Best Practice Guideline
Total Knee Arthroplasty

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Disclaimer
This Best Practice Guideline (BPG) was developed by experts in clinical practice who work in Joint Commission Disease Specific Certified environments. The BPG was guided by the NAON Executive Board with oversight from NAON’s Director of Education. It is provided as an educational tool based on an assessment of current scientific and clinical research information, as well as quantifiable best practices. The tool is not intended to replace a clinician’s independent judgment and critical thinking, but to enhance the clinician’s knowledge regarding the care and the needs of the total joint patient throughout the continuum of care.

Levels of Evidence
The evidence within this clinical practice guideline is rated to differentiate evidence of varying strengths and quality. “The underlying assumption is that recommendations from strong evidence of high quality would be more likely to represent best practices than evidence of lower strength and less quality” (Newhouse, 2007, p. 90). Refer to the Appendix for an explanation of the levels of evidence contained within this guideline.
# Appendix: System for Rating the Strength of Evidence

## System for Rating the Strength of Evidence

<table>
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<th>Level</th>
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Introduction
In 2010, the prevalence of total knee arthroplasties in the U.S. was 1.52%, corresponding to 4.7 million individuals (Kremers et al., 2015). By 2030, total knee arthroplasties are projected to grow by 673% compared with 2005 (Kurtz, Ong, Lau, Mowat, Halpern, 2007). These increasing demands for total knee arthroplasties are fueled by aging “baby boomers,” joint injuries, and physically active life styles (Wilson, Schneller, Montgomery, & Bozic, 2008).

Purpose
The purpose of the Best Practice Guideline for Total Knee Arthroplasty is to collate the current available literature to provide best practice information aimed at the continuum of nursing care for the patient undergoing a total knee arthroplasty. This guideline will focus on standardizing and improving patient care pathways for total knee arthroplasty.

Rationale for Guideline
The rationale for the guideline is to emphasize the importance of identifying standardized practice guidelines for the total knee arthroplasty patient. Standardized guidelines help to decrease variations that may lead the potential for unfavorable outcomes for this population.

Goal of Best Practice Guideline
Goals of the guideline offers an assessment of the benefits and harms of various care and practice options for the total knee arthroplasty patient. This will empower nurses to effectively manage the acute care requirements of the total knee arthroplasty patient.

Description
A total knee arthroplasty, also known as knee replacement, is a modern surgical procedure that can be described as knee resurfacing (AAOS, 2015). This surgery involves removing the diseased or damaged knee joint and repairing the weight bearing joint with a metal or plastic prosthetic.

Definition of the Problem
Due to the aging population and longer life expectancies the total joint replacement has become as prevalent as several chronic diseases; stroke (6.8 million), myocardial infarction (7.6 million) and heart failure (5.1 million) (Go et al., 2013). With the growing number of total knee arthroplasties being performed, the health care community recognizes the need for standardization of evidence based guidelines on acute and chronic care of individuals with knee replacements. There has been an increasing awareness of the need to develop effective models of care that facilitate acute care management and patient self-management. Research in this area continues to increase and expand for the care of the total knee arthroplasty patient.
Pathophysiology

The most common cause for the need of a knee replacement is arthritis; osteoarthritis, rheumatoid arthritis, or post traumatic arthritis (AAOS, 2015):

- Osteoarthritis is the most common form of arthritis (CDC, 2015). The pathology of osteoarthritis includes radiographic changes such as joint space narrowing, osteophytes and bony sclerosis. Osteoarthritis can be described as progressive loss of hyaline cartilage.

- Rheumatoid arthritis is the most common autoimmune inflammatory arthritis (Singh et al., 2015). Rheumatoid arthritis is a systemic inflammatory disease that can affect multiple joints (Aggarwal et al., 2015). The pathogenesis of rheumatoid arthritis includes fibrosis, synovial cell proliferation, pannus formation and erosion of bone and cartilage. The inflammatory response manifests in the synovial membrane of joints causing hypertrophy and chronic joint inflammation. The overgrowth of the synovial cells and activation of endothelial cells then leads to erosions of the cartilage and bones.

- Post-traumatic arthritis is caused by a physical injury such as vehicle accident, fall, dislocation, or any source of blunt trauma (Lotz, 2010). These injuries damage the articular cartilage and the bone, changing the mechanics of the joint and accelerating the progression towards osteoarthritis. The pathogenesis of posttraumatic arthritis occurs with the injury and progresses over time. Initially there is cell necrosis, collagen rupture and hemarthrosis. Months later there is apoptosis, leukocyte infiltration, and extracellular matrix degradation. Over the years the joint tissue will remodel and chronic inflammation will be present.

Continuum of Care

Preoperative Care

Nutrition Screening

Nutrition screening prior to surgery is simply assessing the patient for nutrition deficiencies. Clinical malnutrition is associated with increased surgical complications, morbidity and mortality, prolongs rehabilitation (Husted, Hom, & Jacobsen, 2008), raises infection rates (Gottschalk, Johnson, Sadlack, & Mitchell, 2014), and delays wound healing (Pedersen & Pedersen, 1992; Pratt, Veitch, & McRoberts, 1981). Preoperative nutritional depletion occurs in 30% of elective surgery patients (Nicholson, Dowrick, & Liew, 2012). Huang, Greenky, Kerr, Austin, and Parvizi (2013) found malnutrition to be common in total joint arthroplasty patients greater than 55 years of age. Enhanced recovery after surgery protocols recommend nutrition screening in all surgical patients.

There is not a consensus on a single best tool to assess nutrition status (van Bokhorst-de van der Schueren, Guaitoli, Jansma, & de Vet, 2013); however, these tools can aid in obtaining a quick and easy snapshot of the patient’s nutritional status. Well known examples include Malnutrition Screening Tool (MST) (Ferguson, Capra, Bauer, & Banks, 1999), Short Nutritional Assessment Questionnaire (SNAQ) (Kruizenga, Seidell, de Vet,
Any positive indicator of high nutritional risk will need further evaluation by a professional to get a more complete picture of the severity and nature of the nutritional deficient (van Bokhorst-de van der Schueren, Guaitoli, Jansma, & de Vet, 2013). The MST, when compared with other screening tools (PG-SGA and NRS-2002), had a fair validity in determining malnutrition in hospitalized adults and elderly and scored fair in orthopaedic elderly (van Bokhorst-de van der Schueren, Guaitoli, Jansma, & de Vet, 2013) (Level I). More research is needed comparing different tools with one specific population such as total joint arthroplasties.

