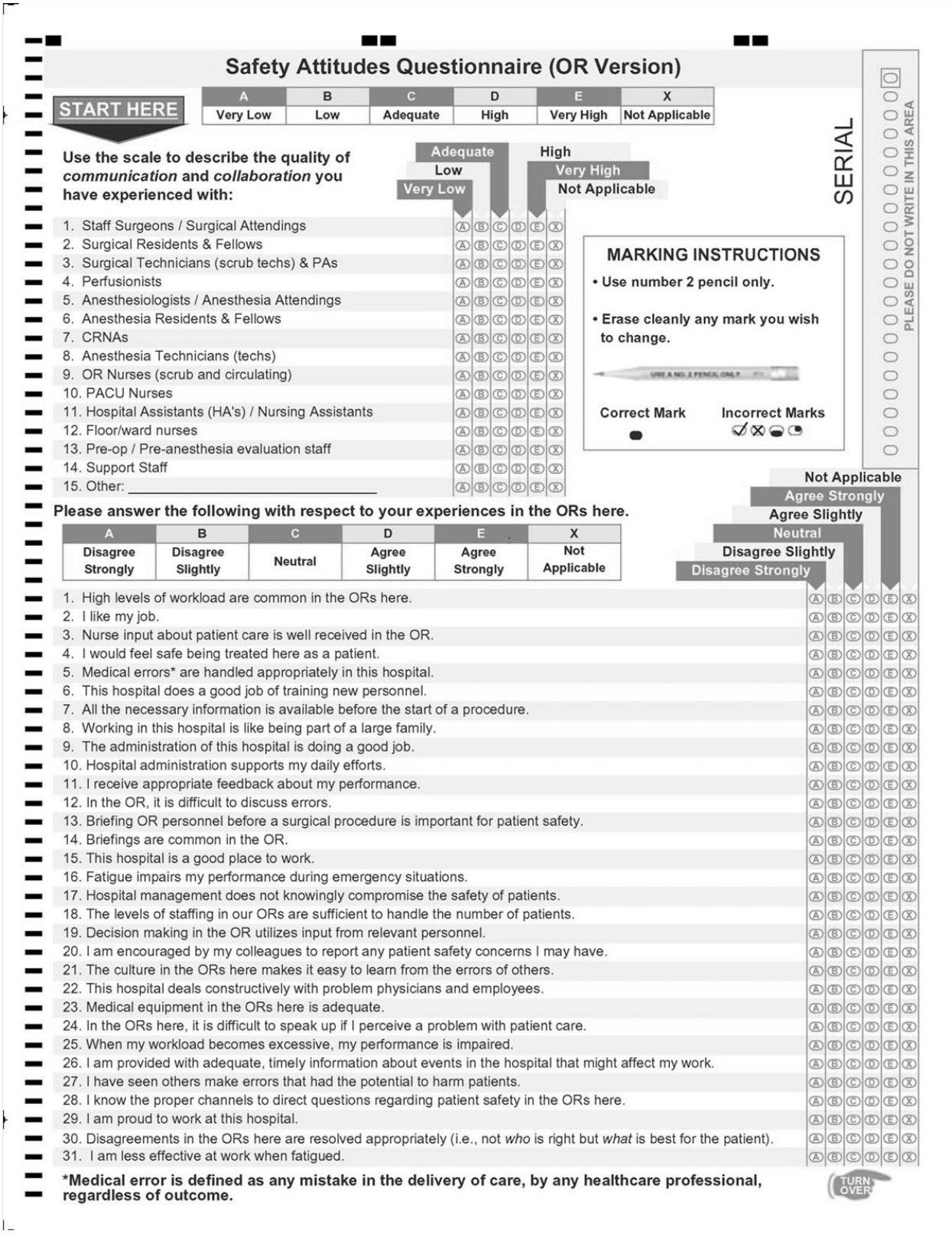
Nurse Verbally Confirms:
- ☐ The name of the procedure
- ☐ Completion of instrument, sponge and needle counts
- ☐ Specimen labelling (read specimen labels aloud, including patient name)
- ☐ Whether there are any equipment problems to be addressed

To Surgeon, Anaesthetist and Nurse:
- ☐ What are the key concerns for recovery and management of this patient?

This checklist is not intended to be comprehensive. Additions and modifications to fit local practice are encouraged.

