Developing an Evidence-Based Total Knee Arthroplasty Treatment Program in a Post-Acute Skilled Nursing Facility: A Case Report

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Abstract

Background and Purpose: Clinical pathways have been established in the acute care setting for a variety of diagnoses and procedures. However, in the post-acute setting, treatment protocols have yet to be developed. This appears due to lack of strong research in post acute rehabilitation and the fact that there are a wide variety of settings in which post-acute rehabilitation is delivered making standardization and outcome measuring extremely difficult. This case report describes the process of developing and implementing clinical guidelines for treatment of total knee arthroplasty (TKA) in a post-acute setting. **Case Description:** The process of identifying evidence-based guidelines is described. Program details, including best practice guidelines for therapy and implementation of changes to service delivery are provided. **Outcomes:** Comparison outcomes from pre-program implementation (2007) and after establishment of practice guidelines (2009) are discussed. Length of stay increased after the program changes by an average of 2.6 days. In 2009 despite patients reporting less pain on admission, they were evaluated to have less active knee range of motion than in 2007. Discharge knee range of motion was similar in the two comparison samples. Tinetti balance scores were also noted to be lower at evaluation of the 2009 patients. These findings may possibly indicate a reason for the increased length of stay in the 2009 case sample. **Discussion:** There are few established clinical practice guidelines in the post-acute setting. By utilizing resources in the literature and community, an evidence-based TKA treatment plan was developed and implemented for one post-acute SNF.

Key Words: Post-acute, rehabilitation, total knee arthroplasty, evidence-based, clinical, practice guidelines, Tinetti, length of stay, skilled nursing facility, outcomes, knee range of motion.

Introduction

Total joint replacements, specifically total knee arthroplasty (TKA) comprise a large portion of the diagnoses seen in the post-acute setting. Trends show that since 1993 the US has seen at least double the increase in total joint replacements. In 2005, over 400,000 TKA's were performed in the US and this number is projected to increase fivefold to over 21 billion by 2030.[1-2] Throughout the 1990's as Medicare payment tightened and hospitals were encouraged to discharge earlier, hospitals implemented critical pathways for care delivery. These pathways, essentially algorithms for care based on diagnostic codes, have been highly studied and found to reduce costs and length of stays while having no negative effect on medical outcomes.[3-5] The resulting shorter length of stays likely increased the need for post-acute (PAC) delivery options. According to the Centers for Medicare & Medicaid (CMS), post-acute care is: "Care that is provided to individuals who need additional support to assist them in recuperating following an acute illness or serious medical procedure."[5]

The skilled nursing facility (SNF) is one delivery setting for post-acute care that has seen a rise in admissions due to earlier hospital discharges.[6] Healy et al[4] found that in 2000 73% of patients following TKA surgery were discharged from the Lahey clinic to a SNF to obtain post-acute therapy. With increased demand of post-acute services, utilization of services in the SNF setting has increased greatly. In 2000, Medicare paid for approximately 66% of TKA surgeries and post acute care including therapies. The cost for total hip and knee replacements combined at that time was $3.2 billion.[7] These rising costs have been a concern since the 1990's with multiple attempts at cost containment such as the Balanced Budget Act of 1997 and the Deficit Reduction Act of 2005.[6,8] However, containing costs

without sacrificing outcomes is difficult to do when there is no standardization of protocols for treatment delivery in the SNF post-acute setting.[5]

While the post-acute arena has been booming for more than a decade, there has been no formal establishment of clinical pathways or protocols as there have been in the acute care setting. Each PAC setting has its own regulations and payment systems as well as different service delivery methods along with differing intensities, staff utilization, frequency and duration of rehabilitative care. As such, there was no way to track data or establish benchmarks across these various service delivery lines or diagnoses.[7-8] In February of 2007 a symposium on post-acute rehabilitation was held to investigate the various service delivery options in the post acute field and provide recommendations of areas for further study. Despite post-acute rehabilitation being a large component of the health care delivery system, few studies have been conducted to determine the rehabilitation process and establish evidence-based treatment protocols for specific medical conditions that will efficiently provide optimal outcomes.[6,9] Review of the literature shows that evidence-based treatment for TKA in the post-acute setting is minimal.[6,10] Currently there is a wealth of evidence-based individual assessments and interventions to choose from when treating patients following a TKA. There is not a determined protocol for post-acute rehabilitation following TKA nor is there a standard of outcome measurements that have been identified to assess if the protocols in place are having an impact on patient outcomes. Long term studies indicate that knee replacements improve quality of life but whether therapy is effective in the post acute setting is not well established.[11-12] However, there are established tests and measures along with interventions that can be utilized to create a standardized TKA treatment program.