**Joint Coach (Care Partner) Selection**
Social support is an important part of the overall recovery from a total arthroplasty and can contribute to improved physical and cognitive functioning (Lange-Collette, 2002). Social support has an influence on health behaviors, prevention, treatment, and with the way persons recuperate from numerous diseases (Hurdle, 2001). Informal support can help patients with the untoward effects of the operation; filling a gap when support from health professionals is not what is needed (Johnson, Horwood, & Gooberman-Hill; 2015).

Best practices state the care partner or coach should be knowledgeable about their loved ones surgery including; preparation needed before surgery, the rehabilitation needed after surgery, and general expectations and goals for total hip arthroplasty. The care partner/coach should play an active role throughout the arthroplasty journey. They should attend a preoperative educational class with the patient or other offerings that offer someone to reach out to for questions and concerns (online, one-on-one, over the telephone), take part in physical and occupational therapy, and should be willing and open to learning discharge needs. Discharge needs may include planning to stay with the patient at home for a few days, filling prescriptions, maintaining awareness of physical precautions, and transporting to therapy and other postoperative appointments.

**Planning for Postoperative Destination**
Discharge destinations for patients after total knee arthroplasty are variable. Patients may be discharged home with homecare or without homecare. They may also be discharged to another inpatient facility. Inpatient facilities are either acute inpatient rehab facilities or skilled nursing facilities. Although insurance coverage for the discharge destination may influence patient decisions about post-surgical care, this should not be the determining factor when choosing care after surgery (Radcliff, Cote, Olson, & Liebrecht, 2012).

Inpatient rehabilitation does not reduce complication and infection rate and patients either have similar or improved outcomes when discharged home rather than an inpatient facility. Nationally, home is the desired discharge plan for total knee arthroplasty patient. Patient education about discharge should include the support and should be aimed at helping patients anticipate challenges with their transition home (Mitchell, 2015). Consistent communication among the healthcare team, including the patient and support person is the critical to a successful transition after discharge and the patient should be following the agreed upon care path despite discharge destination (Pearson, 2001).
Mandatory Preoperative Education

Twenty-five studies addressing preoperative education were reviewed. Six of those studies reported statistical significance in relation to preoperative education reducing length of stay, falls, complications and financial charges (Bergin et al., 2014; Clarke, Timm, Goldber, & Hattrup, 2012; Huang, Chen, & Chou, 2012; Jones et al., 2011; Lin et al., 2011; Yoon et al., 2010). Jones and colleagues (2011) identified total knee replacement patients were 2.6 times more likely to have a shorter length of stay after comprehensive preoperative patient education than a control group (Level III). Contradictory to the 2004 Cochrane review on written, audiovisual or a combination of both, pre-operative education, several studies found structured preoperative teaching can shorten length of stay (Bergin et al., 2014; Huang et al. 2012; Jones et al., 2011; Yoon et al, 2010). Yoon and colleagues (2010) found one-on-one education that significantly reduces the length of stay by approximately one day. One-on-one education is not financially ideal; however, the personal nature of the educations allows for open communication and provides a comforting environment for the patient to ask difficult or personal health related questions.

In addition to decrease length of stay, Bergin and colleagues (2014) found preoperative incentive spirometry patient education decreased postoperative complications compared to a control group. Decreased financial charges were also found in those patients who had received preoperative patient education (Bergin et al., 2014; Huang et al., 2012). While most of these studies focused on length of stay, one study was noted to reduce postoperative falls in patients who participated in a one on one nurse led preoperative education program (Clarek, Timm, Goldber, & Hattrup, 2011).

Further research is needed on the appropriate timing of preoperative education. Preoperative education timing has ranged from day before to 4 weeks prior to surgery (Jones et al., 2011; Yoon, et al. 2010). Also, content of the structured education sessions has not yet been clearly defined nor has the length of time the education should last. Despite these limitations, formalized, comprehensive preoperative patient education encourages the patient to be an active participant in their care (Hass, Jaekel, & Nesbitt, 2015). A few topics were found repeatedly in the literature, which could be used as a basis for preoperative education:

- multidisciplinary approach
- preoperative educational booklet which was given to the patient and reviewed during educational sessions
- care pathway from admission to discharge
- preparation for surgery: preadmission assessment, smoking cessation, nutrition, clearances if needed, preoperative lab work, preparation of the home and what to bring to the hospital
- intraoperative care: anesthesia
- postoperative care: pain control, wound care, hand hygiene
- physical and occupational therapy
- mobility
- venous thromboembolism (VTE) prevention
- discharge needs and goals
durable medical equipment or DME
- discharge to home environment
- infection prevention

Preoperative Patient Optimization
Enhanced recovery programs are increasingly used in all types of surgery. In the past ten years, these programs have been well studied and documented in the literature. There are varying definitions of these programs including ‘Accelerated Rehabilitation’, ‘Fast-track’, and ‘Rapid Recovery’ (Berend, K.R., Lombardi, A.V., & Mallory, T.H., 2004; Jakobsen, Kehlet, Husted, Petersen, & Bandhom, 2014; White, Houghton-Chemmey & Marval, 2013). The purpose of this clinical practice guideline is not to state which term or definition is correct, but to provide the literature that supports the practices of these programs. The main goal of these programs are to improve patient outcomes and expedite recovery by optimizing the surgical care pathway prior to surgery. The outcomes related to these practices in total hip and knee arthroplasty include, shorten length of stay (Christelis, et al., 2015; Isaac et al., 2004), improve patient experience (Jones, Wainwright, Foster, Smith, Middleton, & Francis, 2014 (Level III & IV); Machin,Phillips, Parker, Carrannante & Trust, 2013) (Level IV), and overall enhance clinical and functional outcomes.

