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Improving Safety in the First Hour Following Total Joint Replacement Surgery

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Running Head: IMPROVING SAFETY IN THE FIRST HOUR FOLLOWING TOTAL JOINT
REPLACEMENT SURGERY

Improving Safety in the First Hour Following Total Joint Replacement Surgery

Systems Change Project
Submitted in Partial Fulfillment of the Requirements for the Degree of
Doctor of Nursing Practice

St. Catherine University
St. Paul, Minnesota

Susan E. Heitman
May, 2012

IMPROVING SAFETY IN THE FIRST HOUR FOLLOWING TOTAL JOINT
REPLACEMENT SURGERY

ST. CATHERINE UNIVERSITY

ST. PAUL, MINNESOTA

This is to certify that I have examined this
Doctor of Nursing Practice systems change project
written by

Susan E. Heitman

and have found that it is complete and satisfactory in all respects,
and that any and all revisions required by
the final examining committee have been made.



Name of Faculty Project Advisor

May 10, 2012

Date

DEPARTMENT OF NURSING

IMPROVING SAFETY IN THE FIRST HOUR FOLLOWING TOTAL JOINT
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IMPROVING SAFETY IN THE FIRST HOUR FOLLOWING TOTAL JOINT REPLACEMENT SURGERY

Executive Summary

The purpose of this systems change project was to review and analyze the literature as well as evaluate patient data related to the practice of bypassing the post anesthesia recovery room (PACU), or Phase 1 recovery, in a Critical Access Hospital. The overarching question for this project was: When is it safe for the total joint replacement patient receiving spinal anesthesia with or without sedation to bypass Phase 1 recovery in a Critical Access Hospital?

Methods: This project was grounded in Participative Action Research, Change Theory and the nursing theory of Relationship Based Care. A chart review of 168 patients who had total joint replacement surgery over a 6 month period was completed during summer 2011. Data abstracted included pre-surgical data: age, body mass index, and ASA score as well as post-surgical data: Aldrete score, patient vital signs including mean arterial pressure (MAP), type and length of surgery, estimated blood loss during surgery, need for oxygen supplementation, nausea, vomiting, itching, and pain.

Results: Of the total sample of 168 patients, 66 (39.3 %) had an Aldrete score of less than or equal to 7 in the first hour postoperatively, 32 (19%) had a MAP \leq to 63 in the first hour and 21 (12.5%) had a MAP \leq to 60. Age, ASA scores and BMI were not associated with decreased Aldrete scores or MAP. Patients with total hip arthroplasty and bilateral total knee arthroplasty had a higher incidence of lower Aldrete scores and lower MAP than unilateral total knee arthroplasty patients.

Conclusions: Because nearly 40% of the sample had Aldrete scores of 7 or less within the first hour postoperatively, and most PACUs have as one of the criterion for discharge as Aldrete scores of 8 or higher, it is clear that patients who receive total joint replacement arthroplasty in this setting should receive a higher level of nursing care in the immediate postoperative hour.

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Chapter 1

Introduction

The Centers for Disease Control (CDC, 2012) estimates the prevalence of osteoarthritis to be 33.6% in people over the age of 65. Further analysis of CDC data reveals that osteoarthritis accounts for 55% of all arthritis-related hospitalizations and 35% of these are for total joint arthroplasty. Total joint arthroplasty, where the patient's diseased bone is removed and replaced with a permanent prosthesis, is a definitive treatment for patients with osteoarthritis and leads to a decrease in pain, increase in function, and improved quality of life. While this surgery has become a safe and effective treatment, the potential exists for serious postoperative complications and occasionally even death (Parvizi et al., 2007). The potential for serious complications is minimized by careful attention during anesthesia and close monitoring in the post-operative period.

Anesthesia for Total Joint Arthroplasty

Increasingly, total joint arthroplasty is performed using spinal anesthesia where the anesthetic agent is injected directly into the cerebrospinal fluid. After this injection, which is always below the first lumbar vertebrae, the patient is unable to feel their body from the level of administration of the anesthetic agent to their feet. This level of anesthesia is usually from the waist down and is sufficient for a surgery lasting up to 4 hours without the patient experiencing pain. The level of anesthesia then slowly subsides, with sensation returning beginning at the feet and moving toward the waist. Sometimes patients also receive intravenous sedation if needed or requested because they prefer to not be awake or aware of the surgery. Other patients desire to be awake and watch the surgery if this is an option. In studies examining outcomes in patients receiving regional versus general anesthesia, patients receiving regional anesthesia have fewer

anesthesia related complications such as post-operative nausea and vomiting and decreased hospital stays. Thus regional anesthesia is becoming more widely practiced despite the increased time it takes to administer spinal anesthesia as opposed to administering general anesthesia before the start of surgery (Yauger, et al., 2010).

Post-Operative Care

Following the completion of in-patient surgical procedures, patients typically go to a recovery room for close monitoring to assure stability and adequate recovery from the surgical procedure and anesthesia. This immediate postoperative time period is called Phase I recovery. Phase I level of care is usually provided in a unit titled the Post Anesthesia Care Unit (PACU) and requires a nurse to patient ratio of 1:1 or 1:2. Phase I level of care is used to assure patient safety by close monitoring of hemodynamics (blood pressure, heart rate and rhythm, and respirations) enabling quick intervention if needed, and monitoring for the return or maintenance of protective reflexes (the ability to swallow, maintain adequate oxygenation, and to move extremities). In addition, the nurse prepares the patient for transition to Phase II level of care. Phase II level of care is provided in the inpatient surgical unit where the nurse to patient ratio must be no more than 1:4 to meet the criteria established by the American Society of PeriAnesthesia Nurses (ASPN, 2010-2012).

Systems Change Project Site

There is a very successful total joint replacement surgery program at a small rural hospital in the Midwest. For over 12 years, patients having joint replacement surgery have received spinal anesthesia with intravenous sedation administered by Certified Registered Nurse Anesthetists (CRNAs). CRNAs manage the patients intraoperatively and in the immediate postoperative phase. Since the inception of the total joint program, the patients have bypassed

the recovery room following surgery and gone directly to the inpatient surgical unit if they have had a spinal anesthetic and experienced no complications during surgery. Bypassing the PACU for surgical inpatients is not the usual practice in facilities nationwide. While bypassing the PACU is supported in the literature for patients undergoing outpatient or same day surgery, it is not supported in the literature nor is it common practice in the inpatient surgical population.

Purpose

The purpose of this systems change project was to review and analyze the literature as well as evaluate patient data related to the practice of bypassing the post anesthesia recovery room (PACU), or Phase 1 recovery in a specific setting. It was understood that there were differences within healthcare systems that made it nearly impossible to mandate the identical delivery of care across settings. However, it was imperative to be assured that nurses and providers were able to immediately recognize and treat potential or actual complications wherever immediate postoperative care was delivered. The overarching question for this project was: When is it safe for the total joint replacement patient receiving spinal anesthesia with or without sedation to bypass Phase 1 recovery in a Critical Access Hospital (CAH)?

This is an important question in terms of social justice for the patient, the staff caring for these patients, and the hospital. Patients have the right to competent care that meets current professional standards. Patients come to the hospital of study because of its excellent reputation in large part due to the surgeon, but also to the multidisciplinary team functioning under his direction. While the surgeon had always been involved in all levels of the patient's care, he was not aware of the potential issues in the immediate postoperative phase. This study was especially important to nursing who had long felt their patients required a higher level of nursing care postoperatively, but had failed to find support from anesthesia providers and upper level

administration. Finally, the community of this hospital was proud to have a local thriving community hospital and would be devastated if the reputation and the success of the orthopaedic program were threatened due to unsafe care situations.

Summary

Therefore, the purpose of this project was to review the literature on the topic of bypassing the recovery room, identify the existing standards of care related to the topic of recovery room nursing, and collect data to accurately depict the status of total joint arthroplasty patients in the first hour after the patient leaves the operating room in the hospital of study. Following these activities, recommendations for practice and further research would be made. Finally, as a result of engaging nurses and other stakeholders in this systems change project, nursing leaders in the organization would have experienced an increased ability to use evidence to make practice changes and improvements.

Chapter 2

Theoretical Underpinnings

While it is important to recognize and act on the need for change or improvement, identifying theories that identify systematic approaches and strategies relevant to the practice setting enhanced the possibility that the project would be successful. In this chapter, the framework that guided the SCP is discussed, along with a review of the literature related to patient safety when bypassing Phase 1 recovery following total joint replacement. Two theories were chosen to guide this systems change project: Relationship-Based Care (Koloroutis, 2004), and Leading Change (Kotter, 1996).

Relationship-Based Care

Relationship Based Care (RBC) is rooted in three basic tenets: responsibility, authority, and accountability. In RBC, decision making is shared and becomes decentralized. Decentralization of decision making occurs when “authority is granted to those at the level of action—those who are in the best position to judge the adequacy and efficacy of the decisions they make” (Manthey in Koloroutis, 2002, p. 72.) Daily, anesthetists and nurses make independent decisions regarding the patient’s care and needs in the immediate postoperative period. This independent decision making illustrates that authority and autonomy were clearly embraced in this mid-western Critical Access Hospital.

The total joint replacement program at this hospital was widely regarded as excellent in the region, with patients experiencing positive outcomes and expressing high satisfaction with the care they receive. It would seem that there were no issues. In fact, many aspects of the patient experience were the result of highly functioning interdisciplinary teams. There were collegial relationships among all caregivers. Of special note was the relationship enjoyed

between the therapy staff, the inpatient nursing staff, the mid-level providers and the surgeons. One area that had gone unnoticed was the relationship among the staff involved in the decisions made during the immediate postoperative period. While the CRNAs had established a practice of bypassing Phase 1 recovery in all patients who received a spinal anesthetic and had no intraoperative complications, there were no written guidelines or policies to govern this practice. If a patient was unable to have a spinal, then general anesthesia was used and the patients routinely went to the PACU. There was no collaboration with nursing staff who received the patient from surgery regarding the safest disposition post-operatively and the nurses on the inpatient unit felt powerless in making a change.

