

Best Practices in Orthopaedic Inpatient Care

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Most patients admitted in the hospital requiring skilled nursing care are at risk for adverse events or complications from their conditions and treatments. They require close observation during their hospital stays, and care providers must be prepared to detect and intervene quickly when complications occur. Orthopaedic patients are a unique surgical patient population in that their underlying physical conditions, operative locations, and comorbidities can place them at higher risk for complications or adverse events than many other surgical patients. Orthopaedic patients are usually admitted to general acute care surgical units where there are no monitoring devices and the staffing ratios are less intense. In the event that a higher level of surveillance is needed, current practice is to transfer the patient to a care area with telemetry or hardwired monitoring capability, which can result in deviation from the orthopaedic care pathway. In this article, we describe the implementation of best care practices that combine lower nurse to patient ratios, innovative and effective patient education, and continuous surveillance using novel technology in an orthopaedic unit. Data demonstrate that this multifaceted approach to high-quality orthopaedic care has contributed to better patient outcomes.

Healthcare institutions are evolving because of quality, economic, and demographic pressures. This evolution is increasingly evident in the demographics of the inpatient population, as most routine treatments are delivered in the outpatient care setting *versus* the traditional inpatient setting. Therefore, patients who are admitted to the hospital for more intense procedures and treatments qualify as higher risk patients than in years past (HealthLeaders, 2010). This “higher risk” designation is applied to all patient groups now and is not limited to patients in the intensive care unit (ICU), the intermediate care unit (IMC), and telemetry units.

Hospitalized Orthopaedic Patients

Orthopaedic patients often have existing conditions that can complicate operative procedures. These conditions include preexisting comorbidities such as diabetes or heart disease, advanced age, and varying levels of

obesity that increase the potential for adverse events during the perioperative experience (Unbeck, Muren, & Lillkrona, 2008). Because these patients require longer stays than the outpatient care setting can afford, they are admitted to the hospital and require close observation to monitor for potential complications from the high-risk orthopaedic procedures (HealthLeaders, 2010). Potential complications range from the hazards of surgically manipulating the bones, such as bleeding, venous thromboembolic disorders, and fat embolism, to the adverse reactions that can result from the medications or the blood transfusions that patients receive.

Caring for the orthopaedic patient is a multidisciplinary responsibility, and the care team consists of the primary surgeon, specialty physician(s), the physical therapist, and the nurse. The typical treatment plan for the postoperative orthopaedic patient includes acute pain control, monitoring for postoperative complications such as bleeding, hemodynamic instability, postoperative nausea and vomiting, venous thromboembolic prophylaxis, early ambulation, and rehabilitation that includes assistance with activities of daily living and promotion of self-care. Pain control is an important part of the treatment plan because pain control allows therapy to progress. Unfortunately, the use of narcotics for pain management in some patients can increase the risk of adverse reactions such as nausea and vomiting, hypotension, respiratory depression, and severe sedation.

Orthopaedic patients are traditionally treated with opiates postoperatively that are most often administered by intravenous patient-controlled analgesia (IV PCA) or patient-controlled epidural analgesia (PCEA). The most serious side effects of narcotics and epidural analgesic administration include hypotension and respiratory depression, which can be life threatening if not detected and treated in a timely manner (American

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Society of Anesthesiologists [ASA], 2009). As a result, the American Association for Pain Management, the Collaborating and Acting Responsibly to Ensure Safety Alliance (C.A.R.E.S. Alliance), and the Institute for Safe Medication Practices have made recommendations to enhance safety. As the professional organizations that are responsible for safe medication practices and pain management, their recommendations include the use of capnography or related devices to monitor hypoventilation and a reliable sedation-rating tool too consistently and frequently monitor and prevent oversedation (ASA, 2006). Because of a myriad of reasons, changes in the patient's condition are not always assessed in a timely manner on acute care surgical units. Inadequate assessment or delayed response to a change in condition may be harmful to the patient. In some cases, the patient will need to be transferred to a monitored setting for further treatment and more frequent assessment. Nurses on these other units are not necessarily skilled in orthopaedic nursing; therefore, this transfer can lead to a deviation from the patient's care pathway, loss of valuable orthopaedic care, delay and incomplete discharge planning, or extended hospital length of stay (LOS). In addition, intensive or intermediate care admissions are more expensive, and third party reimbursements may be affected when the LOS is extended. There is evidence to suggest that patients may be discharged prematurely to accommodate LOS protocols (Cowper et al., 2007) that results in the potential for increased postoperative complications and possible readmission. In today's healthcare environment, readmission rates are being closely scrutinized by the reimbursement regulators and hospitals may be penalized (Centers for Medicare & Medicaid Services, 2008).