The implementation of these programs begins preoperatively; however, they should continue throughout operative experience. There are many key interventions that comprise the enhancement recovery program for total hip and total knee arthroplasties (Ibrahim, Alazzawi, Bizam, & Haddad 2013; Machin, Phillips, Parker, Carrannante & Trust, 2013; NHS, 2008; Stowers, Lemanu, Coleman, Hill, & Munro, 2014). One of these interventions includes a thorough nursing assessment including measures such as weight, height and BMI, hemoglobin A1C, renal function, activity level and management of co-morbidities. The American Academy of Surgeons (AAOS), Surgical Management of Osteoarthritis of the Knee Practice Guideline (2015), states there is strong evidence to support obese TKA patients have less improvement in outcomes and moderate evidence to support that patients with diabetes are at a higher risk for complications after a TKA. The documentation of a complete and thorough nursing assessment can facilitate the healthcare team in effectively caring for and educating the patient throughout the perioperative stay. The table below was constructed based on the literature for Enhanced Recovery After Surgery (ERAS) for total hip and total knee arthroplasties and comprises of the optimal times, interventions, and outcomes of an enhanced recovery program. This is a reference only of options that were utilized successfully for improved outcomes.
Many of the interventions, such as nutrition assessment, fasting times, tranexamic acid and avoiding drains, has extensive literature and practice guidelines to support implementation. It is highly recommended that these interventions be researched and specific guidelines followed when implementing. Unfortunately, many of these interventions defy our traditional practices, therefore, implementation can be challenging; however, nursing has an integral role in patient care and can have a direct influence on optimization of care for total knee and total hip arthroplasty patient. Some programs have found success in the following risk stratification tools: (1) Risk Assessment

<table>
<thead>
<tr>
<th>Optimal Timing</th>
<th>Intervention</th>
<th>Outcome</th>
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<tr>
<td></td>
<td><strong>Preoperative Care</strong></td>
<td></td>
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<tr>
<td></td>
<td>- Thorough assessment</td>
<td>- Optimize general health and comorbidities</td>
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<td></td>
<td>- VTE prophylaxis risk assessment and planning</td>
<td>- Manage expectations and decrease anxieties about stay</td>
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<td></td>
<td>- Education</td>
<td>- Meet discharge requirements</td>
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<td></td>
<td>- Anesthesia consultation</td>
<td>- Optimized preoperative care</td>
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<td></td>
<td>- Case management consultation</td>
<td>- Improved wound healing</td>
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<td></td>
<td>- Nutrition assessment</td>
<td>- Improved glycemic control</td>
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<td></td>
<td>- Minimal fasting time</td>
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<td></td>
<td>- Neuromuscular electrical stimulation</td>
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<td>- PreHab</td>
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<td></td>
<td>- HgbA1C</td>
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<td></td>
<td>- Multimodal analgesia pre and post op</td>
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<tr>
<td></td>
<td>Staph prophylaxis, nares</td>
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<td></td>
<td><strong>Intraoperative Care</strong></td>
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<td></td>
<td>- Warming systems</td>
<td>- Reduced length of stay</td>
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<tr>
<td></td>
<td>- Tranexamic acid</td>
<td>- Reduce blood loss and subsequent transfusions</td>
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<tr>
<td></td>
<td>- Avoid drains</td>
<td>- Reduced surgery times</td>
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<td></td>
<td>- Minimally invasive surgery techniques</td>
<td>- Maintenance of normovolemia and normothermia</td>
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<td></td>
<td>- Optimized anesthetic techniques</td>
<td>- Reduced physical stress of surgery</td>
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<td><strong>Postoperative Comfort Needs</strong></td>
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<td></td>
<td>- Pulsed electromagnetic fields</td>
<td>- Reduced pain and allow for earlier mobilization</td>
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<td>- Local anesthetic around joints</td>
<td>- Enhanced comfort</td>
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<td></td>
<td>- Regular and effective analgesia</td>
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<td></td>
<td>- Prophylaxis for nausea</td>
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<tr>
<td></td>
<td><strong>Postoperative Care</strong></td>
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<tr>
<td></td>
<td>- Wound dressings</td>
<td>- Reduce VTE</td>
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<tr>
<td></td>
<td>- Early ambulation</td>
<td>- Speed recovery</td>
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<tr>
<td></td>
<td>- Pharmacological and mechanical prophylaxis</td>
<td>- Optimize Independence</td>
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<tr>
<td></td>
<td>- Emphasis on normal eating patterns and hydration</td>
<td>- Optimized postoperative care</td>
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<tr>
<td></td>
<td>- Promotion of ‘wellness’ – remove catheter, drips and drains</td>
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<td>- Clear discharge arrangements</td>
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Table 1-1: Enhanced Recovery After Surgery Implementation Table
and Prediction Tool (RAPT), (2) Predicting Location after Arthroplasty Nomogram (PLAN), (3) Morbidity and Mortality Acute Predictor (arthro-MAP), (4) Penn Arthroplasty Risk Score.

Blood Transfusions Prevention
Historically, joint arthroplasties required extensive soft tissue release and bone incisions, which often resulted in significant blood loss. Reducing blood loss has a positive clinical impact on the patient’s recovery, including the need for blood transfusions and minimizing the additional risks associated with blood transfusions (Bierbaum, et al., 1999). Many procedures have been tested and associated with reduced blood loss in total joint arthroplasties: (1) tourniquet use during surgery (Yi, Tan, Chen, Chen, & Huang, 2014; Li et al., 2014) (Level II), (2) drain placement protocols (Stucinskas, et al., 2009), (3) fibrin sealants (Li, et al., 2015) (Level II), (4) tranexamic acid (AAOS, 2015 (strong evidence); Kedi, et al., 2016 (Level III); Zhao-Yu, Yan, Wei, Yuejv, & Ying-Ze, 2013), and (5) postoperative knee flexion (Liu, Li, Cao, Wang, 2015), as well as minimally invasive approaches. The pros and cons of all these interventions need to be weighed against overall patient benefit. For example, tourniquet use can cause increased postoperative pain ([AAOS, 2015 (strong evidence); Tai, et al., 2012]) and clamped drains may lead to hematoma, delayed wound healing and deep venous thrombosis (Yamada, Imaizumi, Uemura, Takada, Kim, 2001).

No clear guidelines of any one approach can be made based on the current evidence due to low quality (Li et al., 2014). Also, a study was not found comparing all techniques in regards to efficacy. A multimodal approach using pharmacologic agents and topical techniques can be an appropriate method to limit the amount of bleeding. Benefits and side effects of all approaches will need to be considered with each patient and orthopedic surgeon. Preoperative optimization labs should be drawn within a timeframe that allows for corrective action to be taken if needed, many programs suggest ordering and drawing labs 4-6 weeks preoperatively.