The lack of nursing authority to exert their voice on where patients were cared for was also an area where RBC was further applied. This theory, while not formally embraced by this hospital, was readily embraced by other disciplines and areas in the care of the total joint replacement patient. Somewhere in the evolution of the total joint program, the relationships of the team members during this vulnerable postoperative hour were overlooked. It was easy to see why. As the expertise and reputation of the surgeon grew, so did the volume of care and more and more attention was placed on productivity and fast turnaround. This attention was accomplished by efficient, hard-working staff. If there were complications, they were extremely rare, occurred intraoperatively, and were handled in the PACU. If necessary, the patient with a complication was transferred via ambulance or helicopter to a nearby tertiary care hospital for a higher level of care. If there were no detected complications during surgery, patients went to the inpatient unit. Evolving complications were well managed which is why the practice was never reviewed. If a patient had an increased need for nursing care following surgery, it was usually related to hypotension, drowsiness or pain. The nurses caring for these patients were highly

specialized and were able to meet the patient's needs by taking responsibility for calling for orders from the anesthetists. They acted with authority and accountability to meet the needs of their patients, documenting their care in the nurse's notes which were only reviewed if there were complications or negative outcomes. Nurses acted competently, so that by the time the surgeon made rounds later in the day or the next morning, the situations were resolved and the patients were stable. As the volume of patients increased with the reputation of the surgeon and hospital, and the level of nursing care seemed to be higher, the inpatient nursing supervisor and the surgeon effectively advocated for a higher nurse to patient ratio in the inpatient unit to a level of one nurse to 3-4 patients, and the nurses had a very intensive orientation to postoperative orthopedic nursing care. This hospital had been able to keep costs down for patients as well as the hospital by not incurring the high cost of 1:1 nursing care that is given in a PACU. It seemed like the practice of caring for patients in this manner could serve as an exemplar and model for others.

Change Theory

Kotter's (1996) change theory was employed during this project. Kotter identifies eight stages of a change process:

- establishing a sense of urgency,
- creating a guiding coalition,
- developing a vision and strategy,
- communicating the change vision,
- empowering employees for broad-based action,
- generating short-term wins,
- consolidating gains and producing more change, and

- anchoring new approaches in the culture.

The stages of Kotter's change process were useful to the SCP because of the potential that a change would be needed. Because this hospital was small and there were few resources to support staff in making large changes, it was important to choose a guiding theory to ensure that this project would be successful.

RBC and Kotter's change theory were combined to address a key missing piece: competence of operating room (OR) nurses to provide PACU level care. In the RBC model, the Code of Ethics for Nurses (American Nurses Association [ANA], 2001) is espoused with the following statement:

Though it has consequences for others, maintenance of competence and ongoing professional growth involves the control of one's own conduct in a way that is self-regarding. Competence affects one's self-respect, self-esteem, professional status, and the meaningfulness of work. Evaluation on one's own performance is a means by which nursing practice can be held to the highest standards (p. 138).

Competency of nursing staff was where the work of this SCP was important. There was recognition that more patients required a higher level of nursing care in the immediate post-operative period than was realized. Kotter's sense of urgency was thus recognized. Because data were to be collected only over a 6 month period, it was difficult to tell if this higher level of nursing care would be a newer occurrence or had been present all along. For the sake of this project, the assumption was made that this was a new occurrence to allow for productive, forward moving process improvement. This higher level of nursing care led to the crux of the needed change. Neither nurses that staff the operating room, nor nurses staffing the inpatient unit felt competent to deliver PACU level care. The OR nurses had lost, never acquired, or felt comfortable with the skills required for PACU nurses. While the OR nurses had knowledge and skills, they felt uncomfortable related to the infrequent demand for these specific skills. As the

data revealed during the data collection period, inpatient RNs were managing patients requiring labor-intensive intervention in the immediate post-operative period. While they had done this well, they had not truly obtained the skills for PACU nursing, and were leaving other patients in their care vulnerable due to the staffing ratios.

Using the principles of RBC, where “resource driven practice is about clinical staff and managers sharing responsibility, authority, and accountability for the resources required to provide quality patient care” (Koloroutis, 2004, p. 184), the bridge of competence in nursing and shared resources for the care provided in the immediate postoperative period was embraced.

Social Justice

Patient safety was the number one goal of this SCP. In the ANA Code of Ethics (2001), the registered nurse is charged with promoting, advocating for, and striving to protect the health, safety, and rights of the patient. Nurses need to not only speak out when there are unsafe conditions, but to take responsibility for acting to make positive changes to make improvements. In addition to this advocacy role, nurses have the right to be given an assignment that is consistent with their skill and ability to manage the care of the patients assigned. For this project, the concern of the OR nurses for their competence in the PACU, and the concern for the floor nurses for their ability to adequately manage more than one patient in the immediate postoperative period were addressed. All patients have the right to safe, competent care and all nurses have the right to practice in an environment where this care can be delivered. Finally the gap between CRNA driven decision making versus RN decision making for patient disposition following surgery needed to be bridged to work toward more collaborative decision making for the benefit of not only the patient but the nurses caring for these patients.

Literature Review and Synthesis

To fully appreciate the issues related to answering the question of safety when bypassing Phase 1 recovery in the patient receiving a total joint replacement, evidence was reviewed in three categories: complications related to total joint arthroplasty, literature to support bypass of Phase I recovery, and any pertinent standards and guidelines.

The literature search was performed using CINAHL and PubMed with the parameters set at English language journals published within the last 5 years. Search terms included complications, total joint arthroplasty, bypass of recovery room, and fast-tracking. The term fast-tracking became problematic during the search as it was used to not only describe the process of bypassing the PACU, but also as a method of surgical procedures.

Complications Related to Total Joint Arthroplasty

The articles reviewed related to complications can be further categorized by those discussing the use of a scoring system to predict postoperative complications and the incidence and timing of postoperative complications.

Use of scoring systems to predict postoperative complications. Because patients with obstructive sleep apnea are at risk for increased postoperative mortality, Gali, Whalen, Schroeder, Gay and Plevak (2009) studied whether identifying patients preoperatively with the condition could lead to better management of these patients postoperatively. Types of surgery were included but the category of orthopaedics was insufficient to identify whether these procedures were for elective or emergent procedures. The description of inclusion included those with scheduled procedures and an anticipated hospital stay of greater than 48 hours. However, fractures are often now scheduled procedures and patients are less likely to be fully optimized medically before a fracture repair than for a total joint arthroplasty. Anesthesia was at

the discretion of the anesthesia provider, and 86% of patients received general anesthesia and 14% received regional anesthesia. The data were not analyzed by type of anesthesia and there was no standardization of medications used. Duration of surgery was summarized, but was not analyzed by length of surgery to see if respiratory events increased with increased length of anesthesia time. All patients in the study went to a Phase 1 recovery area. However, clearly there was sufficient evidence to support the overall conclusion that identifying patients preoperatively with obstructive sleep apnea may be useful in managing patients postoperatively given their known increased risk for complications.

Hwang et al. (2008) also looked at obstructive sleep apnea with similar conclusions. They enrolled patients who were willing to measure pulse oximetry at home prior to admission for elective surgery, then looked to see if these results could predict complications. Lacking in this study was the timing of the adverse events that were being studied. There was an assumption that all of the patients went to a Post Anesthesia Care Unit (PACU). However, it would be interesting to know if adverse events continued when the patients were taken to the next level of care.

Incidence and timing of postoperative complications. Of the six articles reviewed for this section, four were specific for samples of patients undergoing total joint replacement surgery. Gupta, Parvizi, Hanssen and Gay (2001) concluded that adverse postoperative outcomes occurred at a higher rate in patients with a diagnosis of obstructive sleep apnea. Memtsoudis et al. (2009) concluded that patients receiving bilateral total knee arthroplasties had more complications than those receiving unilateral arthroplasties. The study by Memtsoudis et al. (2009) was particularly difficult because the authors used a comorbidity index from another referenced study that made it difficult to understand the parameter of a comorbidity unit, while

concluding that the odds of perioperative mortality increased by every unit increase in comorbidity index. Mantilla, Horlocker, Schroeder, Berry and Brown (2002) determined that patients greater than 70 years of age had increased risk for adverse events which were more likely to occur during the hospital stay and rehabilitation phase. And finally Parvizi et al. (2007) looked at the rate of complications and whether they were predictable based on medical or history risk factors. While all of these studies were descriptive and helpful in raising concern about the risk of total joint arthroplasty surgery, they did not identify factors that identified whether the immediate postoperative period, or Phase 1, was a time for increased risk.

Taylor, Kirton, Staff and Kozol (2005) concluded that the first 24 hours after surgery represent the highest risk for postoperative complication and heavily focused on the relationship of pain control to adverse events. The average length of stay for the patients studied was over eight days and covered a large variety of surgery types. Type of anesthesia was not included in this study. Tarrac (2006) described postanesthesia complication rates but only looked at patients in the Phase 1 PACU. In her study, only 15.8% of patients received spinal anesthesia.

All of the studies reviewed involved large numbers, from 62 to over 600,000, giving strength to conclusions in each study. These studies also discussed complications. Discussion of complications varied from respiratory events alone as in the obstructive sleep apnea studies, to categorization by Memtsoudis et al. (2009) of device related complications, organ specific complications, and other organ specific complications. Mantilla et al. (2002) categorized complications as definite, probable, or no event. Parvizi et al. (2007) used the concept of systemic or local complications and further subcategorized these as major systemic complications. Tarrac (2006) used the term recovery impact event and categorized these further into interventions and major events.

In summary, while it is important to understand that there were many potential complications related to major surgery and specifically total joint replacement surgery, it was difficult to draw the conclusion that all patients should go to a Phase 1 recovery area due to the risk of these complications. The timing of these complications was not evident in this literature review. It was also difficult to ascertain if there were more complications due to type of anesthesia. Further research is needed related to complications occurring hour by hour following surgery and by anesthesia type. The literature was not sufficient to support or refute the need to go to a Phase 1 recovery area.

