Standardized Electronic Handoff Adherence and Its Effects on Post-Operative Patients

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Author's Note

A potential conflict of interest includes the author currently being employed at the project site. Correspondence to this paper should be sent to Email: Ecampbell@umaryland.edu

Abstract

Problem & Purpose Patients in the post-anesthesia care unit (PACU) of a midsize community hospital experienced average wait times of 80 minutes and median times of 35 minutes post-anesthesia discharge due to suboptimal handoff and communication to the inpatient telemetry unit, as illustrated by chart audit performed during the month before project implementation. Lack of communication contributed to fourteen reported adverse patient events on the telemetry unit over six months in 2023. The literature base supports the implementation of standardized electronic handoff (SEH) to improve throughput, communication, patient safety, and decrease medication errors. This quality improvement) project aims to measure adherence to the implementation of SEH for patients from PACU to the telemetry unit and the effects on communication and throughput. ***Methods*** PACU staff entered SEH using a dot phrase in the patient's chart under the notes section. The telemetry nurse read the SEH and called for any additional report questions prior to patient transfer to the floor. After the patient transferred, the receiving telemetry nurse completed a communication satisfaction survey using QR codes available on the unit. The project lead performed chart audits to determine throughput times and evaluated completed surveys for nurse perception of handoff. ***Results*** Average transfer times dropped from 80 to 51 minutes; however, median times went from 35 to 43 minutes but remained under the goal of 60 minutes or less. At 11% compliance, nurses agreeing to positive questions about handoff increased from 78% to 81% and disagreeing to negative questions improved from 57% to 82%. ***Conclusion*** Practice recommendations include the implementation of SEH. Findings suggest adherence to SEH use, correlates to improved transfer times from PACU to the telemetry unit and improved communication perception with handoff.

Keywords: Electronic, Handoff, Communication, Perception, Adherence, Throughput, Time

Standardized Electronic Handoff Adherence and Its Effects on Post-Operative Patients

An essential part of patient care involves handoff communication to maintain patient safety and the continuum of care. Still, when the handoff process is "inadequate, incomplete, not timely, or misinterpreted" (TJC, 2017) and this can lead to an increase in adverse patient safety events. In 2016, 30% of malpractice claims in the United States were related to handoff communication failures, causing 1.7 billion dollars of malpractice and about 1700 deaths over five years (TJC, 2017). Prior to implementation, a review of hospital staff-submitted patient safety reports conveyed lack of communication contributed to fourteen reported adverse patient events on the medsurg/telemetry unit over six months in 2023. Safety reports consisted of medication errors, physician-to-nurse communication errors about line placement and discontinuation, patient needs for isolation, delay in communication errors, communication errors regarding labs and treatment and communication errors during handoff when receiving a patient transfer from another unit. Patients in the post-anesthesia care unit (PACU) of a midsize community hospital are experiencing average wait times of 80 minutes and median times of 35 minutes post-anesthesia discharge (Table 7) due to suboptimal handoff and communication to the inpatient medsurg/telemetry unit, as measured over the month before implementation.

The evidence based illustrates decreased post-anesthesia discharge wait times for PACU patients prevent delays in the operating room (OR), decrease facility costs, and reduce poor patient outcomes (Sexton et al, 2022). The prior handoff process at the project site was to use a handwritten paper handoff (Appendix A) and send it to the inpatient unit via fax or a pneumatic tube station which caused delays, misinterpretation, and incomplete handoff. The fax machine was sometimes busy, the pneumonic tube station was often offline, or the handoff was received by one nurse and misplaced before the receiving nurse could obtain the report. The QI project

included the implementation of SEH for post-operative patients going to a telemetry unit in the site hospital, to improve the process and communication, and to decrease PACU boarding time.

Available knowledge

Evidence review conveys improvements in communication also positively impact patient outcomes. According to Hou et al. (2019), the implementation of standardized electronic handoff (SEH) (Appendix B) improved communication effectiveness. According to Sexton et al. (2022), they concluded that there was improved communication and a decrease in the number and time of PACU boarders. Lastly, Pandanya et al. (2019) showed a decrease in wait times with the implementation of electronic handoff as well as a reduction in medication errors related to ineffective handoff. Overall, the evidence supports the implementation of SEH but does not recommend a specific pneumonic or handoff template to improve communication.

With the use of an electronic tool and standardizing the handoff process, the PACU staff were able to move patients quickly, preventing throughput delays in the operating room and decreasing throughput times from 97 minutes to less than 60 minutes post-implementation (Sermersheim et al, 2020). Potts et al. (2018) found that electronic situation, background assessment, and recommendation (eSBAR) formatted handoff decreased emergency department (ED) crowding/boarding, increased communication between units, and could be implemented in other areas successfully, which Benton et al. (2020) agreed with. Benton (2020), Blazin et al. (2020), and Stramer et al. (2017) utilized the IPASS handoff (Illness severity, patient summary, action list, situation awareness & contingency planning, and synthesis by receiver), and all found improved communication and a decrease in errors with minimal workflow disruption due to the implementation of standardized handoff. Lastly, Research by Holly & Poletick (2013) also conveyed other factors impacted handoff which were not accounted for in the QI project

included the culture of units, social norms, and education. See Table 1 for additional evidence review.

Rationale

This quality improvement project appropriately utilized the Promoting Action on Research Implementation in Health Services (PARiHS) framework (Figure 2) and integrated the research, clinical experience, unit culture, and context to successfully implement SEH. Experience and data showed the root causes identified as most responsible for prolonged PACU boarding times include ineffective communication for patient handoff (lost report papers, missing data, and nurse availability). The paper handoff sheet was handwritten by the sending nurse and limitations included handwriting legibility, a broken pneumonic tube station, a broken fax machine, and most importantly was often missing key clinical information. Assessment of the unit culture and leadership conveyed staff was ready for change and improvements. The electronic medical record was a resource available to all staff nurses and was utilized to facilitate the change. When deciding on change resources and practices of other units were evaluated and considered.

Other units within the site hospital had already improved patient communication and decreased adverse patient events by implementing electronic handoffs. The established use of electronic handoff on a general surgical unit in the site hospital eliminated the receiving nurse's ability to lose the report sheet and decreased the need for excessive verbal interactions. The electronic handoff mitigated delays in transfer due to both receiving and sending nurses not being available simultaneously for verbal reports, and placed the essential data about the patient in one place for easy access. The specific aim of the QI project was to implement and evaluate the use of SEH and its effects on PACU boarding time and nursing communication perception.

Methods

Context

In the site community hospital where both the PACU and the telemetry unit nurses already used electronic handoff in different capacities, this project facilitated the implementation process with minimal impact on the existing workflow. The PACU utilized SEH to the general surgical unit for all the surgical patients and reported success with improved communication by 19/20 nurses per general surgery nurse face-to-face interviews. The telemetry unit already received SEH from the ED for transferred patients, and the ED reported improved patient throughput evidenced by the decrease in ED boarding times and hospital-disseminated information including emails, improved ED waiting room times, staff meetings, and ED unit newsletters. The QI project was based on the successful implementation of SEH from the emergency room to inpatient units and the PACU to the medical-surgical unit, already in place.

The culture of nursing in both units desired improved patient care, and safety, wisely utilized time, and facilitated continuum of care standards for handoff which supported the change in the handoff process. The project improvement initiatives were supported by management as well as staff, which was important for compliance and sustainability. The project lead, telemetry nurse champion, unit charge nurses, and managers of the PACU and telemetry floor were all available resources during implementation to promote a success. Leadership ensured the new process was followed, supported staff, and included the new process in new staff orientation.

Intervention

The intervention included creating a smart phrase template which was placed in the EMR note section to facilitate handoff. These templates auto-populated patient information from the chart to include demographic information, allergies, code status, labs, and vital signs from the flowsheets. Both labs and vital signs contained information so that data could be trended within

the handoff instead of merely one set of vitals and no labs available on the former handwritten handoff form. The template contained mandatory system drop-down selections for patient assessment information, fill-in sections for mediation given, PACU nurse name, rhythm interpretation, and oxygen needs. Lastly, the new template contained a comment section to add any additional information not entered in the template. Once the patient was discharged from anesthesia (also called Phase I time), the PACU nurse placed the SEH in the EMR and notified the receiving telemetry charge nurse, who then assigned the patient a bed and notified the telemetry staff nurse the SEH was ready for review. The telemetry staff nurse had thirty minutes to call and ask questions before the PACU nurse called the telemetry nurse to ensure the patient could be transported from PACU.

PACU staff nurses recorded times for the phase I complete and when surgical care was complete using the PACU tab in the EMR. When PACU nurses placed SEH in the EMR it was electronically time stamped and the time was audited by the project lead while analyzing results. Two weeks before formal implementation, the project lead and unit champion educated all staff nurses on the telemetry unit on how to find and read the electronic handoff, and all PACU staff nurses were educated on placing the electronic handoff in the EMR for telemetry patients. Feedback about education on the new handoff process was obtained from staff during the education period (Appendix C). Tactics employed included the utilization of the unit managers and the sponsor who transparently disseminated information about the changes to the process and start dates of changes. Early adopters identified from each unit met with the project lead and helped to facilitate change. Data collected by the project lead from the EMR and staff members was used to monitor the process and compliance. Surveys completed by staff were utilized to

assess communication perceptions about the handoff process. The IT department assisted with any technical issues and the entire process was overseen by the clinical site representative.

Measure

The primary process measure of the intervention assessed for 100% compliance with the use of SEH for patients transferring from PACU to telemetry. A secondary outcome measure of throughput time, defined as the time difference between phase I care completion (Appendix D) (discharge from anesthesia time) to surgical care completion (SCC) time (patient transfer). The goal for throughput was less than sixty minutes. To assess the qualitative impact of implementing SEH, subjective data was collected on the receiving nurse's perception of handoff and patient throughput. To determine if the outcomes were a result of the intervention, the project lead performed chart audits for SEH use compliance and searched for notes of extenuating factors which impacted patient throughput times. The telemetry nurse completed the nurse's perception survey based on the experience with SEH after receipt of the patient.

The goal was for 90% of nurses who received SEH to perceive improved communication. For this QI project, communication was defined as any form of information transfer between nurses to handover responsibility of care, including paper condition of transfer, verbal report at bedside or via telephone, and use of standardized electronic handoff. The nursing handover perspectives questionnaire (NHPQ) (Appendix E), which is 0.92 valid and 0.99 reliable (Pun et al, 2019), was used to assess communication perception. To ensure the confidentiality of data, the survey was anonymous. The survey required the transferred patient's MRN number which was coded in redcap to facilitate audit of patient transfer times and SEH use. All chart audits and data entry were conducted by the project lead for consistency and reliability of the collection data process. The project lead performed random check-ins with telemetry and PACU nurses on

both day and night shifts and checked patient notes to monitor contextual elements such as staffing, late discharges, transport delays, no available bed assignments, and cleaning delays.

Analysis

Quantitative data including phase I time to SCC time was analyzed to assess if there was a decrease or increase in PACU throughput. The data was adjusted for uncontrollable circumstances including but not limited bed assignment availability, transport delays, and change of shift delays. This information was analyzed and placed in run charts and utilized data collected during weekly chart audits by the project lead. The project lead also completed weekly chart audits used to assess compliance with SEH. The qualitative data from the NHPQ was analyzed pre- and post-implementation to assess for improved communication evidenced by questions 1, 2, 5,6,7,9,11,13,14,15, 16, 19, and 20 (set A) assessed for more “disagree” responses pre-implementation to more “agree” responses post-implementation (Appendix F).

Conversely, questions 3, 4, 8, 10, 12, 17, 18, 21, and 22 (set B) assessed for more agree responses pre-implementation to more disagree responses post-implementation (Appendix G). This data was analyzed using percentages and pie charts to correlate improvement vs no improvement. Variations in data were considered, and evaluated, and the factors were assessed for effects on the data. Factors with effects on the data included transport, housekeeping, or lack of PACU staff members to transport with patients, staffing shortages, staff level of experience, bed availability, and noncooperative patients.

Ethical Concentrations

Before implementation, HRPO was submitted to the University of Maryland International Review Board (IRB). See Table 6 for the site hospital’s ethical review committee members and process. A copy of the IRB report was submitted to the institution where the project was being

implemented. Associated ethical aspects included collection of protected health information. To mitigate the risk of breach of privacy, data was collected by the project lead only and entered in redcap, a HIPPA-compliant data storage system which codes patient identifiers. Any data which needed to be printed from the Redcap site was automatically deidentified before printing. Only the project lead and project faculty had access to data within Redcap. Conflicts of interest included the project lead working on one of the units involved in the project. Also, a colleague classmate was simultaneously conducting a sister project involving the same SEH from PACU, but to a different inpatient unit and with different outcome measures. The project included 100% of the nursing staff for this implementation which minimized the effects of individual staff members as well as ensured the process was the same for every patient despite the nurse thus mitigating conflicts of interest.

Results and Analytics

SEH was implemented and no modifications were made to the intervention during the project. The compliance of SEH was assessed every week, along with PACU throughput times. Communication handoff perception was assessed pre- and post-implementation. The survey consisted of 22 Likert scale questions which took about 3-to-5 minutes to complete. Of the 17 nurses who completed the education survey only 58% reported ‘yes’ to having education on SEH. This could be because nurses had not transferred a patient from PACU using SEH and did not understand the question to include any prior exposure to electronic handoff use. Knowing the telemetry floor used electronic handoff to receive patients from the ED, suspicion was that the actual percentage of pre-implementation education was higher and could also be attributed to low compliance with survey completion. During implementation, there were 39 patient transfers from PACU to the telemetry unit. During 9 out of 15 weeks there was 100% compliance with use

of SEH, but an overall 15-week compliance rate of 87.6% utilizing SEH. The percent SEH and median transfer time chart (Table 8) display weekly compliance as a run chart. There seems to be minimal if any correlation between the number of patient transfers and compliance percentage. However, it is important to consider if only two patients were transferred, not completing one of two SEH would lead to 50% compliance for the week. There are no runs, shifts, or astronomical points for this data on the run chart.