"PreHab"
Topp, Ditmyer, King, Doherty, & Hornyak, (2002) define preoperative rehabilitation or “prehab” as the “process of enhancing functional capacity of the individual to enable him or her to withstand the stressor of inactivity” (p. 268). The overall goal of prehab is to prevent functional decline until surgery and provide a quicker functional recovery post-surgery (Carli & Zavorsky, 2005; Ditmyer, Topp, & Pifer, 2002; Topp et al., 2002). Cabilan, Hines, Munday (2016) conducted a systematic review evaluating the evidence on the effectiveness of prehab on functional status, healthcare utilization, quality of life, and pain compared to a usual care group (Level II). Based on their review, prehab does not improve functional outcomes. For self-reported functional status, utilizing the WOMAC osteoarthritis index, there were no statistically significant improvements. Prehab was not found to significantly benefit quality of life or pain scores. Contrary to these findings, Beaupre, Davies, & Johnston (2004) found in total knee replacement patients statistically significant benefit of prehab in reducing admission to acute rehabilitation; however, prehab did not significantly reduce readmission rates Overall, Prehab did not show improvement in long-term patient outcomes.
Pain Management Plan before Surgery
Contributing factors for prediction of pain after a total joint replacement are mental health, preoperative knee pain, pain at other sites, and pain catastrophizing are all predictors of obstinate pain after total knee arthroplasty (Lewis, Rice, McNair, & Kluger, 2014) (Level I). Mental exhaustion before surgery is a risk factor of post-operative pain (Lavand’homme, & Thienpoint, 2015). Stress overload and can lead to anxiety, panic attacks, depression alcoholism and other substance abuse (Montero-Marín, Prado-Abril, Piva Demaizo, Gascon, & García-Campayo, 2014). Patients with chronic pain often suffer from insomnia, exhaustion, and depression, all of which are indicators of pre-operative stress; therefore, putting the patient at high risk for post-operative pain (Ayers, Franklin, Ploutz-Snyder, & Boisvert, 2005). The long-term use of opioid medication pre-operatively also will increase the risk of a more painful and extended recovery time (Swivel, Stroh, Lee, Bonutti, & Mont, 2011). AAOS clinical practice guidelines (2015) state TKA patients with select chronic pain conditions have less improvement in patient reported outcomes. Pain catastrophizing, the strongest predictor of postoperative pain, is associated with acute and chronic pain severity (Forsythe, Dunbar, Hennigar, Sullivan, & Gross, 2008), altered central nociceptive processing (Goodin, et al., 2009), overuse of health care (Jacobsen, & Butler, 1996), disability (Forsythe, et al, 2008), and functional decline (Keefe et al., 2000).

Approaches to address pain management prior to surgery may include enhancing the preoperative education to include an outline of the surgical procedure and expected outcomes, enabling the patient to participate in decisions, and ensuring consistent information across all healthcare professionals. Some patients may benefit from earlier surgical intervention and a more intensive analgesic (Lewis, Rice, McNair, & Kluger, 2014) (Level I). Valid screening tests would augment pain management and enhance individualized risk stratification for consistent postoperative pain. Those with neuropathic pain, and long term opioid use may benefit from specific pre or perioperative ant-hyperalgesic medications (Lavand’homme, & Thienpoint, 2015). Hence, a multidisciplinary approach, including ice and distraction, is necessary. A pain management plan before surgery is a key component to patient satisfaction post-surgery.

VTE Prophylaxis Plan
The risk of developing blood clots in either the deep vein (deep vein thrombosis or DVT) or lung (pulmonary embolisation or PE) after joint replacement is high. Following orthopedic surgery, the incidence can be 40% to 60% (Cohen et al., 2012). The risk for fatal PE is 0.2% to 0.3%. Deep vein thrombosis usually occurs in the lower extremities and cause pain, swelling, and erythema. Pulmonary emboli can present with shortness of breath, pain on inspiration, and tachycardia. If not treated, PE can result in circulatory collapse and death (Forster & Stewart, 2015). Risk factors associated with VTE include inactivity, dehydration, hospitalization, trauma, clotting disorders with previous clot, varicose veins with phlebitis, pregnancy, oral hormonal contraceptives, malignancy, obesity, smoking, and age (National Institute for Health and Care Excellence, 2010). Patients should be screened for risk prior to surgery and treatment modified to match risk level (Kulshrestha & Kumar, 2013).

Patients on anticoagulation therapy before surgery should discontinue anticoagulation/antiplatelet therapy before surgery. The amount of time the patients should interrupt their therapy varies by drug and may vary if
neuraxial anesthesia is planned (Benzon, Avram, Green, & Bonow, 2013). Average risk patients should receive pharmacological anticoagulation therapy and mechanical VTE prophylaxis therapy after surgery. Relevant anticoagulants include low molecular weight heparin, fondaparinux, apixaban, dabigatran, rivaroxaban, low-dose unfractionated heparin, adjusted dose warfarin, and aspirin. Choice of anticoagulants is a debated issue, while the use of them is standard practice (Adam, McDuffie, Lahiewicz, Ortel, & Williams Jr, 2013). Pharmacological VTE prophylaxis should be started within 24 hours of surgery, but the timeframes vary by drug and recommendations. They should be continued for at least 14 days and newer recommendations proposed that these medications may be useful for up to 35 days (Forster & Stewart, 2015). Mechanical VTE prophylaxis such as compression stockings or sequential compression devices should be implemented upon admission and continued until full mobility is returned after discharge from inpatient setting (Yi, Hui, Jian, & Yixin, 2014). Care should be taken when issuing compression stockings to patients. Patients must receive education about proper use and the risks of poorly fitting stockings. This information should include, when to put on and remove, how to apply, how to assess skin for problems, and what to do if problems occur (Lim & Davies, 2014)

Patients should be mobilized early and at frequent intervals (AAOS, 2011). Early mobilization and routine mobilization is critical to achieve personal outcomes and prevent many complications including VTE (AAOS, 2011). There is moderate evidence that neuraxial anesthesia is preferred to general anesthesia to prevent VTE (Khatod, Inacio, Bini, & Paxton, 2012).

Patients and patient’s support person or persons should be educated about VTE prophylaxis (Mazaleski, 2011). Education topics for patients and family members should include, risk factors for VTE, pharmacological VTE prophylaxis, mechanical VTE prophylaxis, signs and symptoms of VTE, and how to get help if VTE is suspected or if the patient is unable to adhere to prophylaxis program (National Institute for Health and Care Excellence, 2010). Special consideration should be taken with teaching patients the risks of medications including bleeding and risks of compression stocking use including skin damage (National Institute for Health and Care Excellence, 2010).