Revised 1 / 2009

B: Safety Attitudes Questionnaire- OR Version



Safety Attitudes Questionnaire (OR Version)

START HERE

A	B	C	D	E	X
Very Low	Low	Adequate	High	Very High	Not Applicable

Use the scale to describe the quality of *communication* and *collaboration* you have experienced with:

1. Staff Surgeons / Surgical Attendings
2. Surgical Residents & Fellows
3. Surgical Technicians (scrub techs) & PAs
4. Perfusionists
5. Anesthesiologists / Anesthesia Attendings
6. Anesthesia Residents & Fellows
7. CRNAs
8. Anesthesia Technicians (techs)
9. OR Nurses (scrub and circulating)
10. PACU Nurses
11. Hospital Assistants (HA's) / Nursing Assistants
12. Floor/ward nurses
13. Pre-op / Pre-anesthesia evaluation staff
14. Support Staff
15. Other: _____

MARKING INSTRUCTIONS

- Use number 2 pencil only.
- Erase cleanly any mark you wish to change.

Correct Mark

Incorrect Marks

SERIAL

PLEASE DO NOT WRITE IN THIS AREA

Please answer the following with respect to your experiences in the ORs here.

A	B	C	D	E	X
Disagree Strongly	Disagree Slightly	Neutral	Agree Slightly	Agree Strongly	Not Applicable

1. High levels of workload are common in the ORs here.
2. I like my job.
3. Nurse input about patient care is well received in the OR.
4. I would feel safe being treated here as a patient.
5. Medical errors* are handled appropriately in this hospital.
6. This hospital does a good job of training new personnel.
7. All the necessary information is available before the start of a procedure.
8. Working in this hospital is like being part of a large family.
9. The administration of this hospital is doing a good job.
10. Hospital administration supports my daily efforts.
11. I receive appropriate feedback about my performance.
12. In the OR, it is difficult to discuss errors.
13. Briefing OR personnel before a surgical procedure is important for patient safety.
14. Briefings are common in the OR.
15. This hospital is a good place to work.
16. Fatigue impairs my performance during emergency situations.
17. Hospital management does not knowingly compromise the safety of patients.
18. The levels of staffing in our ORs are sufficient to handle the number of patients.
19. Decision making in the OR utilizes input from relevant personnel.
20. I am encouraged by my colleagues to report any patient safety concerns I may have.
21. The culture in the ORs here makes it easy to learn from the errors of others.
22. This hospital deals constructively with problem physicians and employees.
23. Medical equipment in the ORs here is adequate.
24. In the ORs here, it is difficult to speak up if I perceive a problem with patient care.
25. When my workload becomes excessive, my performance is impaired.
26. I am provided with adequate, timely information about events in the hospital that might affect my work.
27. I have seen others make errors that had the potential to harm patients.
28. I know the proper channels to direct questions regarding patient safety in the ORs here.
29. I am proud to work at this hospital.
30. Disagreements in the ORs here are resolved appropriately (i.e., not *who* is right but *what* is best for the patient).
31. I am less effective at work when fatigued.

***Medical error is defined as any mistake in the delivery of care, by any healthcare professional, regardless of outcome.**

TURN OVER

Please answer by marking the response of your choice to the right of each item, using the letter from the scale below.

A	B	C	D	E	X
Disagree Strongly	Disagree Slightly	Neutral	Agree Slightly	Agree Strongly	Not Applicable

	A Disagree Strongly	B Disagree Slightly	C Neutral	D Agree Slightly	E Agree Strongly	X Not Applicable
32. I am more likely to make errors in tense or hostile situations.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓧ
33. Stress from personal problems adversely affects my performance.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓧ
34. I have the support I need from other personnel to care for patients.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓧ
35. It is easy for personnel in the ORs here to ask questions when there is something that they do not understand.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓧ
36. Disruptions in the continuity of care (e.g., shift changes, patient transfers) can be detrimental to patient safety.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓧ
37. During emergencies, I can predict what other personnel are going to do next.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓧ
38. The physicians and nurses here work together as a well-coordinated team.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓧ
39. I am frequently unable to express disagreement with staff / attending physicians.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓧ
40. Truly professional personnel can leave personal problems behind when working.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓧ
41. Morale is high in the ORs here.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓧ
42. Trainees in my discipline are adequately supervised.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓧ
43. I know the first and last names of all the personnel I worked with during my last shift.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓧ
44. I have made errors that had the potential to harm patients.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓧ
45. Staff / Attending physicians in the ORs here are doing a good job.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓧ
46. All the personnel in the ORs here take responsibility for patient safety.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓧ
47. I feel fatigued when I get up in the morning and have to face another day on the job.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓧ
48. Patient safety is constantly reinforced as the priority in the ORs here.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓧ
49. I feel burned out from my work.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓧ
50. Important issues are well communicated at shift changes.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓧ
51. There is widespread adherence to clinical guidelines and evidence-based criteria regarding patient safety here.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓧ
52. I feel frustrated by my job.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓧ
53. I feel I am working too hard on my job.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓧ
54. Information obtained through incident reports is used to make patient care safer in the ORs here.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓧ
55. During emergency situations (e.g., emergency resuscitations), my performance is not affected by working with inexperienced or less capable personnel.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓧ
56. Personnel frequently disregard rules or guidelines (e.g., handwashing, treatment protocols/clinical pathways, sterile field, etc.) that are established for the OR.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓧ
57. The staff surgeon / attending surgeon should be formally in charge of the OR staff during the surgical procedure.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓧ
58. Communication breakdowns which lead to delays in starting surgical procedures are common.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓧ

59. Have you ever completed this survey before? ○ Yes ○ No ○ Don't Know

BACKGROUND INFORMATION

Position: (mark your position)

- ○ Staff Surgeon / Surgical Attending
- ○ Surgical Resident or Fellow
- ○ Surgical Technician (scrub tech) or PA
- ○ Perfusionist
- ○ Anesthesiologist / Anesthesia Attending
- ○ Anesthesia Resident or Fellow
- ○ CRNA
- ○ Anesthesia Technicians (techs)
- ○ OR Nurses (scrub and circulating)
- ○ PACU Nurses
- ○ Hospital Assistant/Nursing Assistant
- ○ Floor/ward nurses
- ○ Pre-op/Pre-anesthesia evaluation staff
- ○ Support Staff
- ○ Other:_____

Job Status

- ○ Full-time
- ○ Part-time
- ○ Agency
- ○ Contract

Ethnic Group:

- ○ Hispanic
- ○ Black (not Hispanic)
- ○ White (not Hispanic)
- ○ Asian/Pacific Islander
- ○ Multi-ethnic
- ○ Other:_____

Usual Shift

- ○ Days
- ○ Evenings
- ○ Nights
- ○ Variable Shifts

How many years of experience do you have in this specialty? YEARS

How many years have you worked at this hospital? YEARS

CURRENT AGE YEARS

(For each: 0 0, 1 1, 2 2, 3 3, 4 4, 5 5, 6 6, 7 7, 8 8, 9 9)

Gender:

- ○ Male
- ○ Female

Optional collected as part of a cross-cultural study

Citizenship (e.g., Canadian, Filipino, USA, etc.): _____

Country of birth (if different): _____

COMMENTS: What are your top three recommendations for improving patient safety in the OR?

1 _____

2 _____

3 _____

If more room for comments is needed, please provide your response on a separate sheet of paper.

Thank you for completing the questionnaire - Your time and participation are greatly appreciated

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C: SAQ Score Calculation

To calculate the 100pt scale score (e.g., teamwork climate) for an individual respondent: Reverse score all negatively worded items – see table below for list of reverse scored items.

In order to calculate the percent of respondents who are positive (i.e., percent agreement), you would look at the percent of respondents who got a scale score of 75 or higher. A score of 75 on the scale score indicates the same thing as "agree slightly" on the original 5-point Likert scale (1=Disagree Strongly, 2=Disagree Slightly, 3=Neutral, 4=Agree Slightly, 5=Agree Strongly).

Q #	***Teamwork Climate***	***Reverse score?***
35	It is easy for personnel in the ORs here to ask questions when there is something that they do not understand.	**No**
34	I have the support I need from other personnel to care for patients.	**No**
3	Nurse input about patient care is well received in the OR.	**No**
24	In the ORs here, it is difficult to speak up if I perceive a problem with patient care.	**Yes**
30	Disagreements in this OR are resolved appropriately (i.e., not *who* is right, but *what* is best for the patient)	**No**
38	The physicians and nurses here work together as a well-coordinated team.	**No**
19	Decision-making in the OR utilizes input from relevant personnel.	**No**
37	During emergencies, I can predict what other personnel are going to do next.	**No**
39	I am frequently unable to express disagreement with staff/attending physicians	**Yes**
43	I know the first and last names of all the personnel I worked with during my last shift	**No**
55	During emergency situations (e.g. emergency resuscitations), my performance is not affected by working with inexperienced or less capable personnel	**No**
58	The staff surgeon/attending surgeon should be formally in charge of the OR staff during the surgical procedure	**Yes**
	Safety Climate	
21	The culture in the ORs here makes it easy to learn from the errors of others.	**No**
5	Medical errors are handled appropriately in this OR	**No**