Analysis and Synthesis of Bypass Literature

The research related to the ability to bypass Phase 1 recovery and go directly to Phase 2 recovery was reviewed. All studies were supportive of bypassing Phase 1 recovery and reported successful bypass in patients in same day, or outpatient surgery samples. The rates varied from 16% bypass rate (Apfelbaum, et al., 2002), to 87% bypass rate (Williams et al., 2002). Only one study (Song, Chung, Ward, Yohendram & Sibbick, 2004), used a randomized control trial to evaluate the effects of PACU bypass on recovery time and nursing workload. The limitation of this study was that Song et al. only looked at ASA I and ASA II patients. ASA classification is a rating system, ranging from one to five, and was developed by the American Society of Anesthesiologists. Patients with an ASA score of I are the best candidates for sedation/anesthesia as they exhibit no organic, physiologic, biochemical or psychiatric disturbance. Patients with an ASA II rating may exhibit mild to moderate systemic disease that is well managed or controlled. Patients with an ASA III rating are considered less desirable and include those with hemodynamic instability, respiratory depression/failure, oxygen desaturation and obesity. Because Song et al. (2004) only studied patients with ASA classifications of I or II

and between the ages of 18-65 years of age who received short outpatient procedures, there was difficulty considering the relevance of the study to this SCP. However it is included as evidence that bypassing Phase 1 can be safely accomplished in some settings.

The type of anesthesia received was included in these studies and was an indicator of ability to bypass Phase 1 recovery. In the study by Williams et al. (2002), patients receiving regional anesthesia or sedation bypassed more frequently than those receiving general anesthesia. Twersky, Sapzhnikova and Toure (2008) excluded patients who received general or regional anesthesia and only included those that received local anesthesia and/or intravenous sedation. Duncan, Shandro, Bachand and Ainsworth (2001) reviewed only those receiving short acting anesthetics and did not consider regional anesthesia. There was lack of consistency across studies to strongly recommend bypass of Phase 1 recovery in all situations.

All five studies reviewed in this section used individualized author specific criteria for assessing bypass eligibility or success. Two studies used the Aldrete Score (Aldrete, 1998) which historically has been used to evaluate discharge readiness from Phase 1 and Phase 2 recovery. The Aldrete Score assesses 5 elements: respiratory effort, blood pressure, alertness, need for supplemental oxygen, and ability to move extremities. Each element is scored with 0, 1, or 2, with 2 being best. Apfelbaum et al. (2002), Duncan, Shandro, Bachand and Ainsworth (2001), and Twersky, Sapazhnikova and Toure (2008) assigned an Aldrete Score before leaving the operating room, but Duncan et al. (2001) added assessments of nausea, vomiting and pain to their assessment.

Williams et al. (2002) developed a bypass eligibility score that was specific for patients receiving regional anesthesia. This scoring is unique to the University of Pittsburgh and has recently been modified and was published in October 2011 (Williams and Kentor, 2011). The

specificity of these criteria gives excellent direction for assessing patients prior to leaving the operating room and was studied in 894 patients receiving outpatient lower limb surgery. The use of this score resulted in an 87% successful bypass rate.

In conclusion, there was research beginning to support bypassing Phase I recovery. It has been mostly done in low risk for complication samples of patients to show the ability to be successful. Williams et al. (2002) began to study same day surgery patients, but with specificity to regional anesthesia, such as spinal anesthesia, and developed specific criteria that can be used in higher risk patients. Of all the literature reviewed, this research has the most applicability to this systems change project for total joint replacement patients receiving spinal anesthesia and bypassing Phase 1 recovery.

National Practice Guideline Review

There are guidelines and statements to guide the decision making of whether patients can bypass Phase 1 recovery. The American Society of PeriAnesthesia Nurses (ASPAN) has a practice recommendation for fast-tracking, a term used synonymously with bypassing, the ambulatory surgery patient. Absent from this recommendation was language supporting a practice of fast-tracking a surgical inpatient. The practice recommendation states the need for careful patient selection, a collaborative approach among the perioperative team, and employing scoring systems as a way of assessing readiness for transition from one level of care to another (ASPAN, 2010). The practice recommendations are reviewed biannually by the Standards and Guidelines Committee of ASPAN. Present on this committee are nurse experts in perianesthesia nursing as well as nurse researchers and scholars within the specialty of perianesthesia nursing. The practice recommendation stops short of calling their recommendations a standard, thus leaving open the manager's decision to follow the recommendations. While the practice

recommendations are used by many who are in favor of as well as opposed to fast-tracking to give guidance, they stop short of making a statement strong enough to be universally adopted across healthcare delivery systems.

The American Society of Anesthesiologists (ASA) publishes standards of postanesthesia care, and implicit in these standards is the mandate that a PACU be available for all patients following surgical care. There is room within the standard to admit a patient to a level of appropriate care other than the PACU with a specific order from an anesthesiologist. Again, this statement falls short of making a recommendation for or against bypassing the PACU, but it does offer guidelines on how care is transferred from one level, the operating room, to the next level, the PACU. There was no mention in this standard about transfer of care to anywhere other than the PACU, thus it is implied that most if not all transfers of care will occur in the PACU (ASA, 2009). Because this is a standard and not a practice recommendation, the ASA document has a greater ability to be adhered to than the ASPAN recommendation, yet it also stops short of giving anything but an implied guideline for not bypassing the PACU. Absent from these standards was the mention of CRNAs, but there was mention of an Anesthesia Care Team.

Finally, the American Society of Anesthesiologists publishes practice guidelines for post anesthesia care. Within this guideline was a systematic review of literature. The guidelines were reviewed using the Agree appraisal instrument (Cluzeau et al., 2003) and the scoring for the instrument can be found in Appendix A. In general, there were many difficulties with some of the recommendations. For instance, stakeholder involvement was limited to anesthesiologists, and there were no references to certified registered nurse anesthetists, (CRNAs), or perianesthesia nurse experts. There was also available literature to support the presence of family members in the PACU, but this was absent in this guideline. Again in this guideline, like

the ASA standards of postanesthesia care, there was an assumption that all patients go to the PACU following surgery. There were many areas where the literature was insufficient or silent, or the members of the ASA were unable to agree on guidelines. Two conclusions can be drawn from this: there isn't enough research being conducted to support current practice, or the membership of the ASA is at odds on key practice issues. An example of the literature being absent or silent is to what degree voiding should be monitored postoperatively and whether a patient needs to void prior to discharge from the hospital. The Agree instrument asks to evaluate whether tools are evident. There were no tools offered in this guideline, yet there were two widely used assessment tools used in the PACU, one of which is the Aldrete Score. Costs were not addressed in this guideline, and again this is relevant as costs related to the place and type of care are very important considerations and have a perianesthesia impact. Finally, this guideline was published in the Anesthesiology Journal which makes it subject to bias and not necessarily easily accessible to all. Therefore, using the Agree criteria, these guidelines can only be recommended with the exceptions as noted above. There are still many areas within the guidelines where there is strong evidence to support practice regarding patients in the immediate postoperative period. While there was evidence to support bypass of the PACU in ambulatory surgery patients, much of it was published after this guideline was published. An update is necessary. There is a need for standardization of criteria used for assessments and discharge criteria across settings. There has been much work to improve practice and standardize treatment in other disciplines that was absent here. The dissent voiced among the reviewers who were surveyed for this guideline clearly indicates the need for a review.

Summary

In conclusion, Relationship-Based Care was already embraced by members of the interdisciplinary team involved in the care of patients receiving total joint replacements at this CAH, but needed to be further nurtured with the operating room nurses, CRNAs and inpatient nurses when decisions were made about the care of the patient in the immediate postoperative period. Kotter's change theory was applied for decision making in the changes needed as the hospital made decisions related to safety of care for total joint replacement patients in the immediate postoperative period. The available literature was equivocal when giving guidance to the practice, but is beginning to emerge. There were no firm guidelines for or against the practice of bypassing Phase 1 recovery in the inpatient setting, yet it was clearly supported in an ambulatory setting. The next phase of this project was to study the outcomes of the total joint patients more closely in the immediate postoperative period to help answer the question of whether practice was safe and can be recommended to others, or needed to be changed.

Chapter 3

Research Methodology

Introduction

In this chapter, information about participatory action research method, project design and methodology, and ethical considerations will be discussed.

Participatory Action Research

Because this Systems Change Project (SCP) involved current practice, it was important to utilize the participatory action research model to involve key stakeholders. While this project started out as a hope to justify current practice, there was the possibility that data would indicate a need for a practice change. Thus participatory action research methodology was utilized along with Kotter's theory of change (Kotter, 1996) and quality improvement models.

One resource teaches that “participatory action research has a capacity to challenge the structures of knowledge and power. Participation of key stakeholders, especially those who are usually excluded from decision-making about research leads to projects that are more relevant to the lives of ordinary people, while good participatory action research (PAR) is itself an empowering process” (Hughes in Reason and Bradbury, 2008, p. 592). This quote is especially relevant to this project, in that there was potential that the structures of knowledge and power would be challenged.

As the project was initiated it was clear that the stakeholders often acted in isolation of each other. While the decision of CRNAs was made to bypass the recovery room, the nursing capacity to care for these patients was disregarded. The surgeon was unaware of any issues or concerns from the nursing staff. Thus it was clear that it was important the researcher worked at engaging the three main stakeholders (exclusive of the patient) in dialogue to consider each

individual discipline within the multidisciplinary team considered in this research: surgeon, anesthetist and registered nurse. It would be important that individuals from these groups share their concerns and challenges with the care of the patient in the immediate postoperative period in a collegial manner. The tenets of participatory action research include systematic inquiry, professional practice intervention, and participation in decision-making by key stakeholders (Huges in Reason and Bradbury, 2006), so it was clear it was an appropriate methodology to employ.