A run chart was used to assess the Phase I to Surgical Care Complete time difference (Table 8) for patients transferred from PACU to telemetry, a median time utilizing all data points was found to be 43.5-minute transfers. With all throughput data there were twelve runs, no shift, two trends, and two astronomical points. Throughput time constantly changed. After assessing the contextual factors of bed availability, PACU boarders, and patients ready for transfer at the change of shift, all the above correlated with the prolonged throughput times. Removing the five data points which contained prolonged throughput times due to the above outlined contextual factors the average throughput time of 51 minutes was achieved, which met the outcome goal of less than 60 minutes.

A total of twelve NHPQ surveys were completed. Of the twelve included six were completed pre-implementation and six were completed during implementation. In set A questions pre-implementation 78% of the responses agreed and 22% percent “disagreed” with questions 1, 2, 5,6,7,9,11,13,14,15, 16, 19, and 20. After implementation, 81% of responses “agreed” and 19 percent of responses “disagreed,” with the set A questions. Based on this data the nurses perceived improved communication because of SEH. With set B, 57 % responded “disagree” and 43% responded “agree” to questions 3, 4, 8, 10, 12, 17, 18, 21, and 22 (Figure 5). After implementation, 82% responded “disagree” and 18 percent responded “agree,” (Figure 5).

This further illustrated the utilization of SEH perceived improved handoff communication. Overall, there was a strong adherence to the use of SEH, communication was perceived as improved by the receiving nurses, and there was an overall decrease in throughput times for patients going from PACU to telemetry.

In response to low compliance with completing the NHPQ post-patient transfer, additional QR codes were placed on the computers in the telemetry unit, reminder messages were sent to the charge nurses, and reminder emails were sent to all staff nurses. Minimizing the effects of contextual elements helped ensure results were related only to the implementation of SEH. Some unexpected barriers included short staffing during transfer times, leaving less time to complete the survey, and no feasible mechanisms for the computer to remind the staff to complete the external survey, despite reminders being posted around the unit. Another barrier included not being permitted to post signs near the assignment board, which may have elicited more compliance.

While the management in PACU was very supportive of the project and pushed the initiatives, the manager on the telemetry floor was less enthusiastic. The unit champion did remind nurses to complete the survey when possible and was available on the unit to answer questions and reach out to the project lead with any clarification questions or complaints about the process. However, the unit champion often oriented new nurses or ran charge during the implementation process and had less availability to assist otherwise. The only cost for the project incurred by the site was paid education time and by the project lead for printing and laminating QR codes and posters for the unit.

Discussion

Conversations with staff, reading of patient safety events reported by staff, assessment of patient/family wait times for post-operative patients to the telemetry room, helped identify the problem of suboptimal communication and delayed throughput. After the problems were identified, the PARiHS framework was utilized to find a solution. Evidence from research, staff nurse experiences, and hospital reports was gathered to facilitate the plan of utilizing SEH to fix the problem. During planning, leadership was engaged, staff gave input, and unit culture and change readiness was assessed. The above endeavors cultivated the context for a successful QI project, and created evaluation measures of process and outcome goals which could be evaluated to determine key findings.

Key findings for this quality improvement project include the usefulness, completeness, and convenience of utilizing SEH. Since the SEH is placed in the electronic medical record, it is more cost-efficient than the prior process of sending a handwritten form as it decreases the cost of paper and ink. The SEH reduces any potential patient harm events related to lost paper report sheets because the SEH is always available in the chart. This quality improvement project is sustainable with continued PACU leadership support and encouragement and will have no additional financial cost to the institution. The current sustainability and growth plan is for the PACU to continue utilizing the SEH for the telemetry unit followed by expansion to other units until all patient transfers from the PACU to inpatient units utilize SEH, except for intensive care unit (ICU). Conversations with the PACU manager after quality improvement dissemination reiterated support and desire to continue and expand SEH. The PACU manager has placed a ticket with the help desk to ensure medications administered in the PACU will auto-populate to the handoff from the MAR without the nurse having to free type. As such, an even more

comprehensive version of SEH including medications administered (drug, dose, route, and time) will decrease misinformation.

Findings from this quality improvement project were consistent with the research and expected outcomes related to SEH use, improved communication, and decreased throughput times, which supports the use of SEH for patient transfer of care. There were no differences between the observed and anticipated outcomes of this quality improvement project. Factors which could have impacted internal validity include the small sample size, limited compliance rates, and the project lead's interpretation of contextual factors. The bias and interpretation were minimized by careful reading of patient notes to evaluate contextual factors, and limiting data collection to one project lead. Limitations to this project include the emergency department (ED) process of utilizing an electronic handoff varying from that of the PACU. The ED process is to place report in the chart, wait 30 minutes, and send the patient with or without a call from the receiving nurse. This is a potential reason for the decreased number of callbacks from the telemetry floor nurses to accept the PACU patients. Other limitations to this project include no accountability for staff nurses who did not call to accept patients, nurses who did not complete the surveys after receiving patients, and lastly, PACU nurses who did not utilize the SEH for handoff.

Conclusion

Based on this quality improvement initiative, the verbal handoff process can be improved for all healthcare workers utilizing SEH. Completeness of handoff has a positive effect on medical errors. The strengths of this project include a lack of financial cost to institutions, ease of transition, and the lack of need for additional equipment/ tools to implement and sustain this project. This project has a high likelihood of sustainability and further spread of implementation

to other units in the site hospital. Further studies should be done to determine generalizability to other clinical areas and the full effects of using SEH on medical errors, throughput time, handoff completeness, and healthcare costs.

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Table 1

Evidence Review Table

Citation #1 Sexton, P., Whiteman, K., George, E. L., Fanning, M., & Stephens, K. (2022). Improving PACU Throughput Using an Electronic Dashboard: A Quality Improvement Initiative. *Journal of PeriAnesthesia Nursing*, *37*(5), 613–619. https://doi.org/10.1016/j.jopan.2021.11.005 Level: 5

Purpose or Hypothesis	Type of Evidence and Research Design	Sample (population, size, setting)	Intervention Procedures	Primary Outcome/Measures	Results Conclusions
The purpose of this initiative was to improve PACU throughput by developing an efficient and evidence-based handoff communication process between the PACU and the medical-surgical floors.	Quality Improvement	Patients boarding in a 14-bed post anesthesia care unit (PACU) impacted throughput in a large university hospital in West Virginia. The PACU and operating room (OR) boarder rate in 2019 was 12% (n = 1241) and 5% (n = 503), respectively.	An interprofessional team created a nursing patient dashboard in the electronic medical record to be used during handoff communication between the PACU and medical-surgical floor nurses. PACU nurses notified the floor that the patient was ready for transfer. After allowing 20 minutes for the floor nurse to view the dashboard, the PACU nurse and floor nurse spoke on the phone to discuss any outstanding questions.	Staff acceptance Amount of pacu boarders OR boarders Positive comments Time in PACU boarder status Time in OR boarder status	The electronic dashboard was a successful strategy to improve handoff communication between the PACU and receiving units. The dashboard was accepted by the staff with 70% (n = 24) of the comments being positive. A significant decrease in the number of PACU (x2(1, n = 20,608) =122.63, P < .00001) and OR boarding (x2 (1, n = 20,283) =14.55, P = .000136) of patients was found in the C-year compared to 2019. For patients who were boarded in the PACU, no significant difference in PACU delay duration was found (t (11) =1.49, P = .149) with the mean in 2019 of 166.96 (SD = 68.38) and the C-Year mean 132.84 (SD = 39.74). For patients who boarded in the OR, there was a significant difference (t (11) =15.590162, P <.00001) between groups for average duration of boarding with the mean in 2019 of 19.06 minutes (SD = 3.72) compared to 1.62 (SD = 1.1) in C-year. However, in July 2020 the PACU intermittently opened 2 flexible beds when the PACU was full, suggesting that OR boarding was not a reliable measure,

					but PACU boarding remained an accurate measure. The findings of this evidence-based quality improvement project demonstrated the usefulness of an electronic dashboard tool combined with verbal report to improve patient throughput by decreasing the number of patients boarding in the PACU.
Citation #2 Pandya, C., Clarke, T., Scarsella, E., Alongi, A., Amport, S. B., Hamel, L., & Dougherty, D. (2019). Ensuring Effective Care Transition Communication: Implementation of an Electronic Medical Record-Based Tool for Improved Cancer Treatment Handoffs Between Clinic and Infusion Nurses. *Journal of oncology practice*, *15*(5), e480–e489. https://doi.org/10.1200/JOP.18.00245 Level: 5					
Purpose or Hypothesis	**Type of Evidence and Research Design**	**Sample (population, size, setting)**	**Intervention Procedures**	**Primary Outcome/Measures**	**Results Conclusions**
Ineffective handoffs contribute to gaps in patient care and medication errors, which jeopardize patient safety and lead to poor-quality care. The project aims are to develop and implement a standardized handoff process using an electronic medical record (EMR)–based tool to ensure optimal communication of treatment- related information for patients receiving	Quality improvement before and after the intervention over a 1-year period.	Wilmot Cancer Institute (WCI) at University of Rochester Medical Center The EMR-based handoff tool was used in 9,274 of 10,910 (85%) patient treatment visits.	We implemented a formal quality improvement (QI) intervention using the well-established Plan-Do-Study-Act methodology to develop a standard and safe treatment handoff process and an EMR-based handoff tool. Using the Situation-Background-Assessment-Recommendation (SBAR) framework, which captures the four central com- ponents of handoff communication, an EMR-based handoff tool (WCI Handoff Tool) was developed to over- come these barriers.	The primary outcome was the proportion of medication errors as the result of ineffective handoffs (medication errors as the result of ineffective handoffs/total medication errors). These data were obtained from the incident reporting system, and the cause of error was determined through chart review by an oncology quality nurse manager. Secondary process outcomes were objective handoff communication measures. These included the following: (1) handoff tool utilization rate, which was whether the clinic nurse	The proportion of medication errors because of ineffective handoffs was reduced from 10 of 17 (60%) pre-intervention to 11 of 34 (32%) postintervention (P = .07). The EMR-based handoff tool was used in 9,274 of 10,910 (85%) patient treatment visits, and the handoff completion rate increased from 32% pre-intervention to 86% postintervention. Patient waiting time showed an average reduction of 2 minutes/patient/month. Most nurses reported that the new tool conveyed necessary information (85% of nurses) and was effective in preventing errors (81% of nurses). Multidisciplinary stakeholders guided the development and implementation of a standard handoff process and an EMR-based tool to optimize communication between nurses during

cancer treatment between oncology nurses.				completed the tool before the patient received treatment; (2) handoff completion rate, which was utilization rate plus whether the handoff tool was reviewed by the infusion nurse before treatment was administered; and (3) patient waiting time, which was the time from patient check-in at the in- fusion center to the time treatment was started. Last, we elicited nurse satisfaction with the tool by conducting pre-implementation and 1-month post-implementation follow-up assessment surveys.	patient transition. The intervention was associated with a reduction in the proportion of medication errors as the result of ineffective handoffs. In addition, the intervention improved communication between nurses.
Citation #3 Sermersheim, E. R., Moon, M. C., Streelman, M., McCullum-Smith, D., Fromm, J., Yohannan, S., & Powell, R. (2020). Improving Patient Throughput with an Electronic Nursing Handoff Process in an Academic Medical Center: A Rapid Improvement Event Approach. *The Journal of nursing administration*, *50*(3), 174–181. https://doi.org/10.1097/NNA.0000000000000862 Level: 5					
Purpose or Hypothesis	**Type of Evidence and Research Design**	**Sample (population, size, setting)**	**Intervention Procedures**	**Primary Outcome/Measures**	**Results Conclusions**
This process improvement (PI) project aimed to develop a consistent, reliable, and sustainable nursing handoff tool for use in moving patients from one unit to the	Quality improvement postintervention	Rush University Medical Center nursing is a 664-bed urban academic medical center located in Chicago, Illinois	A team then standardized handoff workflow; created an electronic tool, virtually eliminating verbal report; and implemented a new handoff process. use of SBAR, or situation, background, assessment and recommendation, improved	The assign-to-occupy metric identified the time from the patient placement department assigning a patient bed in the EHR system to the actual patient occupying the bed on the assigned hospital unit.	Assign-to-occupy time at 1 year after go-live averaged 55 minutes, and it has been staying less than 60 minutes since the implementation against baseline 97 minutes. Sending units, such as the ED and critical care departments, responded well as they were able to expedite patient throughput, thereby freeing up