28	I know the proper channels to direct questions regarding patient safety in this ICU.	**No**
20	I am encouraged by my colleagues to report any patient safety concerns I may have	**No**
11	I receive appropriate feedback about my performance.	**No**
4	I would feel safe being treated here as a patient.	**No**
12	In the OR, it is difficult to discuss errors.	**Yes**
7	All the necessary information is available before the start of a procedure.	**No**
13	Briefing OR personnel before a surgical procedure is important for patient safety.	**No**
27	I have seen others make errors that had the potential to harm patients.	**Yes**
36	Disruptions in the continuity of care (e.g. shift changes, patient transfers) can be detrimental to patient safety.	**No**
14?	Briefings are common in the OR	**No**
44	I have made errors that had the potential to harm patients.	**Yes**
46	All the personnel in the ORs here take responsibility for patient safety.	**No**
48	Patient safety is constantly reinforced as the priority in the ORs here.	**No**
51	There is widespread adherence to clinical guidelines and evidence based criteria regarding patient safety here	**No**
56	Personnel frequently disregard rules or guidelines (e.g. hand washing, treatment protocols/clinical pathways, sterile field, etc.) that are established for the OR.	**Yes**
	Job Satisfaction	
5	This hospital is a good place to work.	**No**
29	I am proud to work at this hospital.	**No**
8	Working in this hospital is like being part of a large family.	**No**
41	Morale is high in the ORs here	**No**
2	I like my job.	**No**
45	Staff/Attending physicians in the ORs here are doing a good job.	**No**
47	I feel fatigued when I get up in the morning and have to face another day on the job.	**Yes**
52	I feel frustrated by my job	**Yes**

53	I feel I am working too hard on my job	**Yes**
	Stress Recognition	
25	When my workload becomes excessive, my performance is impaired.	**No**
32	I am more likely to make errors in tense or hostile situations.	**No**
16	Fatigue impairs my performance during emergency situations.	**No**
31	I am less effective at work when fatigued.	**No**
1	High levels of workload are common in the ORs here	**No**
33	Stress from personal problems adversely affects my performance.	**No**
40	Truly professional personnel can leave personal problems behind when working.	**No**
49	I feel burned out from my work	**No**
	Perceptions of Management	
17	Hospital management does not knowingly compromise the safety of patients.	**No**
10	Hospital administration supports my daily efforts.	**No**
26	I am provided with adequate, timely information about events in the hospital that might affect my work.	**No**
18	The levels of staffing in this clinical area are sufficient to handle the number of patients	**No**
9	The administration of this hospital is doing a good job	**No**
	Working Conditions	
22	This hospital constructively deals with problem physicians and employees.	**No**
42	Trainees in my discipline are adequately supervised.	**No**
6	This hospital does a good job of training new personnel.	**No**
23	Medical equipment in the ORs here is adequate	**No**

D: Neurosurgery Communication Initiative Study- checklist

Please initial next to appropriate box

Pre-operative Area	Before Induction	Before Incision	Before patient leaves OR
To be filled out by specific provider	***(With at least nurse and anesthesia)***	***(With RN, ST, anesthesia and surgeon)***	***(With RN, ST, anesthesia and surgeon)***
SACU RN Has the patient confirmed his/her identity, site, procedure, and consent? ☐ Yes Is the site marked? ☐ Yes Labs reviewed? ☐ Yes Is vancomycin indicated (all penicillin allergic patients, MRSA patients)? ☐ Yes If indicated, will vancomycin be infusing prior to room entry? ☐ Yes ☐ No- Page surgeon **Surgeon** Special Equipment ☐ Two IVs ☐ Arterial line ☐ Fiberoptic Intubation ☐ Blood needed ☐ Specific concerns have been communicated with anesthesia **Anesthesia** ☐ Specific concerns have been communicated with surgeon	**To anesthesia:** ☐ Have antibiotics been given? **To nursing team:** ☐ Confirm which disposables and meds should be on the field. ☐ Confirm patient positioning specifics. (e.g. Jackson table, headrest) ☐ Confirm imaging needs (e.g. C-arm, x-ray) ☐ Has sterility (including indicator results been confirmed)? ☐ Are there equipment issues or any concerns?	☐ Confirm all team members have introduced themselves. ☐ Confirm where the skin incision will be made. ☐ Time out completed. ☐ Anticipated Critical Events **To surgeon:** ☐ What are the critical or non-routine steps?	**Nurse verbally confirms:** ☐ Name of the procedure from surgeon ☐ Completion of counts ☐ Class of the procedure ☐ Correct specimen labeling ☐ Any equipment problems to be addressed **To surgeon, anesthesia, RN** ☐ What are the key concerns for post operative period? ☐ Any pertinent positives in the handoff?