Anesthesia providers would be interviewed on their comfort level and decision making with the current practice of bypassing Phase 1 recovery with total joint replacement patients who had spinal anesthesia. Nurses caring for the patients would be engaged in dialogue to express their concerns both with the level of care they were being asked to provide postoperatively on the inpatient unit and how they would be able to add the care of the patients in the PACU without changing how the unit was staffed.

Because the SCP included an extensive chart review, the researcher discussed the elements of the chart review and engaged the anesthetists regarding their ideas about additional items that should be collected from the charts. The inpatient supervisor was consulted to add ideas to strengthen the process.

Initiating the SCP

The researcher initiated this Systems Change Project (SCP) at a Critical Access Hospital (CAH), which is defined as having 25 inpatient beds, following conversations with operating room personnel from other organizations. During these conversations the researcher became aware that the practice of bypassing the PACU was not consistent with the practice of most hospitals either large or small. CRNAs in the study hospital indicated they felt that this practice

was safe for patients receiving spinal anesthesia if they didn't experience any complications during surgery. The perioperative registered nurses were cross-trained to care for patients in the operating room and in the PACU as is the practice in many Critical Access Hospitals. Because the hospital does not have an intensive care unit, patients were carefully selected for this setting. Patients who had a high likelihood of requiring intensive care nursing postoperatively were not cleared for surgery at this rural hospital because the facility does not have an intensive care unit or capability of caring for patients on a ventilator. Instead, these patients had the option of going thirty-five miles north to one of two tertiary care hospitals. Because the usual practice was that patients rarely go to the PACU following surgery for total joint replacement, staffing the PACU had not regularly occurred.

Perioperative nurses, who were cross-trained for surgical and recovery room nursing, had supported the practice of bypassing the PACU. On the rare occasions that the CRNAs were unable to accomplish spinal anesthesia or a patient suffered a complication intraoperatively and the patient needed the PACU, staffing of the PACU had to be arranged. There were no regularly scheduled PACU nurses for patients receiving total joint replacements due in large part to the perception that patients don't require Phase 1 recovery. In fact, the data showed that 7% of total joint replacement patients in this hospital went to the recovery room. Given that there were from 10-18 total joint surgeries performed each week, weeks went by when there were no total joint replacement patients in the PACU. Therefore, nurses became frustrated when they received news of a patient needing the PACU. A change in staffing was required to care for these patients and the nurses had some discomfort because their PACU nursing skills hadn't been frequently used. This response of the nurses further supported the CRNAs decision to bypass the PACU.

The in-patient nursing supervisor in this facility indicated that much of the time patients did very well postoperatively but there were times when the need for more intensive nursing care was required in the immediate postoperative period. This need could occur in the first hour following surgery or several hours after the patient was admitted to the inpatient unit. Also, registered nurses in hospitals in the region reported it was rare to bypass the PACU. One nurse from another hospital in the region reported they also bypass the PACU in similar circumstances, but they do not have the high volume of total joint replacements that the researcher's hospital had, and they staffed at a higher level; 1:1 or 1:2 nurse to patient ratio in the immediate post-operative period even though it occurs outside a PACU.

The orthopaedic surgeon in the facility had always been a proponent of his patients bypassing the PACU if the CRNAs felt it was safe. In fact, he promoted it to his patients. Per the surgeon, the patients reported a very high satisfaction rate with the entire surgical experience at the facility, which included satisfaction with their care from the surgeon, the CRNAs, the nurses, and the therapists. Bypassing the recovery room and early reunification with family members following surgery were among the many satisfiers for his patients.

Because the researcher had become aware that the practice in the hospital of study was different from others, in preparing for this SCP, the researcher visited with nursing leaders at other hospitals of similar size in the same region. Other than the other hospital in the region mentioned earlier who also bypasses the PACU with patients receiving spinal anesthesia, all hospitals sent their inpatients to the PACU before they were admitted to the inpatient unit. While at local, regional and national meetings, the researcher also asked questions of perianesthesia nurses, inpatient surgical nurses, surgeons, anesthesiologists and anesthesiologists about the ability of a patient to bypass the PACU and go directly to an inpatient unit. The

networking that took place in these conversations further led the researcher to question the safety of current practice as well as to question whether broad practice recommendations could be followed in all settings.

In the researcher's facility, the PACU and operating room were only a short distance away from the inpatient unit. A site visit was made to a larger institution where the distance between the operating room, PACU and in-patient unit would make it very difficult for anesthesia providers who are busy in the operating room and PACU all day to effectively manage patients in the inpatient unit. The inpatient unit in the site visit hospital was very large, and it would be difficult in that setting for a nurse to manage a fragile postoperative patient. In fact, the inpatient nursing supervisor of this unit indicated that several years ago there was an increase in complications following surgery, and after careful chart review they concluded that the patients were coming to the floor too soon and they actually advocated for a longer stay in the PACU. One anesthesiologist, when asked about the practice of bypassing the PACU, indicated that for him it was more about the patient being taken to a place where the appropriate care could be provided.

Finally, the researcher investigated the practice of bypassing the PACU at national meetings. At a conference of the American Society of PeriAnesthesia Nurses (ASPN) in Seattle, WA in April 2011, the researcher learned that Phase 1 and Phase 2 recovery were not about a place, but about a level of care. At this same conference, the researcher networked with many perianesthesia nurses and nursing leaders. While there was support for bypassing Phase 1 recovery in ambulatory surgery patients, these individuals stated that bypassing Phase 1 recovery for patients who were to be admitted to an inpatient unit was not acceptable practice. This

experience further led the researcher to ask the question of whether the facility of study was a pioneer in their practice or whether the practice was unsafe.

Project Design and Methodology

The purpose of this retrospective chart review was to analyze data of patients receiving total joint replacement surgery under spinal anesthesia in a Critical Access Hospital in the Midwest who had bypassed Phase I recovery in the past six months. There was a history of over 12 years of practice of bypassing Phase 1 recovery in this hospital accompanied by nationally recognized positive patient outcomes. By applying discharge criteria from Phase I recovery to this data set, it was hypothesized that practice recommendations could be developed that would include patient safety guidelines and safe staffing levels. All charts of patients who received a total knee arthroplasty (TKA), total hip arthroplasty (THA), and bilateral knee arthroplasties (BTKA) from January through June 2011 were reviewed. The following data were abstracted and recorded:

- ASA score (a score assessed by the anesthesia provider to place patients in a risk category prior to the induction of anesthesia)
- Patient age
- Patient vital signs: temperature, pulse, respiratory rate and blood pressure following surgery. (In addition to these vital signs, a Mean Arterial Pressure [MAP] was calculated. MAP was not currently calculated but it was hypothesized that it may be a relevant indicator of patient safety related to hypotension or hypertension)
- Height and weight from which body mass index (BMI) were calculated
- Aldrete score
- Incidence of nausea, vomiting, itching, and level of pain

- Length of surgery
- Blood loss during surgery
- Need for oxygen supplementation to maintain acceptable oxygen saturation.

Once data were abstracted they were entered into an Excel spread sheet and then entered into SPSS software for further analysis.

Chart Review

Institutional Research Board (IRB) approval was obtained from St. Catherine University. Permission to perform this review was also obtained from the Chief Financial Officer and Safety Officer of the hospital because this hospital did not have a formal process for review of research.

The chart review was conducted with the help of medical records staff in the hospital. The support of the Health Information Manager was secured to negotiate the cooperation and time of medical records staff.

Timeline

In fall 2010, the researcher met with her advisor and site mentor and established relationships with personnel who would be stakeholders in the project: CRNAs, inpatient surgical supervisor, administrative team, nursing manager, chief operating officer (COO), and chief executive officer (CEO). There was collective support by everyone who was contacted about this project. The researcher was aware that the CRNAs were defensive about anything that challenged their autonomy so was concerned from the outset of this project that there would be conflict. However, out of respect for their advanced practice and autonomy, and commitment to being a servant leader, the researcher chose to have collegial conversations about findings from the literature. These conversations were held in the CRNAs' offices. There were especially rich conversations about the value of the blood pressure assessment in the Aldrete score. The

researcher shared her concern that this assessment was often not helpful, as patients seem to have a higher than baseline blood pressure on admission, often related to anxiety. Yet this assessment was used because it was available. We all agreed that using a mean arterial pressure would be a more valid indicator in our patient population who often had some degree of hypotension. The researcher intentionally engaged CRNAs in these conversations in an effort to not polarize efforts in case it was ultimately decided to recommend a change in practice. In spring 2011 a literature review was conducted and IRB process completed. Data were collected in summer 2011 and analyzed in fall 2011.

Budget

No additional funds were required for this project other than the researcher's time and in-kind time from staff involved in the project.

Ethical Considerations

An overriding question to this project was what if no changes were made? What risks would remain following obtaining information that there were no studies or guidelines defining the practice at this hospital? What if nurses failed to rescue a patient on the floor and it was determined that the patient was in a vulnerable state following surgery and the nurse to patient ratio was inadequate to carefully monitor the patient?

While it is difficult to find the true cost of the failure to treat a patient in this setting, Allecia (2008) reports the rate of patient safety issues is about 3% of all Medicare hospitalizations. A significant portion of all total joint replacement surgeries are provided to Medicare eligible patients. The cost of a wrongful death can be as high as \$1.25 million (Allecia, 2008). Clearly a move to increase patient safety by increasing the nurse to patient ratio in the

first hour after surgery was not only budget neutral, but it actually far exceeded the potential cost of a negative outcome for the total joint replacement patient.

While the anesthesiologists expressed resistance to looking at this because the overall outcomes were good, the researcher felt it was important to secure patient data during the fragility of the immediate post-operative period to see if it would be important to increase the staffing ratio in the inpatient unit or if it validated the nurses' concern that patients were too fragile to consistently bypass Phase 1 recovery.

If the data showed a need for more care, then whose burden is it to care for these patients immediately postoperatively? By taking the patients to the PACU a charge will be incurred, which raises the total cost of the hospitalization. This increase in cost is and should remain a very compelling concern in an era when healthcare costs should be minimized when at all possible. If the issue is increased vigilance by nurses, can it be accomplished in the inpatient setting with 1:1 nursing care in the first hour? This ratio will accomplish the level of care needed, but it cannot be billed for if it doesn't occur in a true PACU setting

In summary, the participatory action research process was utilized to engage the key stakeholders in this SCP. Further, the data elements to be retrieved in a retrospective chart audit were described along with a timeline and budgetary components.