next, for patients moving to lateral or lower levels of care (eg, emergency department [ED] to general medical floor), and decrease assign-to-occupy time, the duration from bed assignment to bed occupancy.			report by allowing nurses to give a focused and guided handoff		beds. The PACU staff were able to move patients quickly, preventing throughput delays in the operating room.
Citation #4 Starmer, A. J., Schnock, K. O., Lyons, A., Hehn, R. S., Graham, D. A., Keohane, C., & Landrigan, C. P. (2017). Effects of the I-PASS Nursing Handoff Bundle on communication quality and workflow. *BMJ quality & safety*, *26*(12), 949–957. https://doi.org/10.1136/bmjqs-2016-006224 Level: 2					
Purpose or Hypothesis	**Type of Evidence and Research Design**	**Sample (population, size, setting)**	**Intervention Procedures**	**Primary Outcome/Measures**	**Results Conclusions**
Our goal was to improve the handoff process to reduce the rate of medical errors and adverse events associated with handoff communication failure	Prospective Pre-test Posttest Quantitative	Convenience, pediatric intensive care unit in 2011–2012 Report given for 10,740 patient admissions.	**Control**: Pre-I-Pass intervention implementation **Intervention:** The I-PASS Nursing Handoff Bundle intervention consisted of educational training, verbal handoff I-PASS mnemonic implementation, and visual materials to provide reinforcement and sustainability.	**DV:** handoff communications, including illness severity assessment, patient summary, to do list and an opportunity for the receiving nurse to ask questions. **DV measurement method:** We developed handoff direct observation and time motion workflow assessment tools to measure: (1) quality of the verbal handoff, including interruption frequency and presence of key handoff data elements; and (2) duration of handoff and other workflow activities.	**Statistical Results:** I-PASS implementation was associated with improvements in verbal handoff communications, including inclusion of illness severity assessment (37% preintervention vs 67% postintervention, p=0.001), patient summary (81% vs 95%, p=0.05), to do list (35% vs 100%, p<0.001) and an opportunity for the receiving nurse to ask questions (34% vs 73%, p<0.001). Overall, 13/21 (62%) of verbal handoff data elements were more likely to be present following implementation whereas no data elements were less likely present. Implementation was associated with a decrease in interruption frequency pre versus post intervention (67% vs 40% of handoffs with interruptions, p=0.005) without a change in the median handoff duration (18.8 min vs 19.9 min, p=0.48) or

					changes in time spent in direct or indirect patient care activities. **Clinical significance**: Report can be given more efficiently and not take more time, but also decrease miscommunications which lead to patient safety events. **Conclusions:** Implementation of the I-PASS Nursing Handoff Bundle was associated with widespread improvements in the verbal handoff process without a negative impact on nursing workflow. Implementation of I-PASS for nurses may therefore have the potential to significantly reduce medical errors and improve patient safety.
Citation #5 Potts, L., Ryan, C., Diegel-Vacek, L. & Murchek, A. (2018). Improving Patient Flow from the Emergency Department Utilizing a Standardized Electronic Nursing Handoff Process. *JONA: The Journal of Nursing Administration, 48* (9), 432-436. doi: 10.1097/NNA.0000000000000645 Level: 5					
Purpose or Hypothesis	**Type of Evidence and Research Design**	**Sample (population, size, setting)**	**Intervention Procedures**	**Primary Outcome/Measures**	**Results Conclusions**
The primary focus of this process improvement initiative was to implement an eSBAR format-based nursing hand- off process nursing handoff process to decrease boarding time as measured by the (ready to move)	Quality improvement	The setting was a 495-bed urban academic medical center. The initial implementation occurred between the ED and a general medical unit.	Once the patient was ready to be transferred to their inpatient bed, the following steps took place. The charge nurses from the ED activated the RTM timer in the CMT. Patient placement staff assigned a clean bed within the CMT.	Before implementation of this initiative, the baseline RTM-to-occupied times from the ED to inpatient units were a mean of 84 minutes; the vendor-recommended target was 30 minutes or less. Two weeks after implementation, this decreased to a mean of 49 minutes, a 35-minute (41.7%) decrease. Figure 4 shows that at 10 months after implementation this decrease was sustained and	Implementing a standardized electronic handoff process can result in decreased ED crowding through a decrease in boarding time. The eSBAR tool provided a useful standardized nursing handoff method for transitioning care from the ED to inpatient units. Our primary focus was on ED boarding time. Future research could examine financial, quality, safety, and patient/staff satisfaction outcomes related to ED crowding that might be affected by this process. Improved communication and decreasing boarding times for ED admissions can

RTM-to-occupied metric in the capacity management technology (CMT).			Activation of the CMT bed assignment sent an automatic text page to the inpatient charge nurse letting him/her know that the patient would be transferred to the unit. The inpatient charge nurse notified the staff nurse assigned to the patient that the eSBAR was complete and available for viewing. The ED prepared the patient for transport to the inpatient unit. The eSBAR instrument used was the inpatient summary, part of an existing tool within the electronic medical record (EMR) designed by the EMR vendor.[13]	even improved, with an average time of 47 minutes, relative to a consistent number of ED admissions.	result in improved patient access to care and improved communication between nursing units. As a result of this process improvement initiative, we have expanded to house-wide implementation. This effective and sustainable electronic nursing handoff process can be implemented in other practice settings realize safer, more effective handoffs and care transitions.
Citation #6 Blazin, L. J., Sitthi-Amorn, J., Hoffman, J. M., & Burlison, J. D. (2020). Improving Patient Handoffs and Transitions through Adaptation and Implementation of I-PASS Across Multiple Handoff Settings. *Pediatric quality & safety*, *5*(4), e323. https://doi.org/10.1097/pq9.0000000000000323 Level: 5					
Purpose or Hypothesis	**Type of Evidence and Research Design**	**Sample (population, size, setting)**	**Intervention Procedures**	**Primary Outcome/Measures**	**Results Conclusions**
Initiation of I-PASS for inpatient nursing report, Physician handoff and imaging/procedure handoff and	Quality improvement initiative	Convenience St. Jude Children's Research Hospital (St. Jude) is an 80-bed pediatric hospital with integrated outpatient clinics	Control Protocol: pre-implementation Intervention Protocol: Evening shift to shift physician signoff, Morning and evening inpatient nursing bedside report, and nurse handoffs for	DV: perceived improved handoff quality and reduction of patient errors DV measurement method and time: Survey post implementation of I-PASS standardized handoff tool	Statistical Results: The 2018 Patient Safety Culture Survey yielded an overall response rate of 69%. 75% of percent of inpatient nurses, 80% of physicians, 94% of diagnostic imaging technologists, and 46% of procedures nurses reported that I-PASS improved or improved overall handoff quality.

evaluate errors frequency, and to evaluate clinician attitudes about effects of I-PASS on personal and overall handoff performance		offering subspecialty and surgical services for children with cancer, blood disorders, and other catastrophic diseases. St. Jude sees ≈7,500 patients in ≈3,500 inpatient admissions and ≈75,000 outpatient visits per year.	patients to diagnostic/imaging procedural areas.		Clinical significance: Further, perceived handoff error rates decreased for inpatient nurses, overall perceptions of handoff performance increased across all disciplines studied, and most respondents reported increases in personal handoff performance. Conclusions: Staff perceived improvement in patient safety/ reduction of errors with the initiation of I-PASS standardized handoff tool and improved patient safety.
Citation #7 Benton, S. E., Hueckel, R. M., Taicher, B., & Muckler, V. C. (2020). Usability Assessment of an Electronic Handoff Tool to Facilitate and Improve Postoperative Communication Between Anesthesia and Intensive Care Unit Staff. *CIN: Computers, Informatics, Nursing*, *38*(10), 500–507. https://doi.org/10.1097/CIN.0000000000000563 Level 5					
Purpose or Hypothesis	**Type of Evidence and Research Design**	**Sample (population, size, setting)**	**Intervention Procedures**	**Primary Outcome/Measures**	**Results Conclusions**
To facilitate widespread adoption of the electronic IPASS form for handoff communication from the operating room to the neuro ICU, the primary objective of this usability assessment project was to evaluate user perceptions of the handoff form prior to its implementation. Additionally, we	Quality Improvement	Personnel in the sending team (ie, certified RN anesthetists [CRNAs], anesthesiologists and anesthesia residents, and fellows) and receiving team (ie, neuro ICU nurses and nurse practitioners [NPs]) total of 38 handoffs observed.	The IPASS handoff form was adapted for postoperative use using an iterative approach over a series of four phases: (1) requirements/information gathering, (2) adaptation/development, (3) evaluation and modification, and (4) usability testing.	Ease of use Satisfactory (for information) User friendly	Results of this project show that participants viewed the postoperative IPASS handoff form to be easy to use (87.5%), satisfactory (75.0%), and user-friendly (75.0%), which can facilitate its widespread adoption. Our findings show that the key feature that makes an electronic handoff form usable and user-friendly is its customization, which allowed for certain information to auto populate or be entered by the clinician to meet the provider-specific needs.

wanted to identify key features that make the handoff form more user-friendly.					
Citation # 8 Hou, Y., Lu, L., Lee, P., & Chang, I. (2019). Positive impacts of electronic hand-off systems design on nurses' communication effectiveness. Journal of Nursing Management, 27(5), 1055–1063. https://doi-org.proxy-hs.researchport.umd.edu/10.1111/jonm.12774 Level: 2					
Purpose or Hypothesis	**Type of Evidence and Research Design**	**Sample (population, size, setting)**	**Intervention Procedures**	**Primary Outcome/Measures**	**Results Conclusions**
In accordance with motivation and goals of this study, the research model explores effects of different designs of electronic hand-off systems on increasing communication effectiveness and benefits of hand-off.	Quasi- experimental	two Taiwan case hospitals, one with ISBAR and the other with non-ISBAR design systems and 200 questionnaires were used to collect data.	Compared 2 similar hospitals with different types of electronic handoff in place. The questionnaire contained eight parts with a total of 44 questions: eight questions were used to gather basic information, and 36 questions were related to the research model.	Respondents were instructed to use a five-point Likert scale to evaluate each item, ranging from 1 (strongly disagree) to 5 (strongly agree). The questionnaires were distributed via email within each hospital. Nurses who had experience using electronic hand-off systems at the two regional hospitals were invited to participate in the study.	The respondent rate was 72%. Using system with ISBAR design, nurses can enhance their communication effectiveness and further increase their individual benefits at hand-off. Using a non-ISBAR hand-off system, communication effective- ness depends solely on the nurses' individual cognitive and expressive ability. System with ISBAR design can ensure effective information transmission among nurses for care continuity and prevention of adverse events.
Citation #9 Kim, J. H., Lee, J. L., & Kim, E. M. (2020). Patient safety culture and handoff evaluation of nurses in small and medium-sized hospitals. *International Journal of Nursing Sciences*. https://doi.org/10.1016/j.ijnss.2020.12.007 Level: 3					
Purpose or Hypothesis	**Type of Evidence and Research Design**	**Sample (population, size, setting)**	**Intervention Procedures**	**Primary Outcome/Measures**	**Results Conclusions**
- investigating the current status of handoffs, perception of patient safety culture, degrees of	Descriptive Design	425 nurses at small and medium hospitals in south Korea - Inclusion criteria included	Self-reporting questionnaires evaluating demographic data, handoff-related characteristics, perception of patient safety culture, and handoff	-Handoff methods -satisfaction with handoff -errors with handoff -Presence of handoff guide	-nurses experienced errors in handoff -Handoff differed based on multiple factors (education level, employment length of time, job satisfaction, methods used etc)

handoff evaluation, and identifying the factors that make a difference in handoff evaluation in small and medium-sized hospitals.		nurses who (a) were nurses on duty, (b) had at least six months of working experience, and (c) understood the aims of our study. Exclusion criteria included nurses who (a) were nurses in training, (b) had no experience in the handoff. We used the G-power 3.1.3 to determine the sample size.	evaluation	-method for improving handoff -Patient safety perception	-Handoff structure is needed -education about structured handoff should be implemented -40% of adverse reactions are related to ineffective handoff. -57.6% of nurses were dissatisfied with handoff. -only 11.3% reported no handoff errors -no guidelines present -nurses with Kardex or use EMR have higher evaluations of handoff -nurses with both checklist and guidelines have higher evaluations of handoff and lower error rates -moderate level of safety perception
Citation #10 Holly, C., & Poletick, E. B. (2013). A systematic review on the transfer of information during nurse transitions in care. *Journal of Clinical Nursing, 23*(17-18), 2387–2396. https://doi.org/10.1111/jocn.12365					Level: 3
Purpose or Hypothesis	**Type of Evidence and Research Design**	**Sample (population, size, setting)**	**Intervention Procedures**	**Primary Outcome/Measures**	**Results Conclusions**
-To evaluate the dynamics of knowledge handoff during transitions in acute care hospital using qualitative studies	Systematic review of qualitative data	-29 studies -800 handoffs -300 surveys	-Only qualitative studies -inter shift handoff -communication types used	-2 themes identified. -individual nurse influence patient as gatekeepers of information -embedded hierarchy related to handing over information	-outcomes vary in method used for handoff and information handed off -quality and safety are correlated to type and quality of handoff -findings support need for consistent guideline -Guidelines could stimulate recall -incongruency between verbal and written report -handoff is complex and influenced

					by culture and social norms which extend beyond quality & safety
Citation #11 Galatzan, B. J., & Carrington, J. M. (2018). Exploring the State of the Science of the Nursing Hand-off Communication. *CIN: Computers, Informatics, Nursing*, *36*(10), 484–493. https://doi.org/10.1097/cin.0000000000000461 Level: 3					
Purpose or Hypothesis	**Type of Evidence and Research Design**	**Sample (population, size, setting)**	**Intervention Procedures**	**Primary Outcome/Measures**	**Results Conclusions**
What is the current state of the science of nursing hand-offs? What does the research indicate as best practice? Where should nursing scientists focus future research on nurse-to-nurse hand-off communication?	Systematic review	30 articles	**n/a**	six themes -standardized tools. - nurses' perception of and satisfaction with the hand-off -communication and communication patterns - use of electronic tools -handoff content -cognition/memory.	-Standardized handoff must be flexible - no studies directly tie standardized handoff to improved patient outcomes -nurses are satisfied with structured and consistent handoff -nurses are not using electronic records or forms -human factors should be investigated -Standardized tool implementation is meant to improve structure/consistency, improve quality, and decrease information overload in efforts to improve communication and patient outcomes -Successful implementation must account for culture and workflow