Monitoring, Early Recognition, and Failure to Rescue

The ASA-published guidelines for appropriate vital sign assessment of postoperative patients receiving IV PCA or PCEA recommend that the patient be assessed for ventilation, oxygenation, and level of consciousness every hour for the first 12 hours and then every 2 hours for the next 12 hours to detect side effects (ASA, 2006). Vital signs on acute surgical units, however, are usually checked routinely every 4 hours by nursing technicians and then reported to primary nurses when necessary. This routine fails to meet the recommended guidelines for patient assessment. Moreover, nurse to patient ratios on acute surgical units have been reported to be 1:5 or more (Aiken et al., 2010), meaning that nurses are limited in the amount of time they spend with each patient during their work shift. The combination of higher risk patients, the potential for medication side effects, and current nurse to patient ratios may lead to a situation of undetected respiratory depression, hypotension, and other complications.

Although studies have demonstrated that the early warning signs of patient deterioration typically occur up to 8 hours or more before an arrest situation, heavy reliance on routine vital signs collection often results in a failure to assess when interventions are required and thus a failure to respond to changes in the patient

condition. This delay in treatment can result in "failure to rescue" (FTR), which occurs when doctors, nurses, or caregivers fail to notice symptoms or respond adequately when a patient's condition is deteriorating (Silber et al., 2007). Many documented sources and studies describe the impact of FTR. The Institute for Healthcare Improvement (2008) estimated that more than 1.5 million instances of medical harm occur each year from late or absent recognition of clinical deterioration of patients. In 2008, the Agency for Healthcare Research and Quality (AHRQ, 2008) reported an average of 12–15 incidences of respiratory failure per 1,000 at-risk postoperative patients (AHRQ, 2008). Failure to rescue patients whose conditions are rapidly deteriorating is an area of significant unintended harm in the healthcare environment. The ability of surgical nurses to observe the subtle changes in physiological parameters that will necessitate prompt and close monitoring to accelerate interventional care is of utmost importance.

Program Development

In spring 2008, the University of Maryland Medical Center, an urban academic medical center, opened a dedicated orthopaedic unit. During the planning phase, a multidisciplinary team consisting of nurses, rehabilitation staff, orthopaedic surgeons, an anesthesiologist, and a case manager was convened to explore best practices and to identify solutions aimed to prevent and mitigate the risks that postoperative orthopaedic patients face. Through this process, a new care model with improved patient education procedures, improved staffing ratios, development and implementation of standardized care pathways, and the implementation of a continuous patient surveillance strategy was established. The overarching goals of the unit redesign were to improve patient outcomes by maintaining the patient's plan of care and adherence to the orthopaedic care pathways by caring for the patients on the orthopaedic unit. To do this, a multifaceted approach that included empowering the patients to succeed through education (Johansson, Nuutila, Virtanen, Katajisto, & Salanterä, 2005), optimization of nurse staffing, and development of a process to proactively identify patients who are at higher risk for complications was developed (see Table 1).

Patient Education

To better prepare patients and families for the inpatient hospital course, members of the multidisciplinary team developed a preoperative education class. The goal of the program was to reduce patient anxiety (Papanastassiou, Anderson, Barber, Canover, & Castellvi, 2011), increase participation in recovery, increase coordination and preparedness for the discharge process, and enhance patient and family knowledge about hospitalization and recovery. Topics discussed in the preoperative class included what to expect before, during, and after surgery, how to prepare for surgery, a review of the physical and occupational therapy that would take place postoperatively, information about pain control, and postoperative care. Discharge