Chapter 4

Data Analysis

Introduction

In this chapter, the data from the retrospective chart review will be described along with information from key stakeholders in the participatory action research process.

Chart Review Results

In August 2011 all charts (N=186) of patients receiving total joint arthroplasties were reviewed. These total joint arthroplasties included total knee arthroplasty (TKA), total hip arthroplasty (THA), and bilateral total knee arthroplasty (BTKA). Once all of the data were abstracted from the charts, further inspection excluded 12 charts (7%) where patients received general anesthesia, and 6 (3%) charts due to missing data. With these exclusions, there were 168 (93%) charts that met the inclusion criteria of all patients receiving primary total joint replacement under spinal anesthesia, who bypassed Phase 1 recovery between January and June, 2011. Data elements were collected from documentation in the first 60 minutes that the patient was assessed while in the inpatient room using the Phase 2 nursing documentation tool (Appendix B). A thorough review of these data and discussion on the implications of the findings follows.

Demographic Data

The age range of the sample was from 35 years to 84 years with 108 females and 60 males. There were 109 TKAs, 43 THAs, and 16 BTKAs.

Physiological Data

While data for pain, itching and nausea and vomiting were collected, there was a low incidence of these occurrences: 11 (5.4%) of patients complained of pain with a level of 4 or

greater on a 10 point scale, 3 (1.5%) of all patients complained of itching, and 11 (5.4%) complained of nausea. The most significant findings were related to low Aldrete Score and decreased mean arterial pressure, MAP. Comparison of Aldrete Score and other variables will be discussed followed by discussion of MAP.

Aldrete Score

The Aldrete score has been widely used to measure patient's readiness to be discharged from one phase of recovery to another. Six months prior to beginning this data collection, a competency assessment for the Aldrete score was written and all nurses doing Phase 1 and Phase 2 recovery were required to complete and maintain this competency. The Aldrete score is comprised of five assessments: activity, respiration, circulation, consciousness, and oxygenation. Each element is assigned a score of 0, 1, or 2 based on guidelines specific for each element. In this institution, orders were written by CRNAs to discharge patients from Phase 1 recovery (PACU) when a patient achieved an Aldrete score of 8 or better. For this reason, an Aldrete score of 7 or less in the first hour was used to see if patients in Phase 2 recovery, which occurs in the inpatient setting, had scores lower than what were used to discharge patients from Phase 1.

Surgery Type

Aldrete scores by surgery type are displayed in Table 1.

Table 1
Aldrete Scores by Surgery Type

Surgery	n	Aldrete ≤ 7	% A	% B	Aldrete ≤ 6	% A	% B
BTKA	16	7	43.8	4.2	3	18.8	1.8
THA	43	23	53.5	13.7	6	14	3.6
TKA	109	36	33	21.4	9	8.3	5.4
total	168	66		39.3	18		10.7

Please note.

- n= total number in sample in each age range
- %A is total percent within the surgery group exhibiting the condition (% of BTKAs having the surgery exhibiting an Aldrete score of ≤ 7 /6)
- % B is total percent of the sample exhibiting the condition (% of all surgeries, BTKA, THA and TKA exhibiting the condition)
- Aldrete ≤ 7/6 = an Aldrete score less than or equal to 7 or 6 in the first hour after the patient was admitted to the inpatient floor.

By surgery type, THAs had the lowest Aldrete scores with 23 (53.5%) having a score of 7 or less. Of the THAs, 6 (14%) of the THAs had a score of 6 or less. BTKAs had the next lowest scores, with 7 (43.8%) having an Aldrete of 7 or less and 3 (18.8%) with a score of 6 or less. Finally, 36 (33%) of TKAs had Aldrete scores of 7 or less and 9 (8.3%) had scores of 6 or less. In the total study population of 168, 66 (39.3%) had Aldrete scores less than or equal to 7, and 18 (10.7%) had scores of 6 or less. It is interesting to note, that while THAs had the highest rate of an Aldrete score of 7 or less, BTKAs had a higher rate of Aldrete score of 6 or less. The findings are consistent in many ways with what others have found in similar work. In particular, Tarrac (2006) who studied patients in a Phase 1 recovery unit describes an overall complication rate for orthopaedic surgeries of 14%, in contrast to this study which has an overall complication rate of 39.3% when using the Aldrete benchmark.

The findings in this study of complications were higher in bilateral total knee arthroplasty (43.8%) vs. unilateral knee arthroplasty (33%) as measured by a lower Aldrete score is consistent with Memtsoudis et al.(2009). In their study of complication rates, which were much more

severe and included the entire hospital stay, the authors reported a higher rate of complications between bilateral total knee arthroplasty (9.45%) vs. unilateral knee arthroplasty (7.0%).

Age

Age and Aldrete were compared and these results appear in Table 2.

Table 2
Aldrete Scores by Age

Age	n	Aldrete ≤ 7	% A	% B	Aldrete ≤ 6	% A	% B
30-39	3	0	0	0	0	0	0
40-49	10	5	50	3.0	1	10	6
50-59	52	18	34	10.7	6	11.5	3.6
60-69	64	25	39	14.9	7	10.9	4.2
70-79	27	10	37	6	2	7.4	1.2
80 ->	12	8	67	4.8	2	16.6	1.2
Total	168	66		39.3	18		10.7

As illustrated in Table 2, this comparison did not show any strong correlation. While the range of age was from 35-84 years of age, 143 (85%) were between 50-79 years. The 80+ year age group had the highest percentage within the age group of Aldrete score of 7 and 6 or less with 67%, followed by the 40-49 year age group with 50%. However it should be noted that this was a very small group with only 5 in the sample studied being in the 40-49 year age range.

ASA Score

ASA score, the score assessed by CRNAs prior to surgery and used to identify risk, is as follows: 1 being a healthy individual, 2 being a person with mild to moderate systemic diseases that are well controlled, and 3 being a person with severe systemic disease such as angina, poorly controlled hypertension, symptomatic respiratory disease, renal disease and massive obesity.

The ASA risk classification also has a category for 4 and 5, but these patients were not accepted for surgery in this hospital. Table 3 displays the relationship between Aldrete and ASA scores.

Table 3
Aldrete and ASA Scores

ASA	n	Aldrete ≤ 7	%	Aldrete ≤ 6	%
1	28	9	32.1	3	10.7
2	93	38	40.9	10	10.7
3	47	19	40.4	5	10.6

Interestingly, while ASA score is used to identify complexity as it relates to pre-existing medical conditions that may increase the risk of surgery, the percentage of patients in the sample with Aldrete scores of ≤ 7 or 6 were fairly evenly distributed with as many patients with an ASA score of 2 (40.9%) having lower Aldrete scores as those with an ASA of 3 (40.4%). One would also expect a very low rate of ASA 1 scored patients to have complications, however in this sample 32.1% of the patients had Aldrete scores ≤ 7. There was an even distribution at 10% of patients having an Aldrete score ≤ 6.

Body Mass Index (BMI)

Body mass index, BMI, was evaluated in relation to Aldrete scores. To calculate BMI, the following formula was used: weight in pounds x 703 ÷ height in inches². This information is displayed in Table 4.

Table 4
Aldrete Scores and Body Mass Index

BMI	n	Aldrete ≤ 7	%	Aldrete ≤ 6	%
10-19	3	1	6	0	0
20-29	56	24	15	6	3.8
30-39	66	24	15	6	3.8
40-49	32	11	6.9	4	2.5
50 or >	3	1	.6	1	.6

As illustrated in Table 4, the majority of patients in this group (N=122) had a BMI of 20-39. In addition, 48 (30%) of these patients had an Aldrete score of 7 or less and 12 (7.6%) had an

Aldrete score of 6 or less. There was no associated increase of nursing interventions as measured by this data collection and low Aldrete scores with an increase in BMI.

Length of Surgery

Per hospital protocol, length of surgery (LOS) in this institution is defined as the time from incision until the time when dressings are applied.

Table 5
Aldrete Scores and Length of Surgery

LOS	n	Aldrete ≤ 7	%A	%B	Aldrete ≤ 6	%A	%B
0-119	116	44	37.9	26.2	13	11.2	7.7
120-179	47	19	40.4	11.3	5	10.6	3
180-240	5	3	60	1.8	0	0	0

Length of surgery predictably showed an increase in rate of patients with Aldrete scores of 7 or less. The largest number of patients (N=116) had surgeries that lasted 119 minutes or less. This group had the lowest rate of Aldrete scores of 7 or less. For patients whose surgery lasted between 120-179 minutes, (N=47) 19 (40.4%) had an Aldrete score of 7 or less. Finally, 5 patients in the sample had a surgery lasting 180 -240 minutes and 3 (60%) of these had an Aldrete score of 7 or less. This pattern was not the same for patients with an Aldrete score of 6 or less. Of these, 13 (11.2%) patients with surgery lasting 0-119 minutes and 6 (10.6%) patients with surgery lasting 120-179 minutes or less had an Aldrete score of 6 or less. None of the patients with longer surgeries had an Aldrete score of 6 or less.

Estimated Blood Loss (EBL)

CRNAs document estimated blood loss during surgery. In this study, EBL was less than 500 ml in 161 of the studied patients. Data comparing EBL and Aldrete score appears in Table 6.

Table 6
Aldrete Scores and Estimated Blood Loss

EBL (ml)	n	Aldrete ≤ 7	%A	%B	Aldrete ≤ 6	%A	%B
0-499	161	61	37.9	36.3	17	10.6	10.1
500 or >	7	5	71.4	3	1	14.3	.6

As illustrated in Table 6, 61 (37.9%) had an Aldrete score of 7 or less and 17 (10.6%) had an Aldrete score of 6 or less. While there were only 7 patients in the sample with an EBL of 500ml or more, 5 (71.4%) of these had an Aldrete score of 7 or less, with 1 (14.3%) having an Aldrete score of 6 or less.