Preoperative Surgical Skin and Nares Preparation

The impact of surgical site infections (SSI) is well known and is well reported in the literature. Surgical site infections doubles readmission rates (Whitehouse, Friedman, Kirkland, & Richardson, 2002), prolongs lengths of stay (de Lissovoy, Fraeman, Hutchins, Murphy, Song, & Vaughn, 2009; Kurtz, Lau, Schmier, Ong, Zhao, & Parvizi, 2008; Whitehouse et al., 2002) and increases financial costs for the patient and the hospitals (de Lissovoy et al., 2009; Kurtz et al., 2008; Rao, Cannella, Crossett, Yates, McGough, & Hamilton, 2011; Whitehouse et al., 2002). Understanding the impact of SSIs can enhance the implementation of evidence based interventions. Numerous studies have been conducted to show that implementation of a decolonizing protocol can decrease the rate of SSIs in total joint arthroplasties (Illingworth et al., 2013).

Numerous studies have been conducted to show that implementation of a decolonizing protocol can decrease the rate of SSIs in total joint arthroplasies; however, there are mixed results on what a decolonization
protocol should entail. Some studies suggest treating all those who are at high risk for infection (Weiser, Eng, & Moucha, 2015) others suggest screening the nares for colonization and treating those who are positive (Buehlmann, Frei, Fenner, Dangel, Fluckiger, & Widmer, 2008) (level IV); (Kim et al, 2010) (level III); (Roa et al., 2011)(Level IV). The evidence supporting a decolonization protocol is strong; yet, more evidence is needed on the efficacy of decolonization treatments and their cost ( American Academy of Orthopaedic Surgeons, 2013) Regardless of screening, chlorhexidine bathing is recommended (Bebko, Green, & Award, 2015) (Level IV)

Implementation of some type of decolonization protocol is the first step in preventing SSI. Infection disease practitioner, pharmacy and surgeons are key players when considering a decolonization protocol. Nurses also play an important part in mitigating SSI by educating their total knee replacement patients about their role in infection prevention (Mori, 2015). The use of a decolonization protocol in total joint arthroplasty patients has the potential to eliminate SSIs, preventing unwanted complications, emotional stress and financial burdens. The following are recommend steps for a decolonization protocol:

- Screen for colonization of the nares of Staphylococcus aureas (SA) two to four weeks prior to surgery (Rao et al., 2011) (Level IV).
- Educate the patient on the importance of decolonization (Rao et al., 2011) (Level IV); (Bebko, Green, & Awad, 2015) (Level IV).
- For those patients who screen positive for SA, one week prior to surgery have patient use nasal mupirocin twice a day and take chlorhexadine baths once a day (Rao et al., 2011) (Level IV); (Kim et al., 2010) (Level III); (Buehlmann, Frei, Fenner, Dangel, Fluckiger, & Widmer, 2008) (Level IV)
- Assess for patient compliance day of surgery.

A study by Courville et al. (2012) found treatment of mupirocin ointment with every patient, regardless of screening, or use of screen first then treat, before a total joint arthroplasty, had a lower cost and greater benefit compared to no decolonization protocol at all (Level II).

Implementation of a decolonization protocol is the first step in preventing SSI. Nurses also play an important part in mitigating SSI by educating their total knee replacement patients about their role in infection prevention (Mori, 2015). There is significant literature supporting implementation of a decolonization protocol; however, further research is needed on efficacy of protocol treatments and cost effectiveness. The use of a decolonization protocol in total joint arthroplasty patients has the potential to eliminate SSIs, preventing unwanted complications, emotional stress and financial burdens.

Intraoperative Care

Anesthesia

Total joint replacement procedures can be performed after induction of general anesthesia or neuraxial blockade anesthesia, which can be epidural or spinal block. Anesthesia is a key component of reducing postoperative pain. General anesthesia is performed by administering medications that cause amnesia, analgesia,
muscle paralysis, and sedation. Neuraxial anesthesia is performed by injection of anesthetics in the fatty tissue that surround the nerves of the central nervous system. This provides numbness to the patient from the abdomen to the toes. The injection is performed after a local anesthetic is given. Patients typically receive sedation medication intravenously in addition to the neuraxial blockade.

Complications/Side Effects of General Anesthesia:
- reduced perioperative tissue oxygen tension
- postoperative nausea/vomiting
- delirium

Complications/Side Effects of Neuraxial Anesthesia:
- postoperative hypotension
- pinal/epidural hematoma
- spinal headache
- respiratory depression
- urinary retention

Common side effects of both General and Neuraxial Anesthesia:
- urinary retention
- nausea/vomiting
- ileus

**Nerve Block: Continuous Catheter Infusion versus ‘Single Stick’**
Peripheral nerve blocks provide accompanying anesthesia and analgesia to patients post-operatively. Local anesthetics are administered via a single shot administration or an infusion catheter that is placed for continue analgesia delivery until post-operative day number one or two. Common peripheral nerve block medications include: Lidocaine, Bupivacaine, Ropivacaine, and Mepivacaine. Regional anesthesia is a beneficial adjunct in pain management but does require special training and technical skills by the anesthesiologist. Most blocks are performed with patient supine and use of ultra sonographic probe to identify nerve.

Common nerve blocks for total hip replacement:
- Psoas Nerve Block
  - femoral, lateral femoral cutaneous, and obturator nerves affected
  - anterior, lateral and medial aspects of thigh affected

Complications associated with peripheral nerve blockade includes postoperative motor weakness, neural injury (Liu et al., 2009), hematoma and infection (Capdevila, Bringuier, & Borgeat, 2009). In the post anesthesia care units, attention to tinnitus, metallic taste in the mouth, restlessness, incoherent speech, nervousness, blurred vision, tremors, seizures, Bradycardia, prolonged PR interval, hypotension, and decreased respirations should be noted and reported to anesthesia. These effects can occur due to accidental
vascular injection. Patient teaching to report any symptoms of systemic toxicity should be given preoperatively. During the placement of peripheral nerve blocks, patients should be monitored with pulse oximetry, electrocardiography, and blood pressure monitoring, as described in the American Society of Anesthesiologists' Standards for Basic Anesthetic Monitoring (ASA, 2015).