E: NCIS Post-Operative Survey

NCIS I PLACE PATIENT STICKER HERE |

Anesthesiologist _____ I I

Circulator filling out form _____

Scrub tech _____ I I

Procedure Please check one from each column below:

craniotomy for _____ cervical anterior one level

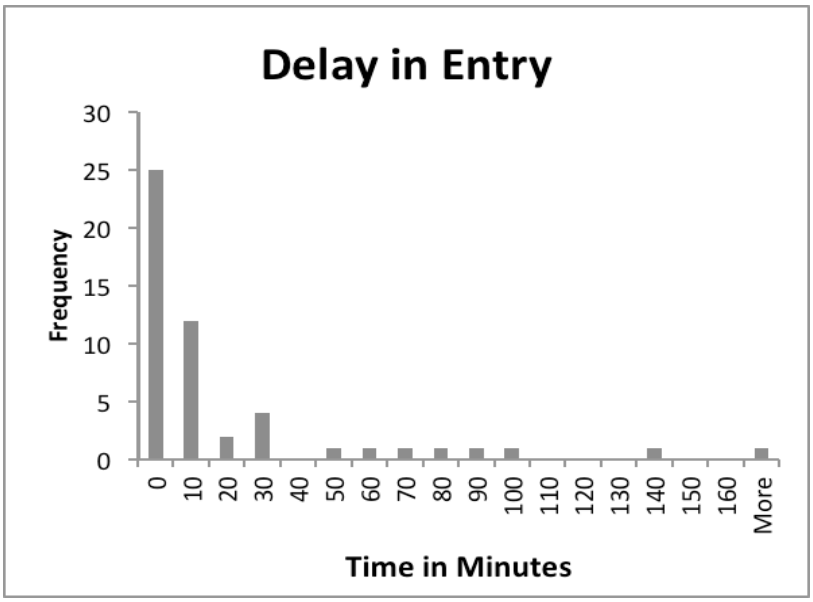
burr hole for _____ thoracic posterior multilevel

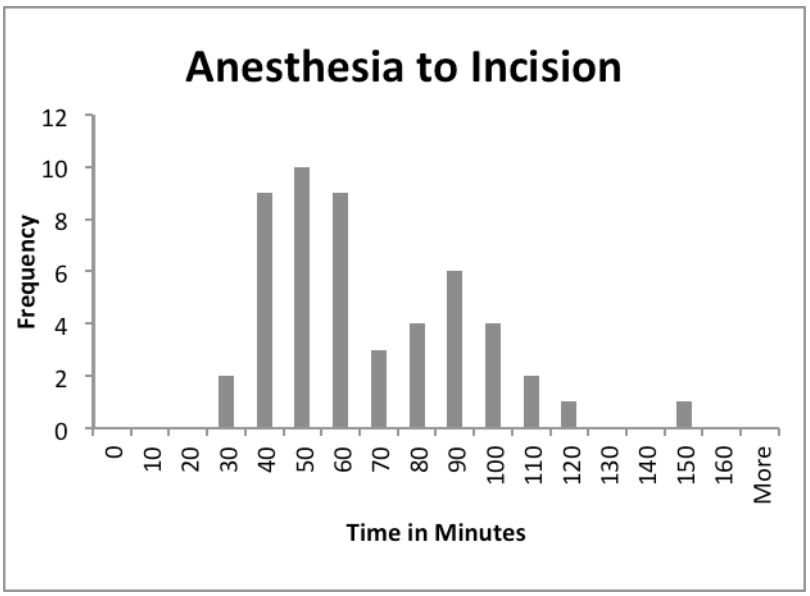
other_____ _____ lumbar with instrumentation with instrumentation