Analysis of Aldrete Score Results

Drawing conclusions from Aldrete scores is difficult, as the score itself is multifactorial. However, each individual element of the Aldrete score requires assessment and some nursing and/or medical intervention. For instance, if the patient is unable to move lower extremities, spontaneously or on command, a score of 1 is given and the patient has safety needs and often cannot assist in voiding. Many patients can wiggle their toes or begin to lift their legs at the end of surgery, an indication that the spinal anesthesia is receding, but they are not able to independently maintain safety related to ability to reposition, move without assistance, or feel discomfort. Respirations are always intact when a patient bypasses the PACU, but if a patient is sleepy, they may not be able to cough and deep breathe, and need frequent reminders to breathe deeply. Often this breathing incapability is related to previously diagnosed or undiagnosed obstructive sleep apnea, a dangerous condition if not monitored closely in a postoperative patient. If a patient is unable to keep their oxygenation saturation level above 92%, which is another assessment in the Aldrete score, supplemental oxygen is needed and the patient requires closer monitoring. Circulation, another component of the Aldrete score is calculated as a ratio

from the patient's baseline which is obtained on admission. For instance, if a patient has a systolic blood pressure that is $\pm 20-50\%$ of their baseline, they are scored at a 1. If they have systolic pressure that is $\pm 50\%$ of their baseline, they score a 0 and intervention is needed, often in this case, a fluid bolus. The patient's ability to maintain oxygen saturation is an assessment that is based on whether the patient can maintain oxygen saturation of $> 92\%$ without supplemental oxygen. If the patient needs oxygen they are scored at a 1, if the patient needs more respiratory support than oxygen via nasal cannula, they score a 0 in this category. Consciousness is the 5th element assessed. If a patient is only aroused when being called by name, they receive a 1, if they need to be shaken to awaken or more, they are scored a 0. To reach a score of 7 a patient has to have at least 3 areas where a 1 is scored, which increases the need for close monitoring and increased nursing intervention.

Mean Arterial Pressure (MAP)

Mean arterial pressure was also calculated due to the perception by nursing staff that most of the issues with patients following surgery were related to hypotension. Mean arterial pressure (MAP) is used by clinicians to evaluate the perfusion of vital organs. When blood pressure is low, MAP provides a better indication than either systolic or diastolic pressure of whether a person's brain and vital organs are sufficiently perfused. Normal MAP is approximately 70-105 mmHg. The literature debates the exact level at which MAP becomes critical, but it is generally understood that a MAP of 60mmHg represents a critical measurement level (Ferns, 2010).

When abstracting MAP data from the chart, patients had to have at least one MAP of ≤ 63 or ≤ 60 to be counted. A comparison of MAP and Surgery Type appears in Table 7.

Table 7
Mean Arterial Pressure by Surgery Type

Surgery	n	MAP ≤ 63	%A	%B	MAP ≤ 60	%A	%B
BTKA	16	7	43.8	4.2	5	31.3	3
THA	43	9	20.9	5.4	7	16.3	4.2
TKA	109	16	14.7	9.5	9	8.3	5.4
total	168	32		19	21		12.5

Please note.

- n= total number in sample in each age range
- %A is total percent within the surgery group exhibiting the condition (% of BTKAs having the surgery exhibiting an Aldrete score of $\leq 7/6$)
- % B is total percent of the sample exhibiting the condition (% of all surgeries, BTKA, THA and TKA exhibiting the condition)

In contrast to the Aldrete scores, the type of surgery with the highest incidence of low MAP was BTKAs. Of this group, 7 (43.8%) had a MAP of ≤ 63 in the first hour, and 5 (31.3%) had a MAP of ≤ 60 . The next most frequent were the THAs with 9 (20.9%) with a MAP of ≤ 63 and 7 (16.3%) with MAP ≤ 60 . Finally the TKAs fared the best with 16 (14.7%) with MAP ≤ 63 and 9 (8.3%) with MAP ≤ 60 .

Tarrac (2006) addressed hypotension in her study of postoperative complications and set her criteria for hypotension as a MAP of < 60 mmHg. In her study, only 6.5% of her total sample exhibited hypotension. In the group of patients with hypotension in her study, 44% of them had total knee replacement. In this study the rate of patients with hypotension was much higher at 12.5%.

Age

MAP and age are compared in Table 8.

Table 8
Mean Arterial Pressure and Age

Age	n	MAP ≤ 63	%	MAP ≤ 60	%
30-39	3	0	0	0	0
40-49	10	2	1.2	0	0
50-59	52	11	6.5	8	4.8
60-69	64	14	8.3	11	6.5
70-79	27	4	2.4	2	7.4
80 ->	12	1	6	0	0
Total	168	32	19	21	12.5

Age and MAP in this sample show the same trend as age and Aldrete score with the majority of patients with MAP ≤ 63 or 60 being in the mid- range of age; 50-79 years of age. Overall, 32 (19%) of all patients had a MAP ≤ 63, and 21 (12.5%) had a MAP of ≤ 60.

ASA Score

MAP and ASA scores are displayed in Table 9.

Table 9
Mean Arterial Pressure and ASA Score

ASA	n	MAP ≤ 63	%	MAP ≤ 60	%
1	28	8	4.8	5	17.9
2	93	18	10.7	12	12.9
3	47	6	3.6	4	12.5

The results in this sample related to mean arterial pressure and the ASA score are actually counterintuitive. It would be expected that a patient with a higher ASA score, which indicates a patient with co-morbid health conditions, would have a higher incidence of any complication. However, in this sample the opposite is true. The highest incidence of a MAP ≤ 60, 5 (17.9%) patients had an ASA score of 1, while the highest incidence of a MAP of ≤ 63 was in the patient group with ASA scores of 2, 18 (10.7%).

Body Mass Index

As with the Aldrete score, BMI showed no strong trend with MAP as illustrated in Table 10 with the incidence being distributed throughout the range of BMIs.

Table 10
Mean Arterial Pressure and Body Mass Index

BMI	n	MAP ≤ 63	%	MAP ≤ 60	%
10-19	3	1	.6	1	.6
20-29	56	13	8.1	5	3.1
30-39	66	9	5.6	8	5
40-49	32	6	3.8	4	2.5
50 or >	3	1	.6	1	.6

Length of Surgery (LOS)

LOS and MAP are compared in Table 11.

Table 11
Mean Arterial Pressure and Length of Surgery

LOS	n	MAP ≤ 63	%A	%B	MAP ≤ 60	%A	%B
0-119	116	20	17.2	11.9	16	13.8	9.5
120-179	47	11	23.4	6.5	4	8.5	2.4
180-240	5	1	20	.6	1	25	.6

As with the Aldrete score group, length of surgery showed a higher percentage of patients with MAP issues in the category of 180-240 minutes, but there were only 5 patients in that category, with 1 (20%) having MAP ≤ 63 and 1 (25%) having MAP ≤ 60. While most patients, 116, had surgery that lasted between 0-119 minutes, 20 (17.2%) in this category had a MAP ≤ 63, and 16 (13.8%) of them had a MAP ≤ 60. Of the 47 patients who had surgery lasting 120-179 minutes, 11 (23.4%) of them had MAP ≤ 63, and 4 (8.5%) of them had MAP ≤ 60.

Estimated Blood Loss (EBL)

Finally findings related to estimated blood loss, EBL and MAP are displayed in Table 12.

Table 12
Mean Arterial Pressure and Estimated Blood Loss

EBL (ml)	n	MAP ≤ 63	%A	%B	MAP ≤ 60	%B	%B
0-499	161	31	19.3	18.5	21	13	12.5
500 or >	7	1	14.3	.6	0	0	0

Unlike the Aldrete score, $EBL \geq 500$ ml did not correlate with a higher rate of $MAP \leq 63$ or ≤ 60 . Of the 161 patients with $EBL \leq 499$ ml, 31 (19.3%) had a $MAP \leq 63$, and 21 (13%) of them had an $MAP \leq 60$. Of the 7 patients with $EBL \geq 500$ ml, 1 (14.3%) had a $MAP \leq 63$, and none had a $MAP \leq 60$.

Analysis of Mean Arterial Pressure Findings

This study did not replicate any previous studies of postoperative complications, but it supports the finding of others. In particular, Parvizi, et al. (2007), who studied the timing of near-fatal complications in total joint arthroplasty patients, found that nearly all of them occurred in the first 2 days following surgery, and that more than half (58%) couldn't have been predicted by preoperative status of the patient. They concluded that all of the complications had the potential to be life-threatening and required emergent medical intervention in the form of medications and close monitoring. These authors listed hypotensive crisis as a major complication but failed to define the hypotensive crisis, so it is difficult to make a comparison on the incidence.

Results from Participatory Action Research Process

While the stakeholders were involved throughout the process, as the study findings were revealed there was still resistance to making needed changes which is consistent with what is

expected in Participatory Action Research and was supported by the uniqueness of the hospital. This small rural hospital has highly specialized inpatient surgical nurses, who are highly competent in orthopaedic postoperative care, but feel less competent in the specific skills required in the PACU because that type of care is infrequently needed. However, the evidence presented in this study reveal a much more vulnerable patient population than anyone realized. The incidence of hypotension alone was enough to justify a higher level of nursing care in order to adequately monitor and intervene in the patient with a MAP of ≤ 60 mmHg. The Aldrete score was used because it was a combination of 5 assessments, all of which required nursing observation and intervention.

Currently the staff is at an impasse with this decision. The anesthesiologists and operating nurses strongly resist the idea of taking all patients to the PACU. The anesthesiologists resist because they don't agree with the change being warranted and the operating room nurses resist because they don't feel adequately staffed or competent to provide the care. The researcher has left employment at this facility, but the work of the project continues. The researcher is in contact with the inpatient surgery supervisor who has tried to make the needed changes happen and agrees with the need for a higher level of nursing care. Because of this, she is implementing 1:1 nursing care on the floor in the first thirty minutes after the handoff of care from the CRNA and the operating nurse.