Effects of the local anesthesia can spread to adjacent tissue. This can extend the effects of sensory or motor blockade to other unintended muscle groups thus delaying functional recovery. Actions will need to be in place to prevent patient falls or delayed mobilization during hospitalization. Motor ability returns before sensation. Patients are able to move their limbs before they can feel them which puts them at a high risk for injury. A sensory function assessment should be done throughout the postoperative period until sensation returns. Prolonged sympathetic block can lead to increased risk of postoperative swelling. Ice and elevation are helpful until function returns. Persistent quadriceps weakness postoperatively suggest neural injury caused by direct nerve trauma from the needle, injection or compressive ischemic injury caused by a hematoma. Careful attention to motor function is imperative in the care for those who receive blockades. If a patient is prone to bleeding, hematoma can occur at the catheter insertion site. Severe bleeding can contribute to development of compartment syndrome. Assessment of bleeding at the insertion site will prevent undue complications. With any type of invasive procedure, infection can be a risk. Continual assessment for infection at the insertion site is needed.

Clear nursing guidelines must be made available for care of these patients. Education regarding peripheral nerve blocks covering rational for use, assessment required postoperatively, side effects, and importance of adjunct analgesia may be helpful. Complete assessment including sensory, vascular, and motor function is required and will help differentiate between paresthesia related to the block and potential nerve compromise or ischemic pain.

If a continuous infusion is warranted, bilaterally heel checks are necessary due to this site being the most vulnerable to skin breakdown. With a continuous infusion, patients should be able to move the foot while maintaining sensory numbness.

**Multimodal Pain Management Plan**

According to the AAOS Surgical Management of Osteoarthritis of the knee guideline (2015), there is a strong level of evidence to support the use of peri-articular local anesthetic infiltration compared to placebo in total knee arthroplasty to decrease pain and opioid use. Evidence supports peripheral nerve blockades decrease postoperative pain and opioid requirements. There is moderate evidence to support that neuraxial anesthesia could be used to improve select perioperative outcomes and complication rates compared to general anesthesia. A review conducted by Bauer, Pogatzki-Zahn, & Zahn (2014) found femoral nerve blocks to be the most effective analgesia approach with TKA; however, there are a few studies reporting promising reports on local infiltration analgesia. Other innovative pain reducing measures may include an acute pain management service, acupuncture, massage therapy, guided imagery, acupressure and aromatherapy. Hence, a multimodal
pain management plan that best fits within the context of your program is warranted. Multimodal pain management plans can prevent pain, decrease complications, and improve overall patient outcomes.

Common nerve blocks for total knee replacement:

- **Adductor Canal Block**
  - sensory nerves of adductor canal affected: saphenous nerve, obturator nerve, medial retinacular nerve
  - motor nerve affected: vastus medialis
  - block affects anteriomedial knee from patella to medial lower leg less quadriceps weakness

- **Femoral Nerve Block (less common)**
  - anterior, lateral and medial aspects of thigh affected (often times knee immobilizers have to be used)
  - quadriceps muscle weakness common
  - patients at increased risk of falls due to quadriceps muscle weakness

**SCD and/or Compression Stockings**
Venous thromboembolic disease (VTED) is a serious post-operative complication after lower extremity total joint arthroplasty (Pierce, et al. 2015). Non-pharmacological preventative measures for patients undergoing arthroplasty may include compression stockings and/or the use of sequential compression devices (SCD). Compression stockings apply a constant pressure to the lower extremities. This subsequently decreases the amount of venous stasis. SCD’s work to increase the velocity of venous blood flow and stimulate the release of endothelial-derived relaxing factors that may decrease clot formation. Most orthopaedic surgeons reference guidelines from the American Academy of Orthopaedic Surgery (AAOS) from 2011 and/or American College of Chest Physicians (ACCP) from 2012, when making VTED prophylaxis decisions. (Odeh, et al. 2016) These non-pharmacologic measures are often combined with pharmacologic agents which have anticoagulant effects.

**Skin Antisepsis**
Skin antisepsis is a key component in decreasing risk of infection. The research continues to encourage preoperative ‘full body’ cleansing, however there is no current consensus on which specific protocol is superior. Many programs have started to focus on screening and treatment preoperatively while others utilize a body wash combined with an intrasal swab for anyone that is colonized although not screened. The solution chlorhexidine gluconate (CHG) applied to the skin pre-operatively via impregnated cloths is an at home prep. The cloths are used by the patient and applied to front and back of trunk, arms and legs. Two cloth applications are recommended: (1) the night before the scheduled surgery and (1) the morning of the surgery. Patients should be instructed not to bathe and not to use creams, lotions, or powders after the application. Further studies and research is needed to make a strong recommendation for one particular method.
Surgical site prep for antisepsis is a painting with a solution of poyacrylex/alcohol, iodione-based solutions or chlorhexidine.

**Antibiotic Prophylaxis**

Antibiotic prophylaxis for joint arthroplasty is utilized to reduce surgical site infections. Appropriate antibiotic/antimicrobial agent and timing of administration of this prophylaxis are significant. Infusion of first antimicrobial dose should begin within 60 minutes prior to incision, if using fluoroquinolone or vancomycin the infusion should begin 120 minutes before incision to prevent antibiotic-associated reactions. For knee arthroplasty the antimicrobial should be completely infused if using a proximal tourniquet, prior to inflation of the tourniquet. Dosing should be based on weight and should be repeated intraoperatively if operation is still continuing two half-lives after the first dose to ensure adequate antimicrobial levels until wound closure. This allows for prophylaxis with adequate concentration during the entire time the wound is open and at risk for bacterial contamination. (Bratzler et al., 2005).

For patients undergoing hip or knee arthroplasty the preferred antimicrobial is either cefazolin or cefuroxime. If a patient has a beta-lactam allergy vancomycin or clindamycin may be used. For patients carrying methicillin-resistant Staphylococcus aureus, Vancomycin is indicated. Antimicrobial prophylaxis is recommended to be discontinued within 24 hours after end of the operation.

**Traffic Patterns**

Airborne bacterial contamination is a concern in the operating room. Transmission of organisms has been noted to decrease when the number of personnel entering and exiting the active OR room is limited as well as movement is minimized in the room while surgery is in progress. Additionally, maintaining closure of the OR door allows for decreased mixing of OR air with corridor air, which in turn decreases the bacterial count in the room.

**Maintain Normothermia to Avoid Hypothermia**

Neuraxial anesthesia combined with cold stress of the low degree of temperature that an operating room is kept at can affect a patient and make them hypothermic. Hypothermia has been associated with increased risk of infection, increased risk of cardiac events, as well as an increase of intraoperative blood loss. Prevention of hypothermia and maintaining normothermia can be achieved with use of forced air heaters attached to blankets that can be placed on the patient intra-operatively as well as post-operatively as they recover.