TABLE 1. SUMMARY OF ORTHOPAEDIC INPATIENT CARE REDESIGN

Education	Prepares the patient on the expectations before, during, and after surgery Includes review of rehabilitation therapy exercises pre- and postoperatively Discusses the types of pain management during surgery and postoperatively Includes discussion with case manager regarding discharge planning, short- and long-term rehabilitation centers Provides information about posthospitalization resources
Unit and staffing redesign	Changes in nurse staffing pattern: nurse to patient ratio decreased to 1:4 Unit-based rehabilitation staff Unit-based gym for group therapy sessions Dedicated orthopaedic unit case manager Dedicated orthopaedic nurse practitioner Staff encouraged to obtain orthopaedic and medical-surgical nurse certification
Defensive Monitoring	Use of a novel technology to continuously monitor patient vital signs Staff able to monitor and track trends in vital statistics on a continuous basis via the wireless transmitter Provides advance warning of patient deterioration that is unattainable using traditional spot-checks of vital signs Staff empowered to identify patients as “high risk” and place patients on monitoring technology independently

planning, equipment, devices, and resources available during and after hospitalization were also reviewed. Preoperative education enabled patients to understand their operation and after care, allayed their fears and anxieties, allowed them to experience a shorter LOS, and reduced the chance of readmissions. Patients were scheduled for the preoperative class 3–4 weeks before surgery, which usually corresponded with the day the patient came to the hospital for the preoperative evaluation with the anesthesiologist.

Nurse Staffing

When the new unit opened, the nurse to patient ratio was decreased from one nurse for five or six patients to one nurse for four patients, which allowed for more nursing time per patient. Appropriate nurse staffing has a definite and measurable impact on patient outcomes, medical errors, and LOS. To determine what constitutes appropriate staffing, Curtin (2003) stressed on the nurse to patient ratio and concluded that a range four to six patients per nurse in most acute care inpatient settings was important for quality outcomes. National benchmarking of nursing care hours through national nursing databases can also provide guidance about staffing patterns. Since the opening of the redesigned unit, nursing care hours per patient day has consistently been higher than the benchmark, indicating that the unit has a better staffing ratio than the majority of other surgical units represented in the database.

The practice of nurses on the orthopaedic unit reflects a patient- and family-centered care model, and multidisciplinary rounds and huddles are conducted daily to discuss patient progress. A unit-based pain management tool was developed by the nurses to address the specific type of pain and pain responses experienced by orthopaedic patients. The nurses and patient care technicians work as a team to ensure that patients receive their rehabilitation therapy session, which includes a daily afternoon group therapy session in the unit-based gym. About 30% of the nurses are certified in medical-surgical nursing, and about 20% are certified in orthopaedic nursing. Each staff nurse is encouraged to achieve certification in orthopaedic nursing. The patient care technicians have a patient ratio of 1:7 that allows for di-

rect assistance with positioning and ambulation. The unit also conducts a monthly unit-based orthopaedic education session to address issues and concepts that relate to patient care as well as to discuss any upcoming surgical patient with special clinical problems.

Identification of At-Risk Patients

One of the most important components introduced with the opening of the new unit was the concurrent revision of the preoperative preparation procedures to include the identification of “at-risk” patients. The term “at risk” refers to a group of patients who are identified as potentially needing closer observation during the immediate postoperative time period. “At-risk” patients are defined as patients receiving PCEA, intrathecal opioids, or IV PCA and patients with preexisting diseases or conditions such as cardiac conditions, obesity, and obstructive sleep apnea. In addition, nurses are empowered to independently identify patients who will require closer observation. For example, on the basis of clinical assessment and judgment, the nurse can initiate the use of continuous vital signs monitoring device as per protocol.

The goal of identifying “at-risk” patients preoperatively is to allow the staff time to develop a care plan that allows these patients to be cared for on the designated orthopaedic unit, rather than having the patient cared for in an intermediate care setting. Crucial to this plan of care is a novel monitoring strategy, that allows for the continuous monitoring of vital signs, as well as the provision of specific alerts and notifications. The monitoring system allows the nurse to assess trends of vital signs data, especially during the times when the patient is sedated or sleeping and is “at risk” for undetected complications.