					-perceived increase in handoff effectiveness, satisfaction, organization, and overall content are results of implementation
Citation #12 Delardes, B., McLeod, L., Chakraborty, S., & Bowles, K.-A. (2020). What is the effect of electronic clinical handovers on patient outcomes? A systematic review. *Health Informatics Journal*, *26*(4), 146045822090516. https://doi.org/10.1177/1460458220905162 Level: 3					
Purpose or Hypothesis	**Type of Evidence and Research Design**	**Sample (population, size, setting)**	**Intervention Procedures**	**Primary Outcome/Measures**	**Results Conclusions**
The aim of this systematic review was to understand how conducting patient handover electronically affects patient outcomes.	systematic review	9 Studies	-only quantitative studies -included e handoff and patient outcome data	-handover completeness -Adverse events -length of stay -time to procedures ***All using e-handoff**	-the diversity of results indicate that e-handoff may be effective in specific specialties or setting areas -handover completeness had the most consistency across articles and showed improvement in ¾ studies with e-handoff -Definitions of adverse events was not consistent between the 3 articles, 2 had no significant change with e-handoff, and 1 reported patients 3.1, 3.0, 2.8 less likely to be readmitted within 30, 60, 90 days post implementation -2 article had no significant changes, 1 decreased length of stay (LOS) from 5 to 4 days and LOS was reduced with readmissions 30, 60, 90 days who had e-handoff used -1 articles found significant reduction in time to diagnostic imaging, 1 found reduction in time to PCI and 1 had no significant findings with e-handoff
Citation #13 Aronson, T. M., Oertle, S. E., & Piscotty Jr., R. J. (2021). Key characteristics of a successful EHR-supported e-handoff tool: a systematic review. *Online Journal of Nursing Informatics*, *25*(1), 4–1. Level: 2					

Purpose or Hypothesis	**Type of Evidence and Research Design**	**Sample (population, size, setting)**	**Intervention Procedures**	**Primary Outcome/Measures**	**Results Conclusions**
The aim of this review is to understand what characteristics of successfully implemented EHR report tools contributed to their adoption and use.	Systematic review	20 articles	-3 RCT -10 Quasi-experimental -1 cohort without randomization -6 descriptive cross sectional *All aim at studying handoff and EHR tool	-user involvement is needed in design -using champions to educate and gain feedback -includes only clinically relevant information -use standardized structure -End user customizability -The visual appearance of handoff -Accessibility on multiple device types is important	-Combination of the outcome measures led to improved communication efficacy and decreased errors due to miscommunication User involvement and completeness of information were the 2 most important qualities of successful EHR handoff -decreased boarding times in ED -improved continuity of care -improved report satisfaction and time to spend with patient -Communication errors lead to major adverse events EHR handoff can be a proactive way to prevent complications and catastrophic events

Table 2

Evidence Synthesis Template

Project Title: Implementing Standardized Electronic Handoff to Improve Communication and Decrease Time in PACU after Anesthesia Discharge

JHNEBP Model Level	Total Number of Sources	Author and Quality Rating of each study	Synthesis of Findings
Level 1 Experimental study · Randomized Controlled Trial (RCT) · Systematic review of RCTs with or without meta-analysis			
Level II Quasi-experimental studies · Systematic review of a combination of RCTs and quasi-experimental studies, or quasi-experimental studies only, with or without meta-analysis	4	Hou et al (2019) 2A, Galatzan, & Carrington (2018) 2A Delardes (2020) 2B Aronson et al. (2021) 2A	-Electronic handoff enhances communication effectiveness and increases benefits at handoff. -More research is needed to directly connect standardized implementation to patient outcomes, but an improved perception of outcomes is present -Standardized handoff must be customizable to unit and patient -Consistent and structured handoff is preferred -E-handoff improves handoff completeness, but has varying effects on adverse events depending on how adverse events are defined, but showed improvements in some areas -EHR tools decrease communication errors
Level III Non-experimental study · Systematic review of a combination of RCTs, quasi-experimental, and non-experimental studies, or non-experimental studies only, with or without meta-analysis · Qualitative study or systematic review of qualitative studies with or without meta-synthesis	3	Starmer et al (2017) 3A, Kim, Lee, & Kim (2020) 3B, Holly, & Poletick (2013) 3A	**Similarities** Report can be given more efficiently with standardization and not take more time, but also decrease miscommunications which lead to patient safety events. standardized handoff methods should be used. Quality of hand off affects patient safety. **Differences**-education level and time of employment affect handoff quality -culture & social norms affects type of information transferred during handoff

Level IV Opinion of respected authorities and/or reports of nationally recognized expert committees/consensus panels based on scientific evidence			
Level V Evidence obtained from literature reviews, quality improvement, program evaluation, financial evaluation, or case reports · Opinion of nationally recognized expert(s) based on experiential evidence	6	Sexton et al (2022) 5A, Pandya et al (2017) 5A, Sermersheim et al (2020) 5A, Potts et al (2018) 5A, Blazin et al (2020) 5A, Benton et al (2020) 5A	**Similarities** across the studies included: Standardization and electronic handoff improve communication between nurses and units and decreases errors rates. It improved patient transfer from ED to inpatient units and from pacu to inpatient units decreasing the boarder times in both locations and preventing OR delays. The customizability of electronic handoff makes it ideal to use in any setting and by any provider. **Differences:** The studies took place in multiple settings including an emergency department, pacu, pediatric unit, and oncology unit.
Overall Quality Rating w/rational and Recommendation: Overall quality rating level 5 A good and consistent evidence for practice change.			
Recommendations Based on Evidence Synthesis • Strong, compelling evidence, consistent results: solid indication for a practice change. • Good and consistent evidence – practice change • Good but conflicting evidence: questionable indication for practice change; consider risk/benefit analysis. • Little or no evidence: no indication for practice change			

Table 3

Site Team Members

Team Member Name/Credentials/Title	Contact Information	Responsibilities
1. Ericka Campbell, RN – Project Lead	ECampbell@umaryland.edu	-Facilitate Implementation of the project -Collect pre/post-implementation data and analyze it -Ensure all team members are working together and have the accurate information -Conflict resolution -Facilitate needed education
2. Mary Renfrow, DNP, MS, FNP-C- Project Faculty Advisor	mrenfrow@umaryland.edu	-Advise Student about project progression and completion -oversee the project and facilitate knowledge when necessary -Provide critical feedback throughout the DNP project courses
3. Clinical site representative		-Facilitate relationships -Oversee the project and implementation -Advise and support student
4. PACU RN -ED electronic handoff champion		-ED electronic handoff process coordinator -Provide insight on ED Process, barriers & successes from historic ED implementation -Store data collected by PACU nurses for retrieval
5. Telemetry Manager		-Ensure all needed information is incorporated -Assign a unit electronic handoff Champion Nurse -Ensure surveys get delivered to Nurses for feedback -Ensure dissemination of process & implementation
6. PCC- Project Sponsor		-Push for staff involvement -Introduction of the process to PACU staff -Verify all needed information is included a handoff

7. IT department		-Assist with creating electronic handoff document -Help create a dot phrase template with need changes from original -Technology information contact
8. Ortho RN, electronic handoff champion		-Ortho floor electronic handoff process coordinator -Provide insight on Process what worked well & challenges faced on Ortho floor with implementation -Help improve future process
9. DATA analyst		-Data Analyst -Access transfer times for pacu patients & data reports -Data sheets of phase I &surgical care complete time
10. Telemetry RN, CN I -electronic handoff champion		-Telemetry change Champion -Disseminate surveys and education information -Help with data collection & feedback -Provides insight on any challenges/ barriers
11. Telemetry Charge Nurses		-Assign patient bed -Notify Telemetry staff nurse report is in EMR
12. PACU manager		-Ensure collection of data in pacu -Facilitate smooth transition process in pacu -Support DNP project & its implementation with staff
13. Director of Quality & Patient Safety		-Investigate/ help access RL6 reports
14. Barbara van de Castle, DNP- Co Project Course Director	vandecastle@umaryland.edu	-Course administrator -Facilitate DNP Project courses and needs to meet objectives -Oversee and advise Project faculty advisor

		-Redcap use Advisor
15. Joan Davenport, NP	davenport@umaryland.edu	-Second read for project proposal -Provide critical feedback for DNP project 812 course

Table 4

Gantt Chart

DNP Project Title: Standardized Electronic Post-Operative Handoff: Improving Communication and Decreasing Adverse Events

Student:Ericka Campbell

Project Site:UM Saint Joseph Medical

Project Start: Fri, 12/16/2022

Display Week: 1

Project Identification (NDNP810)	Responsible	START	END
Start of Spring Term	Mary Renfrow	1/23/23	5/16/23
CITI (enter renewal date as end)	Project Lead	12/28/22	12/28/25
HIPAA (enter renewal date as end)	Project Lead	1/19/23	1/19/25
Identify practice problem/root cause	Project Lead, CSR, Spor	12/22/22	1/30/23
MILESTONE submit Root Cause (Fishbone)	Project Lead	1/19/23	1/30/23
Identify stakeholders/team	Project Lead, CSR, Spor	1/23/23	5/16/23
Identify roles/responsibilities	Project Lead, CSR, Spor	1/23/23	5/16/23
Context Assessment		1/23/23	5/16/23
Identify scope/goals	Project Lead, CSR, Spor	1/23/23	5/16/23
MILESTONE submit Evidence Review	Project Lead	1/23/23	2/13/23
Synthesize Evidence	Project Lead	1/23/23	5/16/23
Development project plans	Project Lead, CSR, Spor	2/13/23	3/13/23
MILESTONE: Submit project proposal	Project Lead	1/23/23	4/3/23
Site IRB Inquiry	Project Lead & Mary Re	1/23/23	4/24/23
REDcap	Project Lead	1/23/23	1/30/23
Pre-implementation data collection	Project Lead, IT consult	1/23/23	5/16/23
Pre-Implementation surveys (x 3)	Project Lead	4/1/23	5/16/23
End of Spring Term	Mary Renfrow	1/23/23	5/16/23
Project Development (NDNP811)			
Start of Summer Term	Mary Renfrow	6/5/23	7/21/23
Develop implemenation plans	Project Lead, CSR, Spor	6/5/23	8/28/23
Develop teaching plan	Project Lead & Sponsor	6/5/23	7/5/23
MILESTONE: Site Presentation and Approval	Project Lead, CSR, Spor	7/5/23	7/20/23
MILESTONE: IRB Determination	Project Lead & Mary Re	6/21/23	7/21/23
End of Summer Term	Mary Renfrow	6/5/23	7/21/23
Project Implementation (NDNP812)			
Start of Fall Term	Mary Renfrow	8/28/23	12/16/23
MILESTONE: Project go-live (implement)	Project Lead, CSR, Spor	9/1/23	12/16/23
Educaton/Training	Project lead & tele Cha	8/1/23	8/28/23
Monitor tactics and progress	Project lead & tele Cha	8/28/23	12/16/23
Communicate with stakeholders	Project Lead	8/28/23	12/16/23
Data Collection	Project Lead, IT consult	8/28/23	12/16/23
Dissemination Plan	Project Lead, CSR, Spor	8/28/23	12/22/23
MILESTONE: Manuscript	Project Lead	8/28/23	12/20/23
End of Fall Term	Mary Renfrow	8/28/23	12/16/23

Project Site:UM Saint Joseph Medical

Display Week: 1

Project Evaluation and Dissemination (NDNP813)			
Start of Spring Term	Mary Renfrow	1/22/24	5/16/24
Analyze, synthesize & evaluate results	Project Lead	1/23/24	2/20/24
Sustainability Plan	Project Lead, CSR, Spor	2/21/24	3/20/24
MILESTONE: Develop Poster	Project Lead	2/21/24	3/20/24
MILESTONE: Site Presentation	Project Lead	4/1/24	4/5/24
MILESTONE: Extremal Dissemination	Project Lead	4/6/24	4/11/24
MILESTONE: Final Manuscript	Project Lead	4/12/24	5/10/24
MILESTONE: UMSON Poster Day	Project Lead	4/9/24	4/9/24
Project Closure w/site	Project Lead	1/23/23	5/10/24
End of Spring Term	Mary Renfrow	1/22/24	5/16/24

Insert new rows ABOVE this one

Table 5

Measurement Plan

Project Goals	Data Collection Procedures (who, how, when)	Name of Data Collection Tool
Education on use of electronic handoff	Project lead will ensure all staff in pacu are educated on placing electronic handoff and Lead & Telemetry champions will ensure all Telemetry nurses are educated on electronic handoff receival prior to implementation of project August 2023	Epic Handoff Education
Utilization of Standardized Electronic Handoff for patients from PACU to Telemetry	Project lead will do weekly Chart Audits to confirm SEH in patient chart and collect time stamp data	PACU Phase 1 time to care complete time tool
Improved perceived communication.	Project leader will facilitate surveys for Telemetry RNs to assess communication before and during project implementation via QR code and web links.	Nurse Handover Perspective Questionnaire
Decrease in transition of care time from PACU to Telemetry	PACU nurses are responsible for recording phase I and surgical care complete time in the EHR while caring for patients.	PACU Phase 1 time to care complete time tool