**Postoperative Care**

**Postoperative Incisional Care**

Incision healing begins within hours after surgery and continues for two to seven days post operatively (Yu, Alfieri, Bartucci, Holzmeister, & Rees, 2016). Wound closure can be done with staples, sutures, or adhesive.
There is some evidence that staples are more effective than sutures at reducing incision complications; however, more research is needed about adhesive closures after knee replacement (Newman et al., 2011). Dressings used after total knee replacement may vary but they have three major functions. A dressing should protect the wound from microorganisms, optimize healing, and collect any wound drainage (Dobbelaere, Schuermans, Smet, Van Der Straeten, & Victor, 2015). Some moisture is necessary for wound healing, decreasing infections, and less pain, but too much moisture may cause skin damage and/or bacterial infiltration of the wound (Zarghooni et al., 2015). The initial dressing should stay on as long as possible to reduce risk of bacterial contamination and promote cellular wound healing (McGuiness, Vella, & Harrison, 2004) (Ousey, Gillibrand, & Stephenson, 2013). Cost effectiveness should be taken into consideration when choosing the appropriate dressing without compromising the purpose of the dressing. Nursing staff should be looking for dressings to be used according to manufacturer directions and patients should be assessed for reaction to their dressing including sensitivity and skin irritation. When choosing a dressing, patient’s feedback should be taken into consideration for ease of use, comfort of dressing, and freedom of movement while wearing the dressing (Dobbelaere et al., 2015).

There is an emerging body of research on negative pressure wound therapy (NPWT) that suggests it can decrease wound complications like dehiscence, infection, seroma, and hematoma for high-risk patients. High-risk patients are those that have potential for higher amounts of drainage or those that may have difficulty with wound approximation (Manoharan et al., 2016) Surgeons may elect for this therapy and can place the therapy system bandage at conclusion of procedure or during post op period.

Patient and their support person or persons should be educated about dressing care specific to the dressing applied. That education should include timing of dressing removal if necessary. Patients should know how to keep the incision clean and dry, when to bathe, and how to spot and report signs and symptoms of infection (The American Academy of Orthopaedic Surgeons [AAOS], 2014).

**Rapid Recovery and Early Mobility**

Rapid recovery protocols are loosely defined as protocols that streamline care so patients can be discharged on postop day zero or postop day one. The goals of rapid recovery include reducing costs to maximize efficiency while optimizing patient outcomes. These goals are achieved by using a mix of individual care plans and standardized protocols (Walters, Sayeed, El-Othmani, & Saleh, 2016). Critical elements to these protocols are patient selection, patient optimization, pain management, early mobilization and aggressive exercise protocols.

Patient selection for rapid recovery program starts at the time of decision for surgery. There is some evidence that patients with history of myocardial infarction or pulmonary embolism, chronic anticoagulation therapy, large body mass index, three or more comorbidities, and inability to be discharged home fail rapid recovery programs at a higher rate (Callaghan et al., 2015). Younger independent patients, with friend or family support at home, have better outcomes with faster recovery (Walters et al., 2016). There is also some evidence that healthcare system support that increases patient “touches” like those that have been implemented for chronic...
disease management in the cardiac field improve patient outcomes. Touches are defined as clinical staff having contact with patients or families. The type and amount of post discharge “touches” needs further study (Edwards, Levine, Cullinan, Newbern, & Barnes, 2015).

Preoperative optimization for rapid recovery should include at least one preoperative therapy session to review transfer activities and preoperative education to set expectations for after surgery. It is important for patients to understand discharge criteria and anticipated length of stay (Callaghan et al., 2015). Rapid recovery protocols require aggressive inpatient and outpatient therapy or exercise protocols as well as comprehensive pain management protocols. The interdisciplinary care team’s involvement of these protocols is critical to the success to the patient in a rapid recovery setting. Although the number of therapy sessions after surgery does not seem to effect readiness for discharge, patients participating in therapy on the day of surgery does decrease their length of stay (Pua & Ong, 2014). Exercise is a critical for patients to achieve their personal goals after surgery though there is inconclusive evidence that a home exercise program is preferred to home physical therapy or outpatient physical therapy after discharge (Flores-Garcia et al., 2016). Proper pain control is critical to patient’s success with exercise or therapy. Multimodal pain control using oral medication, local infiltrate, and nerve block is useful for pain control (Perlas et al., 2013). Using ice or cryotherapy as well as compression can reduce symptoms of pain (Su et al., 2012).

**Urinary Catheter and Hemovac Removal**

The need for indwelling urinary catheters and hemovacs has greatly decreased over the years. Many orthopaedic programs are no longer using these devices due to the risks they issue. If an indwelling urinary catheter is placed, the use of a nurse driven removal protocol to reduce the incidence and duration of urinary catheterization is imperative to prevent catheter associated urinary tract infections (Mori, 2014). Regardless of type of anesthesia, the routine use of urinary catheters is not recommended for patients undergoing total knee replacement surgery (Huang, Ma, Shen, & Pei, 2015; Tischler et al., 2015).

Patients that are male, older, have higher American Society of Anesthesiologists grade, history of benign prostatic hypertrophy, large volume intravenous fluid infused, and long surgical time may be more at risk for post-operative urinary incontinence (POUR). There is some evidence that patients with up to 800ml of urine postoperatively may not need catheterization but current recommendations state catheterize only if the bladder contains 500 to 600ml of urine postoperatively (Bjerregaard et al., 2016). When a urinary catheter is necessary, the indwelling catheter should be removed within 24-48 hours after insertion to reduce the risk of POUR and catheter associated urinary tract infections (Zhang et al., 2015). Patients and their support person or persons should be educated about the risks and benefits of using urinary catheters and the signs and symptoms of POUR as well as urinary tract infections.

**Drain Removal**

Intra-articular drains are used to avoid fluid collections and may be continuous suction or intermittent. Limiting fluid collections in and around the wound can accelerate healing, promote tissue approximation, lower risk for infection, and decrease pain (Tsang et al., 2016). The use of drains is also associated with
increased blood loss, which may result in blood transfusion (Bjerke-Kroll et al., 2014). A review of randomized controlled trials by Quinn, Bowe, Galvin, Dawson, & O’Byrne found that using drains had no clinical benefits to patient outcomes (2014). After the drain is placed, nursing is responsible for observing and recording output. There are some studies that suggest that drainage of more than 100ml per hour requires clamping of the drain and drainage of less than 70ml over 8 hours requires the drain to be removed (Tsang, 2015).