This method of uninterrupted monitoring is defined as the practice of proactive and continuous monitoring of a patient’s basic vital signs using a wireless transmitter that communicates to a base station computer. Monitored parameters include heart rate, respiration rate, oxygen saturation level, and noninvasive blood pressure reading. This novel approach can be used for any patient in the hospital and not just for those in traditionally cardiac monitored areas (Bruey, 2009). An additional benefit to the orthopaedic population is that the system allows the

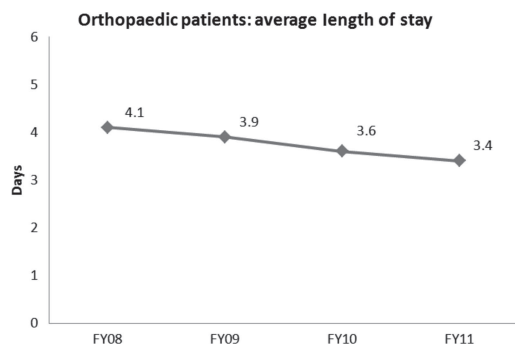


FIGURE 1. Total patients per fiscal year (FY): FY08: *n* = 708; FY09: *n* = 653; FY10: *n* = 645; FY11: *n* = 719.

patient to be ambulatory and to participate in rehabilitation activities while still being monitored.

Implementation Strategy

Determining how to implement the changes within the care model was a challenge for the team to consider. To alleviate the anxiety related to implementing a new patient care model for nursing and rehabilitation staff, unit leaders created a training program that introduced the new model and emphasized the importance of using technology to monitor vital signs continuously. Although no formal satisfaction was measured, staff embraced the changes, adapted to the technology, and responded to vital signs alarms to correctly assess the patients and respond to their needs.

The training program incorporated the changes in the care model and protocols, new standards for patient assessment and reassessments, and new product knowledge and skills. Each nurse and member of the rehabilitative staff attended this program prior to the official opening of the new unit, and the training program continues today as new staff members are hired. Nurses also undergo an annual competency evaluation in the use of the new technology. Finally, the unit collaborated with the staff of the biomedical engineering department to ensure that they were trained in the use of the new monitoring device and could provide the unit with a support system for troubleshooting and ongoing maintenance.

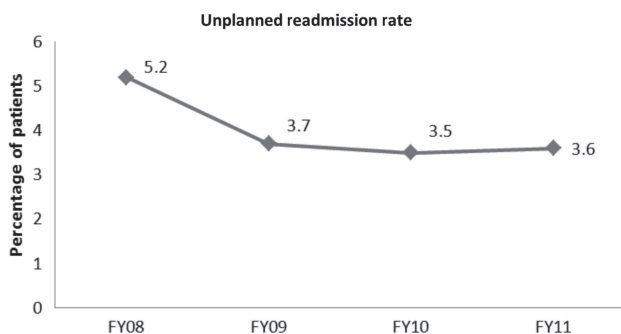


FIGURE 2. Total patients readmitted per fiscal year (FY): FY08: *n* = 35; FY09: *n* = 22; FY10: *n* = 26; FY11: *n* = 26.

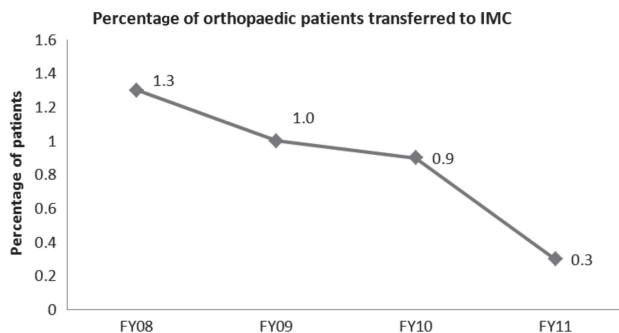


FIGURE 3. Patients transferred to intermediate care (IMC) unit-level care per fiscal year (FY): FY08: *n* = 8/596; FY09: *n* = 6/604; FY10: *n* = 6/651; FY11: *n* = 2/668.

Measurable Outcomes

Data collected before and after opening this orthopaedic unit indicate a positive impact from the implementation of a different care delivery model. Trending data indicate that the LOS over time is decreasing (see Figure 1). The unplanned readmission rate over time has decreased from a one-time high of 5.2% to a low of 3.6% (see Figure 2). The transfers of acute care inpatients to a higher level of care (IMC or ICU) are also decreasing (see Figures 3 and 4).