Table 6
Ethics Procedures/ International Review Board Procedures & Contacts

Institutional Review Board (IRB)

- **Nursing Quality and Improvement**
  - Projects must have IRB determination as non-human subject study
  - SUBMIT Exempt form: retrospective data query and use de-identified data to protect HIPPA
  - Must have an IRB determination to submit for publication
  - TU IRB determination can be accepted by UMMS/UMSJMC
- **Nursing Research**
  - Conducted at UMSJMC
    - Present proposal to the UMMS Nursing and Patient Care Services Research Council
    - Guidance and support provided by council members to the researcher
    - Mentoring support by faculty at UM School of Nursing
    - Investigator access to submit to UM, Baltimore, IRB
- **Contact Person: Research Compliance**
    - Joanna Marshall
    - Joanne.marshall@umm.edu
    - Office of clinical research: 410-427-2031

The Scientific Review Committee membership at UMSJMC includes:

- Gail Cunningham, MD – SVP Medical Affairs, Committee Chair
- Steven Crawford, MD – Assistant Director Psychiatry
- Lisa Geraghty (me) – Research Administrator, Office of Clinical Research
- Heather Hill, CHPC – VP Mission Integration and Spiritual Care
- Hannah Jun, PharmD – SJMC Clinical Pharmacist
- Erica Sauer – Director of Clinical Excellence
- Jeanne Phelps, RN – Research Manager, Office of Clinical Research
- Deborah Sarama – Manager, Oncology Pharmacy
- Kim Schlesinger, MD – Medical Director of the Cancer Institute and Medical Oncologist