In summary, Participatory Action Research methodology was used to frame the work of this systems change project. The key stakeholders were involved, and were included in the formulation of the research question and what data to collect to study the question of safety in the immediate postoperative period. Data were collected, analyzed and reported to the stakeholders in the small rural hospital. While the researcher has left employment at this

hospital, the data collected and presented are being used to move forward with needed changes to improve patient safety.

The next chapter will further discuss the implications of this study and the current status of the systems change project.

Chapter 5

Introduction

In this chapter, the findings and outcomes will be discussed along with what has been learned from this SCP. In addition, recommendations for future study and the implications of this SCP for the DNP will be discussed.

Discussion

Overall, there was a much higher incidence than anticipated of conditions requiring an increased level of monitoring and/or nursing intervention as indicated by the data collected. Nurses on the inpatient unit were well equipped with skills and competencies to manage these patients, but had not felt supported when they raised concerns about the level of care some of the patients required following surgery. Because the nurses were excellent and persistent in contacting anesthetists who managed the patients in the immediate postoperative phase to write needed orders, there was no recognition by the surgeon that there might be a problem. When this project first began, the researcher had hypothesized that there may be an ability to share with others the safety of bypassing Phase 1 recovery in a similar setting, where the hospital is small and the nurses are highly specialized. However given what these data show, this researcher concludes that it is not wise to hold ourselves as exemplars by bypassing the PACU in this very specific set of patients. In fact, it is imperative to advocate for a change in the practice of bypassing Phase 1 recovery for any patient receiving a total joint replacement under spinal anesthesia in the hospital of study. This project ends for the researcher but continues in the facility and is where Kotter's next stages of change theory are being employed. A guiding coalition, Kotter's second stage, was formed with the inpatient nursing supervisor, a perioperative RN with expertise and comfort in PACU nursing, the hospital nursing manager, the

head of the anesthesia department and the surgeon. While the anesthetist was in opposition to having all patients go to the PACU related to the increased cost to the patient, he did not deny the need for an increase in the level of nursing care in the immediate post-operative phase. The surgeon was initially reticent to make the change related to patient satisfaction with early reunification with family members, but became supportive of the change related to patient safety. The nurses persisted and began making plans to ready the PACU for increased use. There was a vision for how the care would be given, Kotter's third stage. The lead perioperative nurse spent time in the inpatient unit learning care specific to total joint replacement patients so that she could add this knowledge to her PACU expertise and serve as a resource to the other perioperative nurses. However, a major roadblock occurred when the hospital nursing manager wanted the change to be made without increasing nursing staffing. This decision by the nursing manager is where the change has floundered. The perioperative nurses, who have lost their supervisor to a job change, this researcher, feel strongly that they do not have enough staff to continue their current workload and assume the care of all total joint patients going to the PACU. The perioperative nurses have not successfully made the case to the hospital nursing manager, which is coupled with resistance from the anesthetists to make use of the PACU for this change. Therefore, there is no true empowerment from nursing to make a broad-based change, even though there is recognition that a change needs to occur. Fortunately, the inpatient nursing supervisor is willing to increase staffing in the immediate postoperative phase, currently Phase 2, on the inpatient unit to 1:1 nursing in the first 30 minutes following admission to the floor. This change will hopefully generate a short-term win, Kotter's eighth stage, and the guiding coalition can be unified by recognizing that the care needed is not predicated on a place, but a level of nursing care.

Recommendations for Further Research

It is postulated that nurses will have an increased sense of being able to perform their job well when patients are appropriately and safely cared for following surgery. Nurses will also feel a sense of empowerment by driving a practice change related to patient safety using data and cost-benefit analysis tools to present the need. While nurse satisfaction and empowerment were not measured in this project, it would be a compelling study to measure nursing satisfaction and empowerment before and after the change.

The participatory action research steps of professional practice intervention and participation of the key stakeholders are ongoing in this project. Based on the results of the data collected, the researcher has recommended that all patients receive 1:1 nursing care in at least the first hour postoperatively. There is opposition to this recommendation that is not about agreeing to do the care, but where it should occur and by whom. The staffing for this change has not been resolved. There is also concern from the anesthesiologists that the moral imperative is not to increase the cost of healthcare by taking the patients to the PACU and they advocate that incurring an added expense to the patient outweighs the need to take the patients to the PACU. To be clear the anesthesiologists are not in opposition to providing 1:1 care and do not dispute the results of the data, they just don't want to raise the cost of healthcare to the patient. This places a burden on nursing administration to increase staffing ratios without being able to bill for the added care. The surgeon also agrees that the staffing ratio needs to increase. Unfortunately, because this project was set up as an individual effort, the collaboration needed to make the changes is floundering related to a change in nursing management. The stakeholders; inpatient nurses, perioperative nurses, anesthesiologists and the surgeon don't meet formally to negotiate the change

and the current nursing manager for the organization is not driven to foster this interdisciplinary dialogue.

Recognizing that nurses had concerns about competence in the PACU, the ASPAN core competency program was purchased and assigned to be completed over a one year span for all perioperative nurses. This program was met with appreciation by the perioperative nursing staff who to date hadn't had a formal competency program developed for the PACU. This competency program was also made available to the inpatient nursing staff caring for postoperative patients.

These data make the case for needing a higher level of nursing care in the immediate postoperative period. The issue is not blame or remorse for the fact that there needs to be a change, but the importance of knowing where and by whom the care will be provided. The literature and this study clearly reveal the potential for complications in surgical patients, and the need to closely monitor the orthopaedic total joint arthroplasty patient in the early post-operative time period. However, the literature and these data also support that complications cannot always be predicted based on preoperative status. The fact that the patients at the hospital of study have overall lower complication rates is a tribute to the entire healthcare team, anesthesia providers and nurses included. Reconciling these emotions will be important to make the changes needed to increase the level of nursing care in the immediate postoperative period. While initially the key stakeholders were not formally engaged in the project, once the results of the data collection were analyzed there has been healthy debate on what to do now that the results are known. There is consensus from all that the level of care needs to increase, and there is healthy ongoing debate on how this level of care will be accomplished.

While the results of this chart review have answered many questions related to the safety of care for the patients studied, it would have been helpful to have more data abstracted. For instance, if the data abstraction tool had been set up to collect data related to the patient's status intraoperatively, many higher level questions that have arisen from the CRNAs and surgeons could have been answered. Examples of questions from CRNAs and surgeons were: What support for blood pressure was required intraoperatively and did this impact later blood pressure issues? How much and what type of fluid volume support was used intraoperatively and how did this impact later blood pressure issues? Did the actual level of where the spinal was receding impact the issues with blood pressure? Did patients who received more sedation during surgery in addition to the spinal anesthetic have more Aldrete score issues related to respiratory status and level of consciousness issues? In addition to the questions from CRNAs and surgeons, it would have been helpful to survey nurse attitudes about the safety of patients during the immediate postoperative hour.

Implications for Practice

There have been many concerns raised throughout this project. Initially when it was started, the three anesthetists were queried about how they felt about the post-operative care practices in this hospital. CRNAs felt confident in the way patients were managed and felt that the nurses on the floor were highly competent and knew when to seek further input from them if patients had issues in the immediate postoperative period. CRNAs felt they were appropriately selecting patients to bypass Phase 1 recovery, and using the PACU when patients experienced complications during surgery. One of the anesthetists, who began practicing at this hospital immediately following his CRNA education admitted to being surprised at the practice of bypassing the PACU as frequently as was done here, but gained confidence in it being of value

as his confidence in the inpatient nursing staff grew. When the researcher became more familiar with the MAP being a more sensitive indicator of a patient's cardiovascular status than a simple blood pressure, there were collegial discussions as to its' value in this hospital setting.

Preliminary results from the researcher's data collection were shared individually with each anesthetist. CRNAs admitted surprise at the results but did not refute that there should be a higher level of nursing care. They didn't see this as necessarily a competence issue, as they had confidence in the nursing staff caring for these patients and in the nurse to patient ratio in the first hour following surgery. The anesthetists and the researcher also felt that in many ways the inpatient nurses were better equipped to care for the patients in the immediate postoperative period because they had such specialized competence related to specific care needed for total joint replacement patients that the PACU nurses do not possess. The results were also shared with the orthopaedic surgeon who was very concerned and wondered why he wasn't more aware of his patients having issues immediately postoperatively. This disparity in the surgeon's unawareness of the fragility of the patients during the immediate postoperative hour can be explained by the anesthetists managing all issues while, he, the surgeon, continued operating. He also admitted to surprise because when he rounded on his patients later on the day of surgery they seemed to be stable. There were times when patients had issues later, and he was aware of those. This lack of awareness of issues immediately postoperatively, in part, can be explained by all of the documentation being in nursing chart forms, and the orders used to manage most of the issues were given by the CRNAs. These often included fluid boluses for low blood pressure, which is anticipated, and does not necessitate a call unless the issue isn't resolved.

The final issue to be worked out is not if, but where this level of care will be given. As stated earlier in this paper, perhaps sending all patients to a PACU and increasing the cost of care

to the patient is problematic in a time when the rising costs of healthcare are being scrutinized. The cost benefit of caring for all patients in the PACU following surgery can be found in Appendix C. There is a profit to be realized even if more nursing staff is hired because it would be offset by the revenue generated by billing for Phase 1 recovery in the PACU. This same level of care can only be billed if it is delivered in a true PACU, it cannot be billed if delivered in the patient's inpatient room. In addition to this factor, the proximity of the PACU to the CRNAs is helpful to gain their increased involvement during this highly vulnerable postoperative period. The PACU is located within the surgery suite making it easier to access CRNAs and easier for CRNAs to monitor their patients during the first hour postoperatively. The nurses on the floor who have been caring for these patients and managing these situations are highly capable of continuing that care but need to have only one patient in the immediate postoperative period. This change can be accomplished by increasing staffing ratios, but it cannot be billed to the patient as the setting is not a true PACU.