The nursing staff agreed that the care delivery model has provided an opportunity for a rapid response to critical changes in patients' vital signs. In addition, because patients could be continuously monitored during rehabilitative sessions, the rehabilitation staff was able to conduct therapy sessions without any fear of undetected changes in clinical status. These practices kept patients within their clinical pathway, which may help reduce hospital stays and improve the chances of patients being discharged home. The data trend was favorable, and it was likely that the implementation of a multifaceted progressive care delivery model contributed to these outcomes. The technology provides for early knowledge of changes in the patient condition, which facilitates timely intervention and treatment, and ultimately improves patient care. This strategy was supported by the multidisciplinary team's established parameters and guidelines for improved clinical workflow and improved patient outcomes, which is illustrated in the following case study.

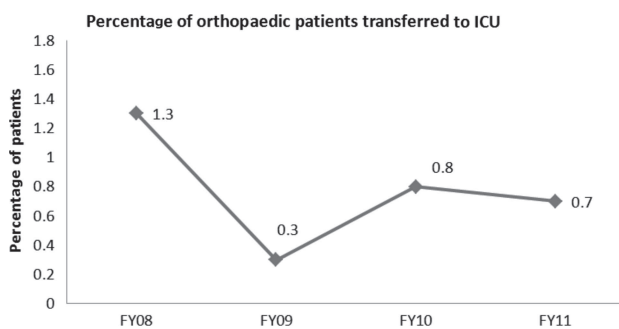


FIGURE 4. Patients transferred to intensive care unit (ICU)-level care per fiscal year (FY): FY08: *n* = 8/596; FY09: *n* = 2/604; FY10: *n* = 5/651; FY11: *n* = 5/668.

Case Study

Mr. G. was a 53-year-old male patient who was admitted to the orthopaedic unit from the post anesthesia care unit (PACU) following a total right knee revision. He had a history of diabetes, obstructive sleep apnea, gastric reflux disease, moderate depression, and obesity. He weighed 220 lb and had a body mass index of 31 kg/m², and he inconsistently used a continuous positive airway pressure machine at home to treat his obstructive sleep apnea. His surgery was performed under regional anesthesia. In the PACU, he received oxygen at 2 L/min by nasal cannula, and the nurses observed occasional periods of apnea. Once he met PACU discharge criteria, he was transferred to the orthopaedic unit where he was placed on IV PCA and was identified as an “at-risk” patient who met criteria for continuous monitoring with the new technology.

Although connected to the monitoring system, oxygen desaturation alerts and apnea alarms triggered periodically, alerting the staff to more closely observe and stimulate Mr. G. during his stay. Alarm histories and full-disclosure waveform reviews revealed that the alerts were valid and that no undetected incidences of apnea occurred. Members of the pain management team were notified and several changes were made to his IV PCA medication dosing in order to reduce the incidence of respiratory depression and sedation. In the new care model, Mr. G. was able to receive all of his postoperative care on the orthopaedic unit and he was discharged home on postoperative Day 3. At home, he was scheduled to receive home therapy and follow-up care, which falls within the guidelines of the care plan for his surgical procedure.

Summary

The changes to the care model on this unit have improved the overall care of the orthopaedic patients by reducing patient transfers for monitoring purposes, helping patients remain on the orthopaedic care pathway, and reducing readmissions to the orthopaedic unit. This change has empowered staff to provide excellent care to higher risk orthopaedic patients by including them in the care planning through strategically timed preoperative and discharge education, and the automation of vital signs monitoring and alert notifications that allow staff the opportunity to respond faster to critical changes. These changes have improved nursing competence by encouraging autonomy, building confidence, and reinforcing accountability. The decision to monitor patients is a collaborative nursing function rather than a purely medical management decision, as it is in traditional telemetry units. In addition, by using their critical thinking skills, nurses are able to identify early signs of distress and intervene appropriately, thus avoiding transfers to a higher level of care. The ability to reduce costly intensive and intermediate care admissions, even in the face of our increasing patient acuity, became an achievable goal.

In conclusion, implementation of best practices for orthopaedic inpatient care at our medical center included a multidisciplinary approach to preoperative patient and

family education that aims to improve their transition from hospital to community. The program also included a knowledgeable nursing and rehabilitative staff, as well as staffing patterns that allowed the providers sufficient time to spend with each patient. Finally, the new care model not only promoted nursing autonomy to intercede when appropriate but also included technology that could expand the reach of the nurse by alerting nurses to changing trends in vital signs and allowing the necessary intervention to be implemented in a timely fashion. The process has led to a decreased hospital LOS and significantly lower hospital readmission rates in our patient population.

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