Table 7
Pre-Implementation Throughput Data

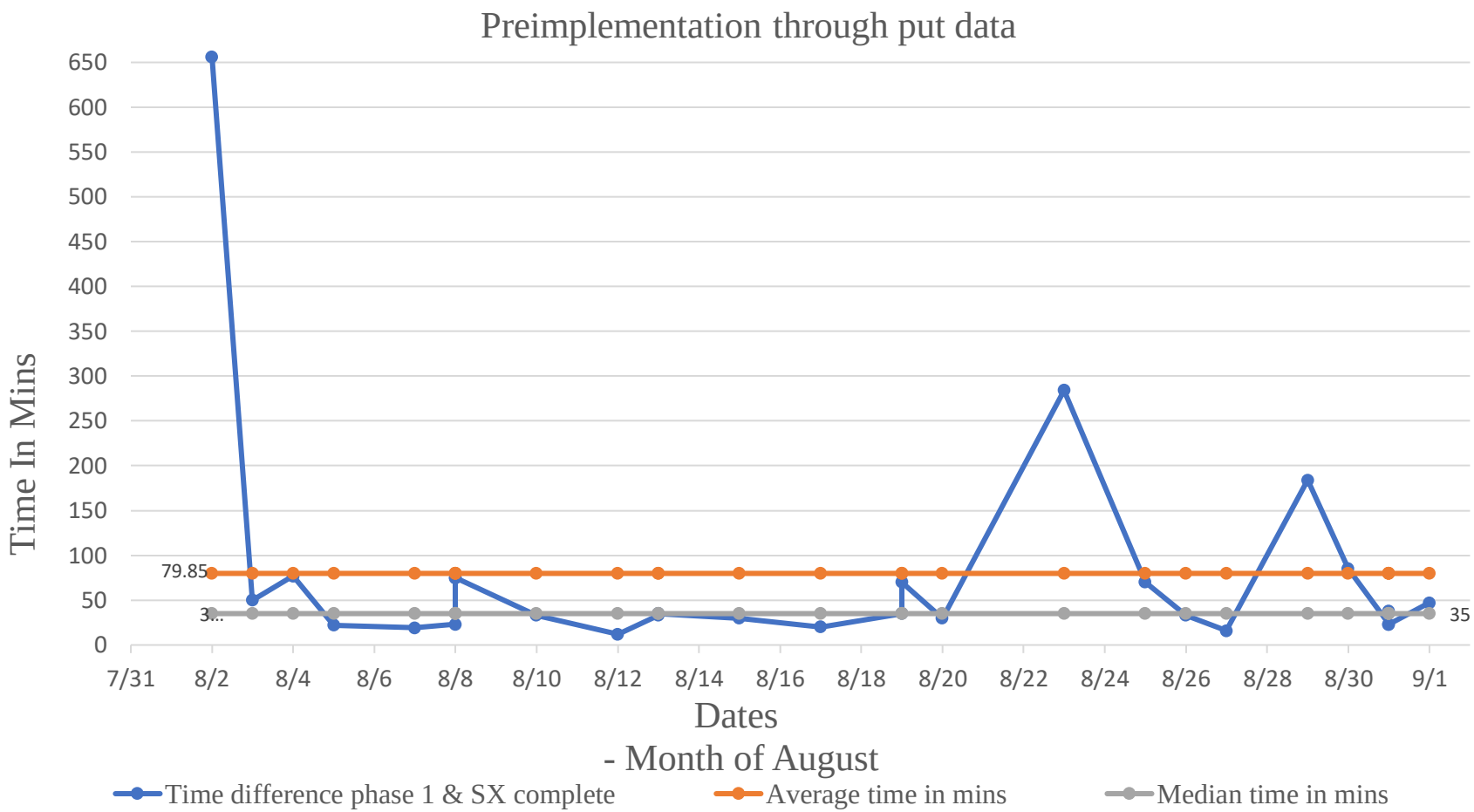


Table 8
Post Implementation SEH Compliance & Throughput times

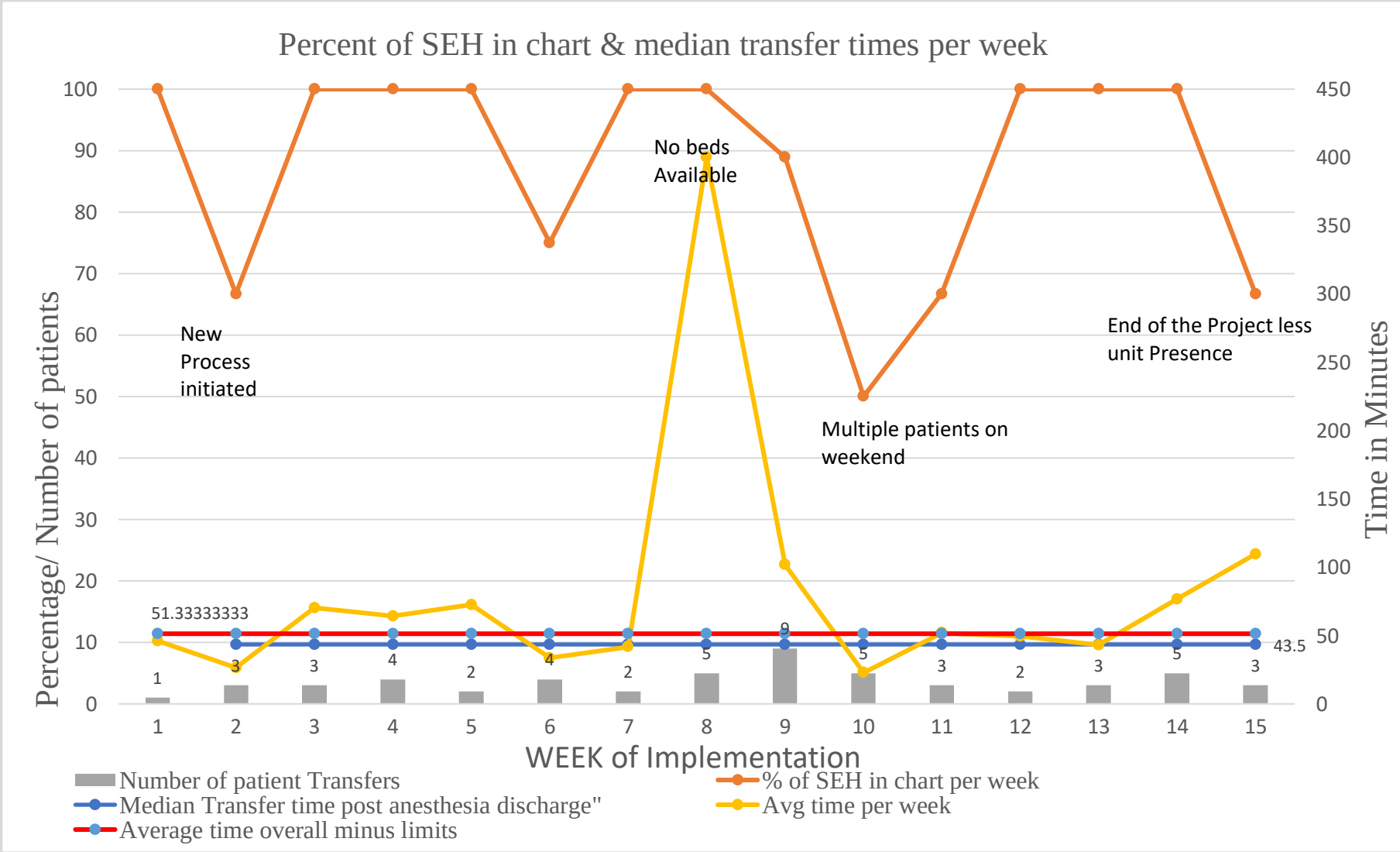


Figure 1
Cause & Analysis Fishbone

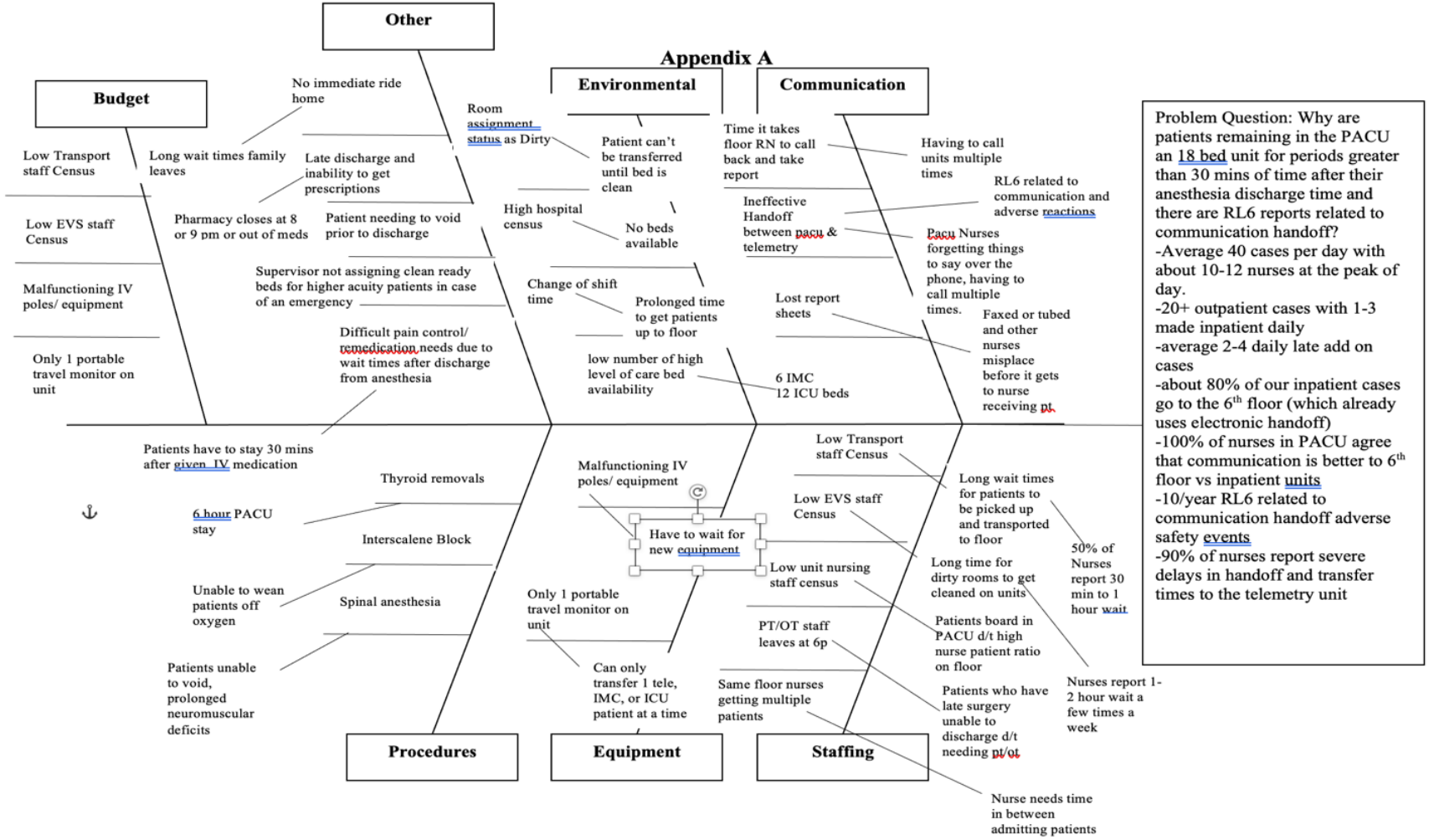


Figure 2
Framework Utilized for QI

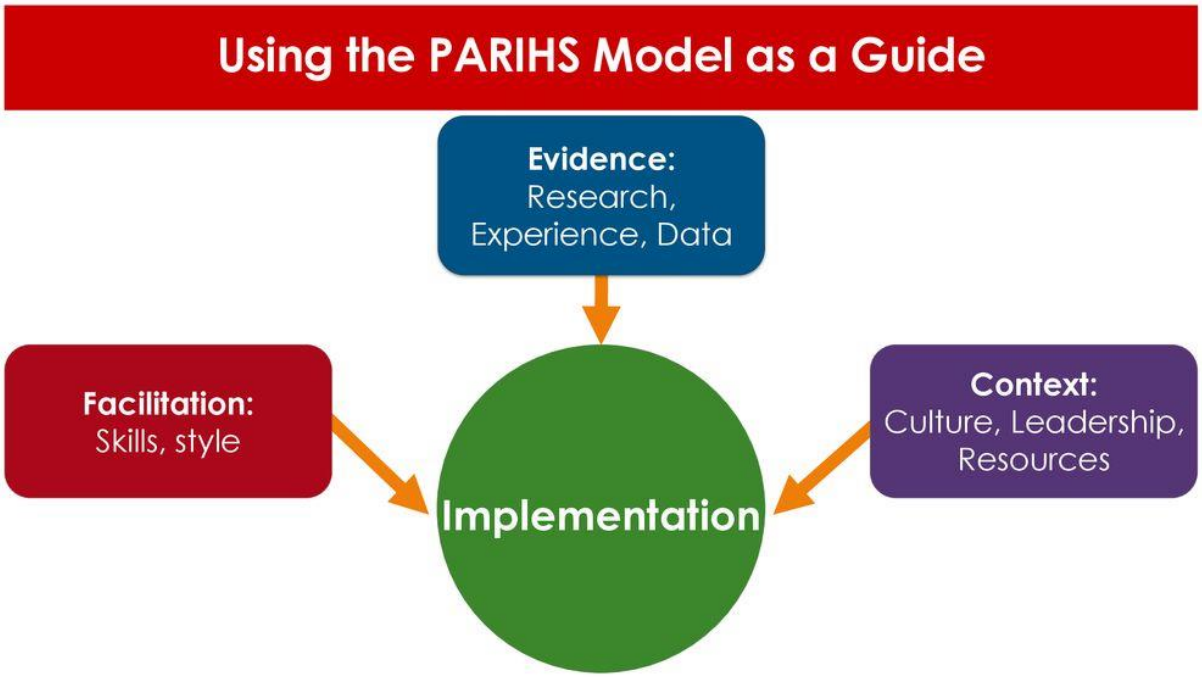


Figure 3
Pre-implementation Process Map

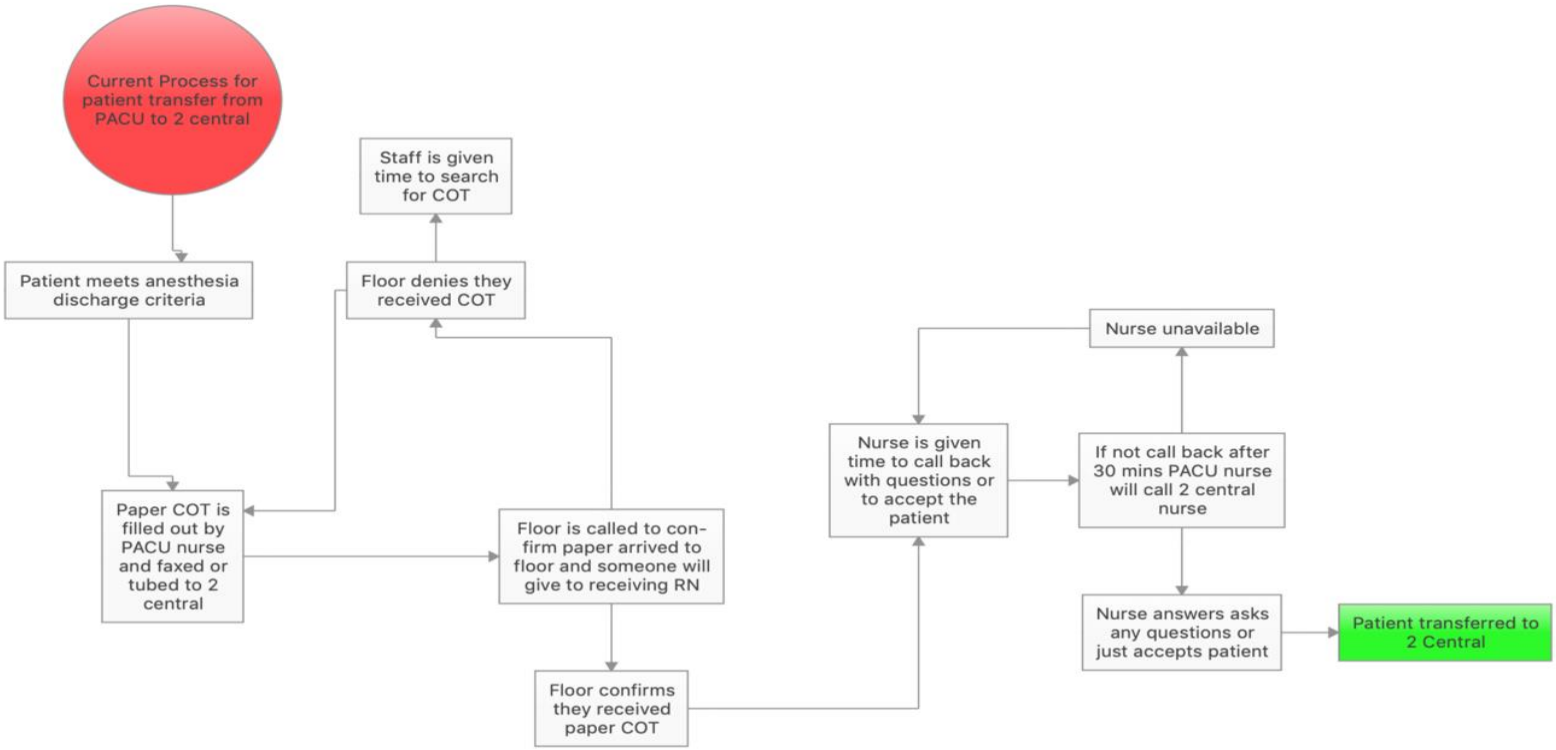


Figure 4
Post Implementation Process Map

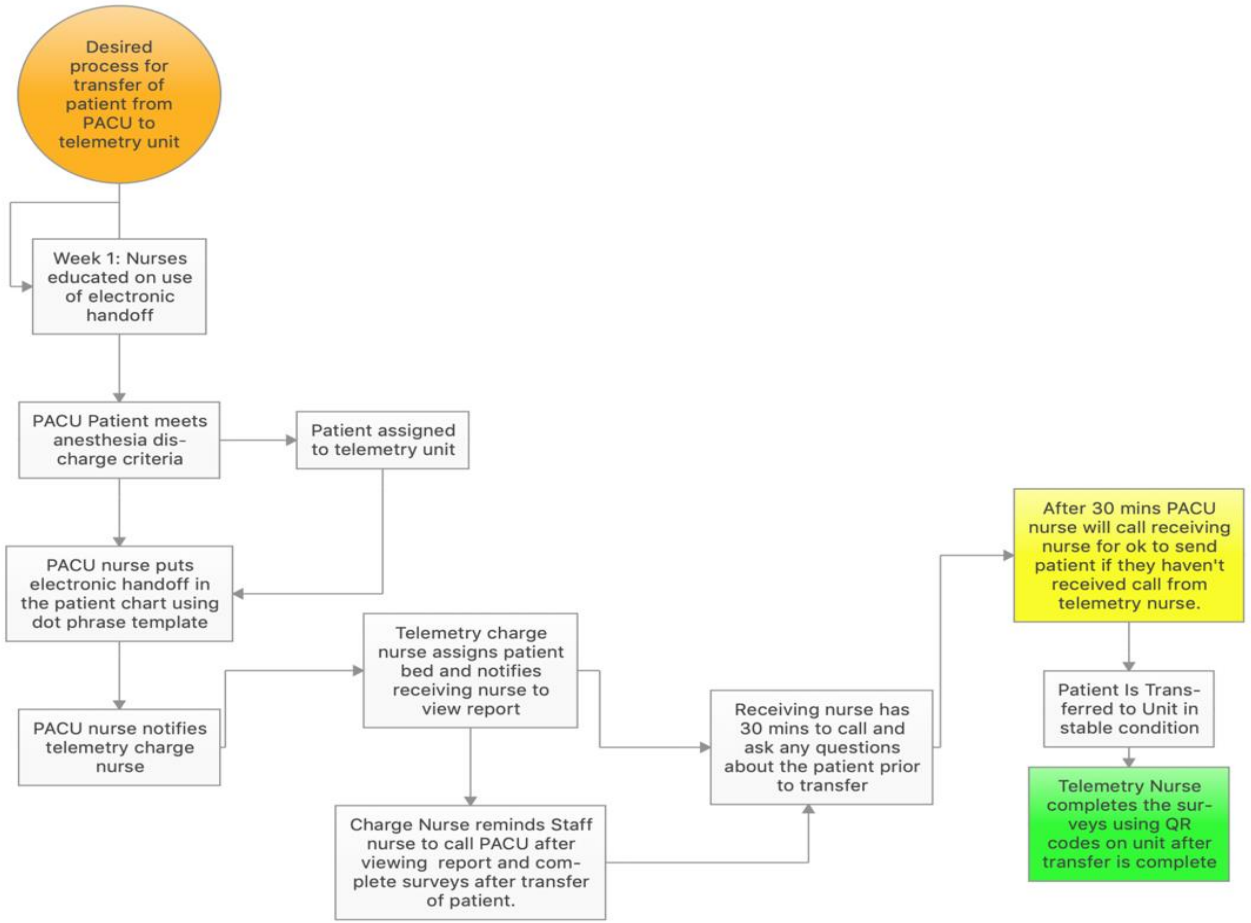
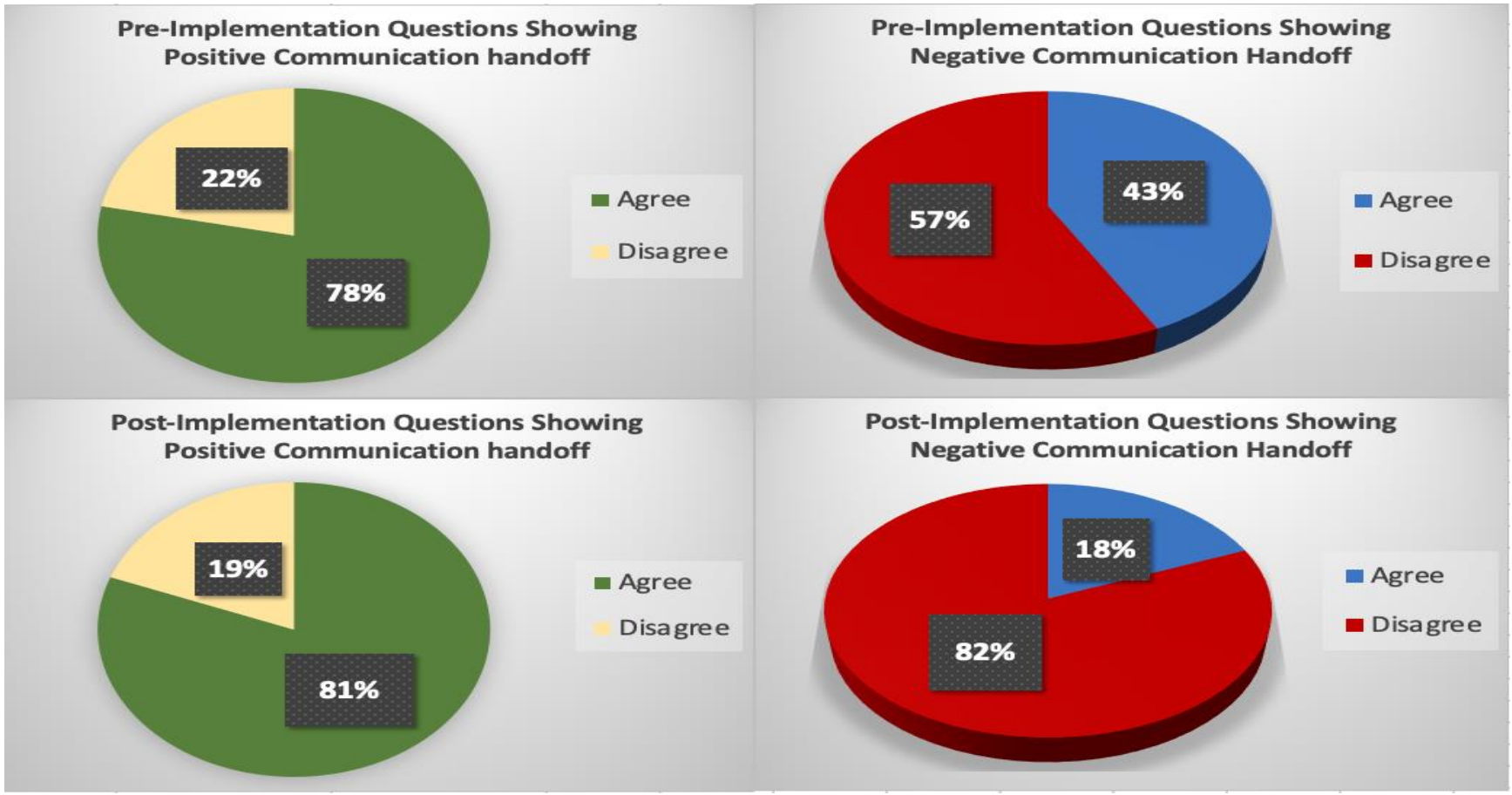
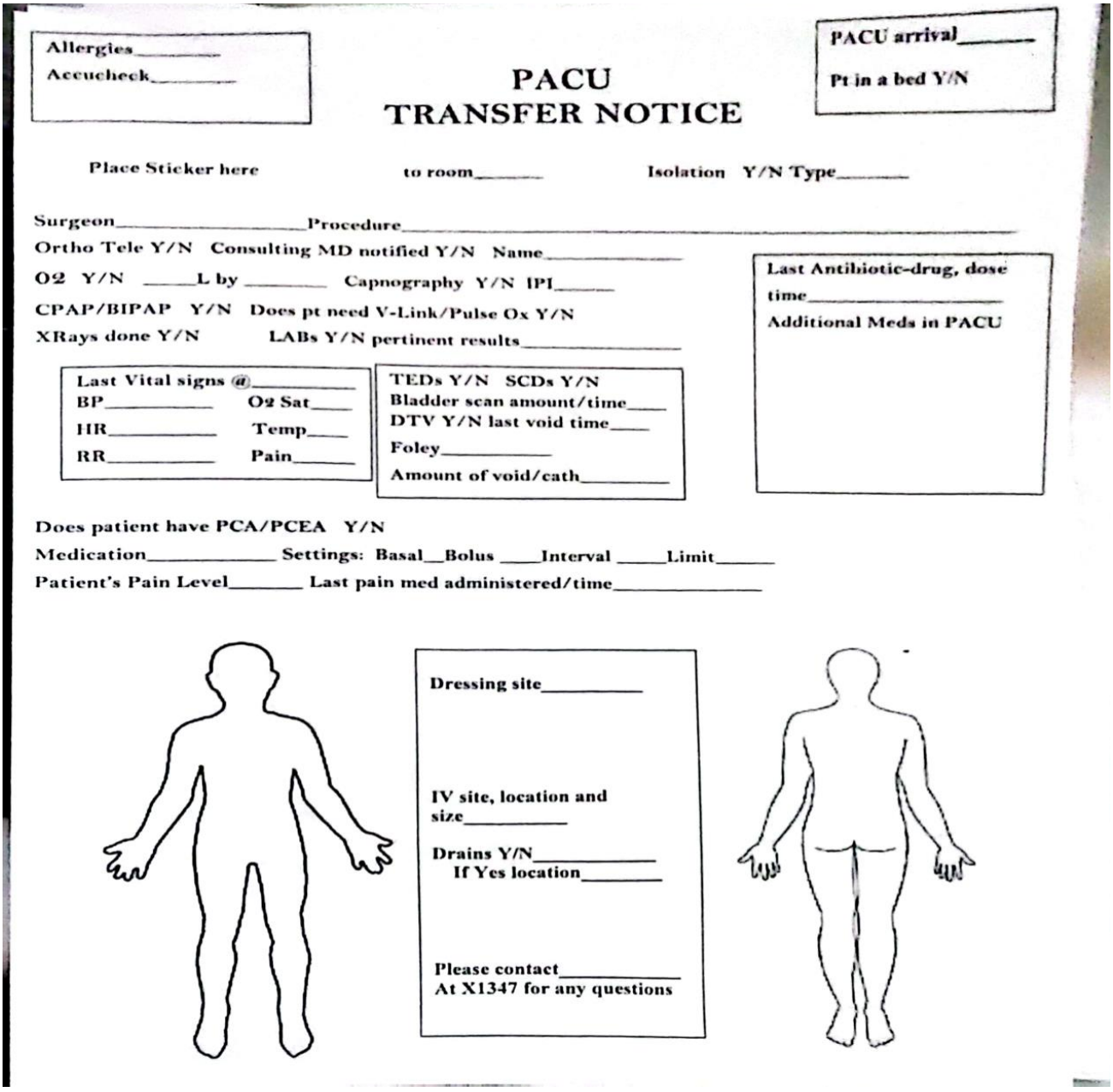