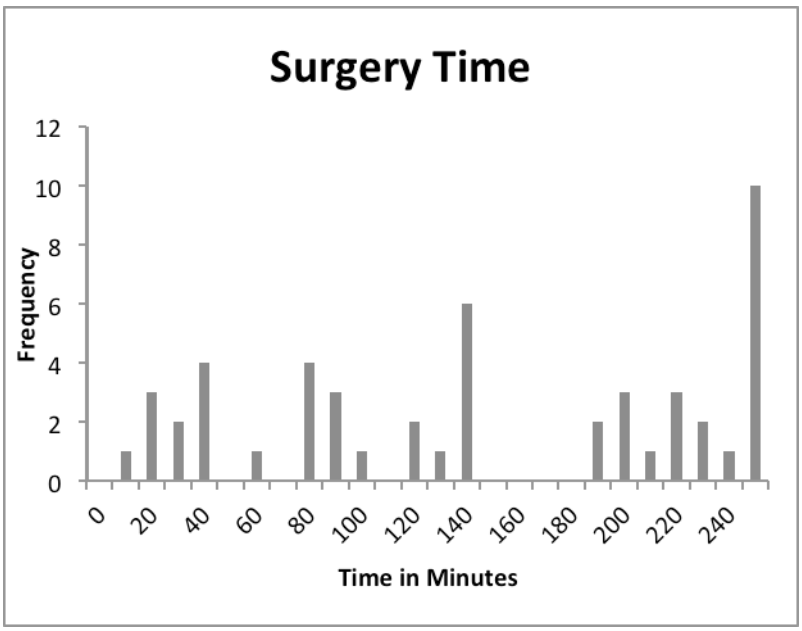
Time boarded for _____ OR entry _____ anesthesia start_____
Incision _____ surgery complete _____ OR exit _____

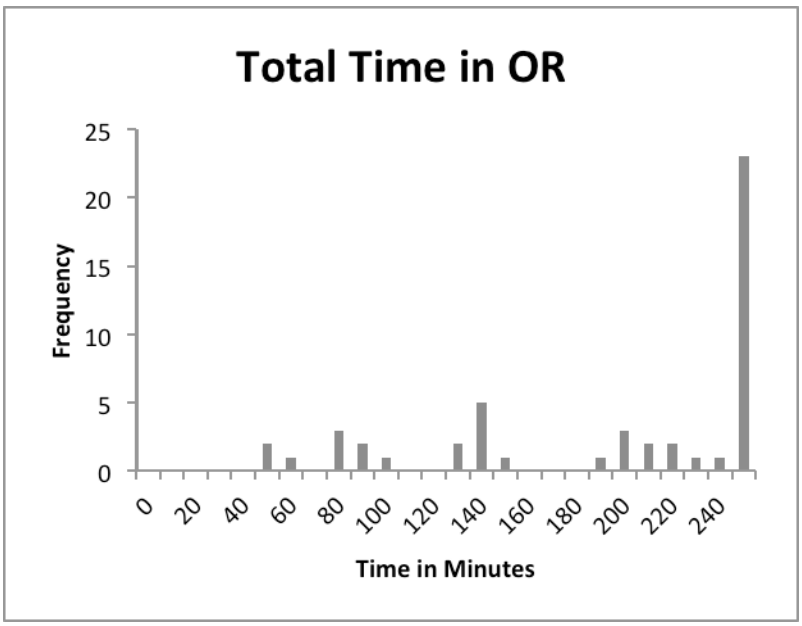
1. Was the case boarded so that all necessary representatives/equipment/supplies were available?
   Y N If no, please explain
   _____
2. Were there any preventable delays in getting the patient into the room on time, including turnover time? Y N
   If turnover was an issue, what was the exact time from previous patient out to this patient in
   _____
3. Were there any preventable delays between the patient entering the room and incision?
   Y N If yes, please explain
   _____
4. Were there any preventable delays that occurred during the case? Y N
   If yes, please explain
   _____
5. Were there any preventable delays that occurred after closure that prevented timely transport to recovery room? Y N If yes, please explain
   _____
6. Were all instruments/equipment present, sterile,and functional? Y N
   If no, please explain
   _____
7. Was radiological support/equipment adequate? Y N If no, please explain
   _____
8. On a scale of 1-10 (one worst and ten the best), how well did people use the checklist?
   1 2 3 4 5 6 7 8 9 10

F: NCIS Results – Frequency plots






Surgery Time
Frequency
12
10
8
6
4
2
0
0
20
40
60
80
100
120
140
160
180
200
220
240
Time in Minutes


Total Time in OR
Frequency
25
20
15
10
5
0
0
20
40
60
80
100
120
140
160
180
200
220
240
Time in Minutes