Future Implications

The process of this systems change project has many implications. These include the role of the Doctor of Nursing Practice (DNP), nursing administration, and nursing practice.

Doctor of Nursing Practice

First and foremost this SCP highlights the value of the DNP role in systematically reviewing a patient care issue and bringing forth issues to various stakeholders in a way that is relevant to current practice. The DNP is not only rooted in nursing care, but in the ability to work with multiple disciplines to work toward change. The DNP is skilled in not only being knowledgeable about evidence based practice, but how to apply it to a unique situation. In this case that situation was evaluating the practice of bypassing the PACU and making

recommendations for change. The DNP bridges the gap between knowledge and practice in a practical application of that knowledge. This project is an example of using evidence from the literature, from expert opinion, and from data that has been collection to inform future practice. It is important to not only collect evidence from the literature, but also to collect data from the particular practice area of concern while also taking into consideration the roles and the environment where care is provided to patients.

Nursing Administration

Nursing administrators find it difficult to add nursing staff in today's healthcare environment. The data from this project justifies the need for 1:1 nursing in the immediate postoperative hour and nursing administrators can use a process like this to justify the level of care needed for various units. Evidence is powerful and when presented as evidence and not an opinion of a few people it is difficult to refute. A strong nursing administrator can use this process to support the need to not decrease staffing during a vulnerable time in a patient's stay. Using the cost benefit analysis presented in this project makes the change easily funded if there is willingness to take the patient to a formal PACU. Generating income is never the motivation for a patient safety initiative, but when there is income that would be available from allowable billing, it would seem implicit in that availability that the care is justified. Knowing how uncomfortable nurses were with the assignments they were given it would be valuable for a manager to measure nurse's job satisfaction before and after this change. If job satisfaction improved, this could be used as a valuable recruiting and retention tool.

Nursing Practice

Bedside nurses not in a leadership role can learn from this process as well. Presenting concerns of safety with data to substantiate the concerns makes a powerful argument for action. If a snapshot in time revealed all patients to be doing well, there is a perception that there are no issues. By collecting data over a period of time, a better picture of an overall state can be seen. There is also a challenge for education to teach the value of using evidence not only from the literature, but from actual unique practice settings to make decisions about patient safety.

Practice Setting

There is emerging literature to support bypassing the recovery room in the inpatient setting that could be studied further and applied to the population of study in this project. Williams (2011) found that by applying specific bypass criteria and “never events” such as pain, hypotension, nausea and vomiting, and urticaria, that it was safe to bypass Phase 1 recovery. His criteria included an assessment for orthostatic hypotension in the immediate post-operative period that could be initiated in this hospital if there were further interest. When this discussion was initiated with the anesthesiologists, there was openness, but they did not want to drive the change. Further work could be engaged in if a multidisciplinary group were willing to engage in further dialogue and collaboration to consider bypassing the PACU.

The evidence gained in this project needs to be shared and crosses many specialties and isn't limited to perianesthesia nursing. However, the researcher plans to focus dissemination efforts initially to perianesthesia nurses. First and foremost, the findings will be shared as a poster presentation or lecture at the national meeting of ASPAN (American Association of PeriAnesthesia Nursing) in 2013. Findings will also be disseminated via poster presentations locally at “Research on the Green” at Viterbo University in April 2012, and the Mayo Clinic

Quality Conference in May 2012. Finally, the findings will be submitted for publication in the ASPAN Journal. Knowledge gained from the extensive literature review is being used to inform everyday practice in the researcher's current role as manager of an Endoscopy Unit that will be providing Phase 1 recovery in the near future. The researcher feels qualified to give an expert opinion on the subject of bypassing Phase 1 recovery and to advocate regularly for patient safety issues.

Finally, the greatest success of this project is that the nurse researcher collaborated with other health professionals to demonstrate that applying theory to frame the study of a practice concern can be an effective way to improve patient safety. This project illustrated that taking a scholarly, evidence-based approach to examine a question or concern, and then sharing the results can make a difference.

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APPENDIX A

Agree Instrument Short Appraisal Form

SCOPE AND PURPOSE

- 1. The overall objectives is (are) specifically described. Agree 1 2 3 4 Disagree
- 2. The clinical question(s) covered by the guidelines is (are) specifically described. Agree 1 2 3 4 Disagree
- 3. The patients to whom the guideline is meant to apply are specifically described. Agree 1 2 3 4 Disagree

STAKEHOLDER INVOLVEMENT

- 4. Guideline development group includes individuals from all the relevant disciplines or stakeholders. *(no CRNAs, no PACU experts, only MDAs)* Agree 1 2 3 4 Disagree
- 5. The patients' views and preferences have been sought. *(There is literature supporting family presence in PACU – this is absent in this guideline)* Agree 1 2 3 4 Disagree
- 6. The target users of the guideline are clearly defined. Agree 1 2 3 4 Disagree
- 7. The guideline has been piloted among target users. *(A pilot is not necessary as this is based on literature to support action or inaction)* Agree 1 2 3 4 Disagree

METHODOLOGY

- 8. Systematic methods were used to search for evidence. *(Strength of evidence guidelines are present and used throughout. There is a clear description about how the task force and ASA members were utilized from a variety of practice settings.)* Agree 1 2 3 4 Disagree
- 9. The criteria for selecting the evidence are clearly described. Agree 1 2 3 4 Disagree
- 10. The methods used for formulating the recommendations are clearly described. Agree 1 2 3 4 Disagree
- 11. The health benefits, side effects, and risks have been considered in formulating the recommendations. *(This is ambiguous, but assumed.)* Agree 1 2 3 4 Disagree
- 12. There is an explicit link between the recommendations and the supporting evidence. Agree 1 2 3 4 Disagree
- 13. The guideline has been externally reviewed by experts prior to publication. Agree 1 2 3 4 Disagree
- 14. A procedure for updating the guideline is provided. Agree 1 2 3 4 Disagree

CLARITY AND PRESENTATION

- 15. The recommendations are specific and unambiguous. *(There is an assumption that all patients go to PACU. There is a statement regarding routine electrocardiographic monitoring may not be necessary in certain categories of patients, but it fails to list which categories.)* Agree 1 2 3 4 Disagree
- 16. The different options for management of the condition are clearly presented. *(There are many areas where the literature is silent and/or the reviewers are unable to agree on the recommendation, yet there are still recommendations to perform assessments. For instance assessment of drainage and bleeding is associated with fewer complications- yet the reviewers*

agree to recommend. Another example: requiring patients to urinate prior to discharge- the literature is insufficient to support, yet reviewers recommend for selected day surgery patients).

17. Key recommendations are easily identifiable. Agree 1 2 3 4 Disagree
18. The guideline is supported with tools for application. *(There are no tools offered in this guideline, yet they are not required. Absent are tools for discharge from PACU such as the Aldrete score or PADSS/)* Agree 1 2 3 4 Disagree

APPLICABILITY

19. The potential organisational barriers in applying the guideline have been discussed. Agree 1 2 3 4 Disagree
20. The potential costs implications of applying the recommendations have been considered. *(This is absent, yet relevant as there are increasingly more ambulatory surgery centers and same day surgeries performed that need to take into consideration the cost/benefit analysis of doing some of the recommendations in these guidelines that are not supported by evidence- for instance there is an assumption that all patients go to a PACU, despite evidence to support bypass of PACU.)* Agree 1 2 3 4 Disagree
21. The guideline presents key review criteria for monitoring and/or audit purposes Agree 1 2 3 4 Disagree

METHODOLOGY

22. The guideline is editorially independent from the funding body. *(This guideline is published in the Anesthesiology Journal, not as a National Guideline independent of the American Society of Anesthesiology. Furthermore, there is no effort to query Certified Registered Nurse Anesthetists or PeriAnesthesia nursing experts.)* Agree 1 2 3 4 Disagree
23. Conflicts of interest of guideline development members have been recorded. Agree 1 2 3 4 Disagree

OVERALL ASSESSMENT

Would you recommend this guideline for use in practice?

Strongly recommend

Recommend (with provisos or alterations) *While there are many difficulties with some of the recommendations as noted above in each category, there are still many areas within the guidelines for which there is strong evidence to support practice with regard to patients in the immediate postoperative period. While there is evidence to support bypass of the PACU, much of it has been published after this guideline was published. An update is necessary. There is a need for standardization of criteria used for assessments and discharge criteria across settings. There has been much work to improve practice and standardize treatment in other disciplines that is absent here and is clear by the dissent among the reviewers who were surveyed for this guideline.*

Would not recommend

Unsure

*Please note: Information in italics justifies the rating selected for each question using the guidelines of the

Appraisal of Guidelines Research & Evaluation (AGREE) instrument. (Quality and Safety in Healthcare, 2003).

APPENDIX B

Data Collection Tool

MR#	Study #	Age	Gender	Surgery	LOS in minutes	WT	BMI	ASA Score	EPL

Baseline BP:

Time	Aldrete	T	P	R	BP	MAP	O2 Sat	O2 (type)

Pain \geq 4	Vomiting	Pruritis	Hypotension

APPENDIX C

Budget for Improving Patient Safety

During Immediate Post-operative Phase following Total Joint Replacement

		Expense	Revenue (annual)
Chart review and analysis (\$50/hr)	100 hours	\$5000	
Recovery room update	Computer, supplies	\$1000	
Cart for implant supplies (to be relocated)		\$600	
Interdisciplinary meeting time	RNx3, CRNA, MD	In-kind related to regular meeting structure	
Post-intervention chart review and analysis	100 hours	\$5000	
Revenue generation 100% 50% 25%	685 patients/yr at \$1029 for 1 hour average recovery room time		\$704,865 (100%) \$352,432 (50%) \$176,216 (25%)
Expense of 1 RN per patient (\$50/hr) 100% (685 pts) 50% 25%		\$34,250 \$17,125 \$8,562	
Manuscript writing and submission	40 hours	\$2000	
Total (25% -100%)		\$22,162- \$47,720	\$176,216- \$704,865