Figure 5
Nursing Perception Question Results



Appendix A

Pre-Implementation Handoff sheet



Allergies_____
Accucheck_____

PACU
TRANSFER NOTICE

PACU arrival_____
Pt in a bed Y/N

Place Sticker here to room_____ Isolation Y/N Type_____

Surgeon_____Procedure_____
Ortho Tele Y/N Consulting MD notified Y/N Name_____
O2 Y/N _____L by _____ Capnography Y/N IPI_____
CPAP/BIPAP Y/N Does pt need V-Link/Pulse Ox Y/N
XRays done Y/N LABs Y/N pertinent results_____

Last Antibiotic-drug, dose time_____
Additional Meds in PACU

Last Vital signs @_____
BP_____ O2 Sat____
HR_____ Temp____
RR_____ Pain_____

TEDs Y/N SCDs Y/N
Bladder scan amount/time____
DTV Y/N last void time____
Foley_____
Amount of void/cath_____

Does patient have PCA/PCEA Y/N
Medication_____ Settings: Basal__Bolus ____Interval _____Limit_____
Patient's Pain Level_____ Last pain med administered/time_____

Dressing site_____

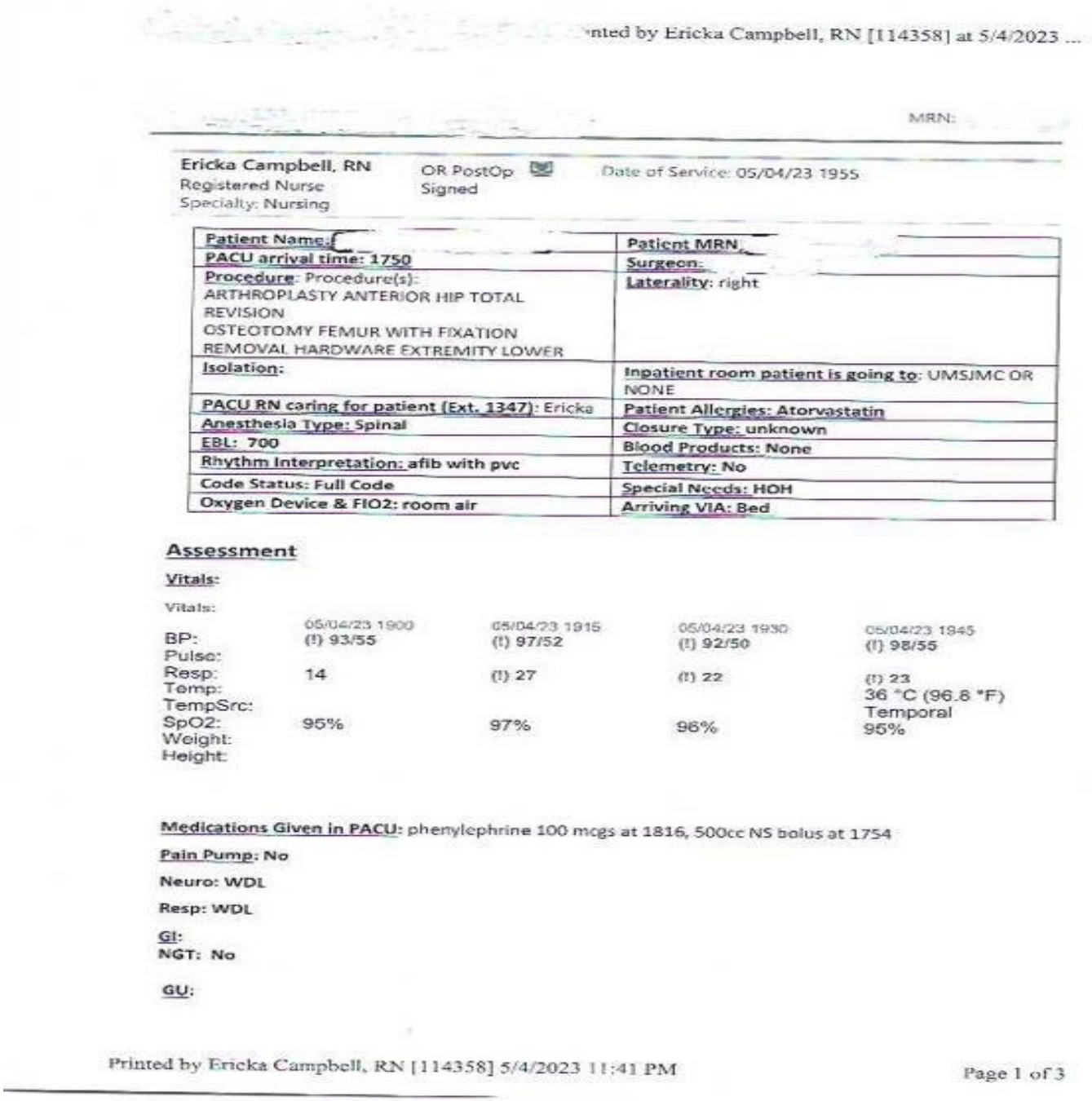
IV site, location and size_____

Drains Y/N_____
If Yes location_____

Please contact_____
At X1347 for any questions

Appendix B

Standardized Electronic Handoff



nted by Ericka Campbell, RN [114358] at 5/4/2023 ...

MRN:

Ericka Campbell, RN
Registered Nurse
Specialty: Nursing

OR PostOp
Signed

Date of Service: 05/04/23 1955

Patient Name:	**Patient MRN:**
PACU arrival time: 1750	**Surgeon:**
Procedure: Procedure(s): ARTHROPLASTY ANTERIOR HIP TOTAL REVISION OSTEOTOMY FEMUR WITH FIXATION REMOVAL HARDWARE EXTREMITY LOWER	**Laterality**: right
Isolation:	**Inpatient room patient is going to**: UMSJMC OR NONE
PACU RN caring for patient (Ext. 1347): Ericka	**Patient Allergies: Atorvastatin**
Anesthesia Type: Spinal	**Closure Type: unknown**
EBL: 700	**Blood Products: None**
Rhythm Interpretation: afib with pvc	**Telemetry: No**
Code Status: Full Code	**Special Needs: HOH**
Oxygen Device & FIO2: room air	**Arriving VIA: Bed**

Assessment

Vitals:

Vitals:

	05/04/23 1900	05/04/23 1915	05/04/23 1930	05/04/23 1945
BP:	(!) 93/55	(!) 97/52	(!) 92/50	(!) 98/55
Pulse:				
Resp:	14	(!) 27	(!) 22	(!) 23
Temp:				36 °C (96.8 °F)
TempSrc:				Temporal
SpO2:	95%	97%	96%	95%
Weight:				
Height:				

Medications Given in PACU: phenylephrine 100 mcgs at 1816, 500cc NS bolus at 1754

Pain Pump: No

Neuro: WDL

Resp: WDL

GI:
NGT: No

GU:

Printed by Ericka Campbell, RN [114358] 5/4/2023 11:41 PM

Page 1 of 3

Due To Void: Yes Time 2350
Bladder Scan: Yes Amount 327 at 1935
Foley: No

Drains: No

Dressing: boarder foam

Lines:

Patient Lines/Drains/Airways Status

Active Active LDAs (selected)

Name	Placement date	Placement time	Site	Days
Peripheral IV 05/04/23 1227 20 G Distal;Left;Posterior Forearm	05/04/23	1227	Forearm	less than 1

Comments: Pleasant patient, HOH

PMH:

Past Medical History:

Diagnosis	Date
• Atrial fibrillation (CMS/HCC)	
• Hypertension	
• Neuropathy *bilat hands*	
• Prostate cancer (CMS/HCC)	
• Stage 3 chronic kidney disease (CMS/HCC)	

Labs: (No results found = no current results for this encounter)

CBC w/Diff

Lab Results

Component	Value	Date/Time
HEMOGLOBIN	10.7 (L)	05/04/2023 06:03 PM
HEMATOCRIT	33.2 (L)	05/04/2023 06:03 PM

No results found for: RELNEU, RELLYM, RELMONO, RELEOS, RELBAS, NEUTROPHIL, LYMPHOCYTE, MONOCYTES, NEUTROABS, GRANABS

Comprehensive Metabolic Profile
No results found for: SODIUM, POTASSIUM, CHLORIDE, CO2, ANIONGAP, BUN, CREATININE, GLUCOSE
No results found for: CALCIUM, PHOSPHORUS, ALB, ALKALINEPHO, AST, ALT,

Appendix C

Epic Handoff Education

Please complete the survey below.

Thank you!

1) Have you recieved hands on training or previous experience with Standardized Electronic Handoff Report
- ◯ Yes
- ◯ No

2) Date and time of education _____

Appendix D

Pacu Phase 1 To Care Complete

Staff Unit	_____
Date of transfer	_____
MRN #	_____
Phase 1 care time	_____
Surgical Care complete time	_____
time spent in pacu after anesthesia discharge	_____
Is Standardized electronic handoff in the chart	◯ Yes ◯ No
Time standardized electronic handoff was signed in chart	_____
difference in time from COT in to surgical care complete	_____
Addition Notes	_____

Appendix E

Nursing Handover Perspective Questionnaire

Please complete the survey below.

Thank you!