**Constipation Prevention**

Constipation is a complication that can occur after THA or TKA. This occurs due to a decrease in activity, decreased fluid intake, and medications such as opioids. Patient education is extremely important to educate and engage patients and families to prevent this complication. Risk of constipation in post-surgical patients can be decreased with an increased intake of fluids and fiber, early mobilization, and a decrease in opioid medications (niddk.nih.gov, 2014) (Level V). Nurses play an instrumental role in providing education at discharge to help patients prevent and manage constipation at home. Nurses should educate patients on non-pharmacological management of constipation and provide medication teaching on any prescribed laxatives (Hunter, 2014).

**Transitions of Care/Discharge Instructions and Prevention of Readmissions**

- Clinical pathway facilitators are key to improving coordination of the care processes and communication with patients and families (Vanhaecht et al., 2010) (Level I).
- Care for comorbidities needs to be proactive, patient-oriented, and multidisciplinary (Williams, A., Dunning, T., & Manias E., 2007) (Level III).
- Follow up telephone calls shown to reinforce discharge education and assist in decreasing readmissions of TJR (Green, U., Dearmon, V., & Taggart, H., 2015) (Level III).
- Standardized protocols, discharge coordinators, and home care programs have proven effective in decreasing 30 day readmissions (Kheir et al., 2015) (Level IV).
- Ensuring that care transitions smoothly to each new phase of care, with the patient as a contributing partner, has the potential to improve pain management and functional outcomes (Samuels, J. & Woodward, R., 2015) (Level V).

**Utilization of Clinical Quality Indicators**

The Institute of Medicine has created a framework for healthcare quality that includes six aims for improvement (Institute of Medicine [IOM], 2001).

1. Patient safety protects patients from intended or unintended harm as a result of care.
2. Effective care is based in scientific knowledge and provided to only those in need of care.
3. Patient-centered care is respectful of individual patient needs, values, and choices.
4. Patients should be included in all clinical decisions.
5. Care must be delivered in a timely and efficient manner.
6. Equitable care provides for all patients despite gender, ethnicity, geographic location, and socioeconomic status (IOM, 2001).

Quality improvement is a cycle that starts with the definition of a goal or problem and then a change to practice with an evaluation of the outcome. There are many systematic process improvement methods available. Despite the method employed, structure must be applied to any changes made to achieve the aims of healthcare quality (Wyszewianski, 2014). Quality indicators to improve the care of the total knee replacement patient may be aligned with the organization’s goals and the overarching goals of the Institute of Medicine.

**Future of Total Joint Arthroplasty**
- LOS or same day discharge
- preoperative optimization
- group therapy
- discharge class
- preoperative home site visit or home care phone call

**What Does the Future Hold for Total Hip/Knee Replacements?**
Telerehabilitation may be a promising alternative to traditional face-to-face conventional rehabilitation. Many programs are going to same day discharge.

**Becoming Joint Commission Disease Specific Certified**
Joint Arthroplasty programs can benefit from becoming certified by The Joint Commission under their Disease-Specific Care Certification. Advanced certification is offered for total hip and knee replacement. Advanced certification looks at the broader continuum of care and involves a much more rigorous on-site review (The Joint Commission, 2016). Certification by a national body validates a program of excellence by its use of evidenced based guidelines and adhering to and utilizing clinical practice standards (Mori, 2012). Applying for and maintaining certification holds a program accountable for commitment to quality care that ultimately benefits the patient and the facility. With certification, a facility becomes known to patients and competing health care facilities as a center of excellence. These facilities demonstrate use of advanced technologies, efficiency in patient care, and have impetus and direction for a successful program. An increase presurgical class attendance, an increase in patient satisfaction, improvement on postoperative documentation, and an increase of orthopaedic certified nurses were all process improvements one facility noted from seeking certification (Mori, 2012). McWilliam-Ross (2011) state the certification process is a demonstration of the program’s commitment to unceasingly pursuing the best possible patient care.
Web Sites

Professionals:
- American Academy of Orthopaedic Surgeons: www.aaos.org
- National Association of Orthopaedic Nurses: www.orthonurse.org
- The Joint Commission: www.jointcommission.org
- The National Guidelines Clearinghouse: www.guideline.gov
- Orthopaedic Nurses Certification Board: www.oncb.org

Patient and Family:
- Bone Smart Knee Replacement & Hip Replacement Patient Advocacy & Online Community
  www.bonesmart.org
- John Hopkins Medicine:
  http://www.hopkinsmedicine.org/healthlibrary/test_procedures/orthopaedic/knee_replacement_surgery_procedure_92,P07673/
References


198. http://dx.doi.org/10.1177/0163278711427558


## Appendix: System for Rating the Strength of Evidence

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Level I</strong></td>
<td>High-quality randomized controlled trial with large sample and statistically significant difference or no statistically significant difference but narrow confidence intervals. Evidence from a systematic review, a meta-analysis, or an evidence-based clinical practice guideline where only results from randomized controlled clinical trials were used.</td>
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<tr>
<td><strong>Level II</strong></td>
<td>Evidence from at least one well-designed randomized prospective comparative clinical trial. Systematic review of primarily Level II studies.</td>
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<tr>
<td><strong>Level III</strong></td>
<td>Evidence from well-designed case controlled trials without randomization, comparative studies and evidence from a systematic review, a meta-analysis, or an evidence-based clinical practice guideline where results from randomized clinical trials and controlled clinical trials were used. Systematic review of primarily Level III studies.</td>
</tr>
<tr>
<td><strong>Level IV</strong></td>
<td>Evidence from case series and cohort studies. Evidence from well-designed descriptive, qualitative, or psychometric studies. Evidence from a systematic review, a meta-analysis, or meta-synthesis of descriptive or qualitative studies.</td>
</tr>
<tr>
<td><strong>Level V</strong></td>
<td>Evidence from the opinion of authorities or experts.</td>
</tr>
<tr>
<td><strong>Level VI</strong></td>
<td>Common practice, as documented in clinical articles or nursing textbooks.</td>
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*Modified from Centre for Evidence-Based Medicine, Oxford, UK. See [www.cebm.net](http://www.cebm.net).*