1)	MRN	_____
2)	Approximate Date and time of patient transfer	_____
3)	I have been provided with adequate information about patients in my care.	◯ 1. Strongly Disagree ◯ 2. Disagree ◯ 3.Agree ◯ 4. Strongly Agree
4)	The handover information was presented in a systematic and organised way.	◯ 1. Strongly Disagree ◯ 2. Disagree ◯ 3.Agree ◯ 4. Strongly Agree
5)	I feel that important information was not given to me.	◯ 1. Strongly Disagree ◯ 2. Disagree ◯ 3.Agree ◯ 4. Strongly Agree
6)	The information I received during handover is often not relevant to my patient care	◯ 1. Strongly Disagree ◯ 2. Disagree ◯ 3.Agree ◯ 4. Strongly Agree
7)	The charts were available during handover to clarify information provided to me.	◯ 1. Strongly Disagree ◯ 2. Disagree ◯ 3.Agree ◯ 4. Strongly Agree
8)	I have used the charts to review patient care during handover, for example drug chart, vital signs, patient allergy, FBC.	◯ 1. Strongly Disagree ◯ 2. Disagree ◯ 3.Agree ◯ 4. Strongly Agree
9)	The way in which information was provided to me was easy to follow.	◯ 1. Strongly Disagree ◯ 2. Disagree ◯ 3.Agree ◯ 4. Strongly Agree
10)	I was unable to keep my mind focused during handover due to excessive noise.	◯ 1. Strongly Disagree ◯ 2. Disagree ◯ 3.Agree ◯ 4. Strongly Agree
11)	I think effective communication skills should be used for handover, for example clear speech, not too fast.	◯ 1. Strongly Disagree ◯ 2. Disagree ◯ 3.Agree ◯ 4. Strongly Agree

12)	From my experience, handover was often interrupted by patients, their significant others or other staff.	◯ 1. Strongly Disagree ◯ 2. Disagree ◯ 3.Agree ◯ 4. Strongly Agree
13)	The information I received was up to date.	◯ 1. Strongly Disagree ◯ 2. Disagree ◯ 3.Agree ◯ 4. Strongly Agree
14)	I had to seek further information about my patient(s) from a nurse or nurse-in-charge after the handover.	◯ 1. Strongly Disagree ◯ 2. Disagree ◯ 3.Agree ◯ 4. Strongly Agree
15)	I had the opportunity to ask questions about things I did not understand during handover.	◯ 1. Strongly Disagree ◯ 2. Disagree ◯ 3.Agree ◯ 4. Strongly Agree
16)	I was asked to clarify if I have any questions about the information received.	◯ 1. Strongly Disagree ◯ 2. Disagree ◯ 3.Agree ◯ 4. Strongly Agree
17)	As a result of handover, I have a clear understanding of the plan (diagnosis, treatment, discharge) for the patient(s).	◯ 1. Strongly Disagree ◯ 2. Disagree ◯ 3.Agree ◯ 4. Strongly Agree
18)	I received adequate information about nursing care during handover, for examples mobility, nutrition/hydration, pain.	◯ 1. Strongly Disagree ◯ 2. Disagree ◯ 3.Agree ◯ 4. Strongly Agree
19)	From my observations, important vital sign measurements are often omitted from nursing handover, for example BP < 100, oxygen saturation < 93%.	◯ 1. Strongly Disagree ◯ 2. Disagree ◯ 3.Agree ◯ 4. Strongly Agree
20)	From my observations, important information about medication is often not given during handover, for example withheld, allergy, unavailable.	◯ 1. Strongly Disagree ◯ 2. Disagree ◯ 3.Agree ◯ 4. Strongly Agree
21)	I believe using Standardized Electronic Handoff will help me to improve my communication skills with my co-workers.	◯ 1. Strongly Disagree ◯ 2. Disagree ◯ 3.Agree ◯ 4. Strongly Agree
22)	I believe using Standardized Electronic Handoff will increase patient quality and safety care.	◯ 1. Strongly Disagree ◯ 2. Disagree ◯ 3.Agree ◯ 4. Strongly Agree

23)	I think Standardized Electronic Handoff is time-consuming.	◯ 1. Strongly Disagree ◯ 2. Disagree ◯ 3.Agree ◯ 4. Strongly Agree
24)	I think Standardized Electronic Handoff is not easy to implement in my handovers.	◯ 1. Strongly Disagree ◯ 2. Disagree ◯ 3.Agree ◯ 4. Strongly Agree
25)	Date and time Survey complete	_____

Appendix F

PLEASE NOTE : DO NOT collect live data if project is in development mode .

Data Exports, Reports, and Stats

Number of results returned: 12
Total number of records queried: 65

Hando! perspective questions that should improve (agree)

I have been provided with adequate information about patients in my care. q1	The handover information was presented in a systematic and organised way. q2	The charts were available during handover to clarify information provided to me. q3	I have used the charts to review patient care during handover, for ... l signs, patient allergy, FBC. q4	The way in which information was provided to me was easy to follow. q5	I think effective communication skills should be used for handover, ... le clear speech, not too fast. q6	The information I received was up to date. q11	I had the opportunity to ask questions about things I did not understand during handover. q13	I was asked to clarify if I have any questions about the information received. q14	As a result of handover, I have a clear understanding of the plan (... discharge) for the patient(s). q15	I received adequate information about nursing care during handover, ... ty, nutrition/hydration, pain. q16	I believe using Standardized Electronic Handoff will help me to imp ... ion skills with my co-workers. q19	I believe using Standardized Electronic Handoff will increase patient quality and safety care. q20	Date time Surv comp
2. Disagree (2)	3.Agree (3)	2. Disagree (2)	3.Agree (3)	2. Disagree (2)	4. Strongly Agree (4)	3.Agree (3)	3.Agree (3)	3.Agree (3)	2. Disagree (2)	3.Agree (3)	4. Strongly Agree (4)	4. Strongly Agree (4)	08-2 17:2
3.Agree (3)	3.Agree (3)	2. Disagree (2)	2. Disagree (2)	3.Agree (3)	3.Agree (3)	2. Disagree (2)	2. Disagree (2)	2. Disagree (2)	2. Disagree (2)	2. Disagree (2)	3.Agree (3)	3.Agree (3)	08-2 08:2
4. Strongly Agree (4)	4. Strongly Agree (4)	4. Strongly Agree (4)	4. Strongly Agree (4)	4. Strongly Agree (4)	4. Strongly Agree (4)	4. Strongly Agree (4)	3.Agree (3)	4. Strongly Agree (4)	4. Strongly Agree (4)	4. Strongly Agree (4)	4. Strongly Agree (4)	4. Strongly Agree (4)	
2. Disagree (2)	2. Disagree (2)	2. Disagree (2)	3.Agree (3)	2. Disagree (2)	3.Agree (3)	3.Agree (3)	3.Agree (3)	3.Agree (3)	2. Disagree (2)	2. Disagree (2)	3.Agree (3)	3.Agree (3)	08-2 19:2
3.Agree (3)	3.Agree (3)	3.Agree (3)	3.Agree (3)	3.Agree (3)	3.Agree (3)	3.Agree (3)	3.Agree (3)	3.Agree (3)	3.Agree (3)	3.Agree (3)	3.Agree (3)	3.Agree (3)	08-2 19:1
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4. Strongly Agree (4)	4. Strongly Agree (4)	1. Strongly Disagree (1)	1. Strongly Disagree (1)	1. Strongly Disagree (1)	1. Strongly Disagree (1)	1. Strongly Disagree (1)	1. Strongly Disagree (1)	1. Strongly Disagree (1)	1. Strongly Disagree (1)	2. Disagree (2)	1. Strongly Disagree (1)	1. Strongly Disagree (1)	09-1 07:3
3.Agree (3)	3.Agree (3)	3.Agree (3)	3.Agree (3)	3.Agree (3)	3.Agree (3)	2. Disagree (2)	3.Agree (3)	3.Agree (3)	3.Agree (3)	3.Agree (3)	3.Agree (3)	3.Agree (3)	09-1 07:3
4. Strongly Agree (4)	4. Strongly Agree (4)	4. Strongly Agree (4)	4. Strongly Agree (4)	4. Strongly Agree (4)	4. Strongly Agree (4)	4. Strongly Agree (4)	4. Strongly Agree (4)	4. Strongly Agree (4)	4. Strongly Agree (4)	4. Strongly Agree (4)	4. Strongly Agree (4)	4. Strongly Agree (4)	09-3 01:3
3.Agree (3)	3.Agree (3)	3.Agree (3)	3.Agree (3)	4. Strongly Agree (4)	2. Disagree (2)	3.Agree (3)	3.Agree (3)	3.Agree (3)	3.Agree (3)	3.Agree (3)	2. Disagree (2)	2. Disagree (2)	10-2 01:3
3.Agree (3)	3.Agree (3)	3.Agree (3)	3.Agree (3)	3.Agree (3)	3.Agree (3)	3.Agree (3)	3.Agree (3)	3.Agree (3)	3.Agree (3)	3.Agree (3)	3.Agree (3)	3.Agree (3)	10-2 03:3
3.Agree (3)	3.Agree (3)	3.Agree (3)	3.Agree (3)	3.Agree (3)	3.Agree (3)	3.Agree (3)	3.Agree (3)	3.Agree (3)	3.Agree (3)	3.Agree (3)	3.Agree (3)	3.Agree (3)	10-2 01:3

Appendix G

PLEASE NOTE : DO NOT collect live data if project is in development mode .

Data Exports, Reports, and Stats

Number of results returned: 12
Total number of records queried: 65

Hando! perspective questions that should decrease (Disagree

I feel that important information was not given to me. q3	The information I received during handover is often not relevant to my patient care q4	I was unable to keep my mind focused during handover due to excessive noise. q8	From my experience, handover was often interrupted by patients, the ... ificant others or other staff. q10	I had to seek further information about my patient(s) from a nurse ... - in-charge after the handover. q12	From my observations, important vital sign measurements are often o ... 100, oxygen saturation < 93%. q17	From my observations, important information about medication is oft ... ithheld, allergy, unavailable. q18	I think Standardized Electronic Handoff is time-consuming. q21	I think Standardized Electronic Handoff is not easy to implement in my handovers. q22	Date and time Survey complete finish_d_t	Complete? nursing_ handover_ perspective questionnai complete
3.Agree (3)	2. Disagree (2)	2. Disagree (2)	4. Strongly Agree (4)	3.Agree (3)	2. Disagree (2)	3.Agree (3)	1. Strongly Disagree (1)	1. Strongly Disagree (1)	08-23-2023 17:29	Complete (2
3.Agree (3)	3.Agree (3)	3.Agree (3)	2. Disagree (2)	3.Agree (3)	3.Agree (3)	3.Agree (3)	2. Disagree (2)	2. Disagree (2)	08-29-2023 08:22	Complete (2
1. Strongly Disagree (1)	1. Strongly Disagree (1)	3.Agree (3)	1. Strongly Disagree (1)	1. Strongly Disagree (1)	3.Agree (3)	3.Agree (3)	1. Strongly Disagree (1)	1. Strongly Disagree (1)		Complete (2
3.Agree (3)	3.Agree (3)	2. Disagree (2)	2. Disagree (2)	3.Agree (3)	2. Disagree (2)	3.Agree (3)	2. Disagree (2)	2. Disagree (2)	08-29-2023 19:20	Complete (2
2. Disagree (2)	2. Disagree (2)	3.Agree (3)	2. Disagree (2)	2. Disagree (2)	3.Agree (3)	2. Disagree (2)	3.Agree (3)	3.Agree (3)	08-29-2023 19:17	Complete (2
1. Strongly Disagree (1)	1. Strongly Disagree (1)	1. Strongly Disagree (1)	2. Disagree (2)	3.Agree (3)	1. Strongly Disagree (1)	3.Agree (3)	2. Disagree (2)	1. Strongly Disagree (1)	08-29-2023 22:00	Complete (2
1. Strongly Disagree (1)	1. Strongly Disagree (1)	1. Strongly Disagree (1)	4. Strongly Agree (4)	1. Strongly Disagree (1)	1. Strongly Disagree (1)	1. Strongly Disagree (1)	1. Strongly Disagree (1)	1. Strongly Disagree (1)	09-12-2023 07:39	Complete (2
2. Disagree (2)	2. Disagree (2)	2. Disagree (2)	2. Disagree (2)	3.Agree (3)	2. Disagree (2)	2. Disagree (2)	3.Agree (3)	2. Disagree (2)	09-12-2023 07:39	Complete (2
1. Strongly Disagree (1)	1. Strongly Disagree (1)	1. Strongly Disagree (1)	4. Strongly Agree (4)	2. Disagree (2)	2. Disagree (2)	2. Disagree (2)	1. Strongly Disagree (1)	1. Strongly Disagree (1)	09-30-2023 01:31	Complete (2
3.Agree (3)	3.Agree (3)	3.Agree (3)	4. Strongly Agree (4)	2. Disagree (2)	2. Disagree (2)	1. Strongly Disagree (1)	2. Disagree (2)	2. Disagree (2)	10-21-2023 01:39	Complete (2
2. Disagree (2)	2. Disagree (2)	2. Disagree (2)	2. Disagree (2)	2. Disagree (2)	2. Disagree (2)	2. Disagree (2)	2. Disagree (2)	2. Disagree (2)	10-24-2023 03:33	Complete (2
2. Disagree (2)	2. Disagree (2)	2. Disagree (2)	3.Agree (3)	2. Disagree (2)	2. Disagree (2)	3.Agree (3)	2. Disagree (2)	2. Disagree (2)	10-28-2023 01:33	Complete (2