Pain, range of motion (ROM), and functional mobility (bed mobility, transfers, ambulation distance, ambulation assistance and stair climbing) must all be addressed in a successful TKA program. Knee ROM (referring to active knee flexion or extension) is often used to measure both personal improvements and outcomes. The gold standard of treatment for TKA is early mobilization with bed rest being contrary to current best practice guidelines. This ensures increased active ROM of the knee during functional activities. Early mobilization also prevents post-operative complications such as deep vein thrombosis or pneumonia. Therefore, it is understandable that research is also finding use of continuous passive motion (CPM) to be an ineffective intervention for TKA treatment.[11,13-14] A meta-analysis of the literature done by Grella[14] found that "use of CPM at standard levels (2-4 hours/day) does not improve outcomes of knee ROM, strength or function or length of stay compared to an early knee mobilization protocol". Research has determined the knee flexion needed to ambulate on level surfaces is 65-70 degrees. Ascending stairs requires approximately 83 degrees for foot clearance while descending stairs requires 90 degrees of active knee flexion. Both sit to stand from a toilet or low chair and tying shoes require over 100 degrees of knee flexion.[2]

The standard for measuring joint range of motion is via goniometric measurements which is a minimum clinical requirement in the training of every Physical Therapist (PT) and Physical Therapist Assistant (PTA). Reliability of goniometric measurements has been extensively studied. Data analysis shows high intertester reliability (r=.98; ICC=.99) and validity (r=.97-.98; ICC=.98-.99).[15] A study by Brosseau et al[16] noted that the faster the ROM increases, the faster the functional mobility improves. Interventions for improving range of motion are a basic component of a PT plan of care and encompass therapeutic

exercises including active assistive, active and resistive, passive stretch, concentric and eccentric exercises. Patients are guided through these various exercises, increasing in both frequency and intensity with the goals being return of active and passive knee ROM to within functional limits. Other interventions can include use of electrical stimulation, either in the form of transcutaneous electrical nerve stimulation (TENS) for pain management or neuromuscular electrical stimulation (NMES) for muscle strengthening. Decreased quadriceps strength can interfere with functional mobility, especially stair climbing. One group of researchers found that when NMES was used to supplement standard ROM and strength exercises, it improved mobility within 8 weeks post operatively.[17] Various additional factors can affect ROM such as postoperative pain which can, in turn, affect the patient's ability to complete a successful postoperative rehabilitation program.[18]

Pain and function are the two main determinants of TKA outcomes at 1-year post surgery and are inter-related: when pain is decreased, function increases. Pain is now thought of as the 5th vital sign. Abatement of pain is known to be a primary reason many patients undergo total knee arthroplasty.[19-20] The Numerical Rating Scale (NRS) is one of many types of pain scales in use. The Numerical Rating Scale (NRS) for pain is based on an 11-point scale (0-10 rating) and has a high degree of sensitivity. It is simple to administer and easy to understand in the majority of the adult population.[21-22] Interventions for pain management include cryotherapy, transcutaneous electrical stimulation, limb elevation and edema management. Cryotherapy research has produced mixed reviews in terms of efficacy, although no studies have shown that applying ice to the injured area causes harm and is often used as part of the routine PT treatment with musculoskeletal injuries or following surgical procedures. Use of cold to the involved extremity, combined with elevation, can assist in

edema management as well as pain control both immediately post-operatively as well as in the post-acute setting.[23]

Functional mobility can be measured in many ways using a multitude of tools. One tool is the Iowa Level of Assistance Scale which has been shown to be reliable and valid for assessing function in 4 major areas: bed mobility, transfers, ambulation assistance and stair climbing. It is based on a 0-6 scale with 0 being independent, 1 for supervision, 2 for contact guard/minimal assist, 3 for moderate assist, 4 for maximal assist, 5 for a failed test even with maximal assistance and 6 being not tested. The Iowa Level of Assistance Scale, the functionally based assessment tool, has good intratester reliability (K=.79-.90; ICC .82), and moderate intertester reliability (K=.48-.78; ICC .82).[24]

Balance is also a necessary component of the examination process. While there are many evidence based balance tests available to therapists, not all have been proven to be reliable for adults living in the community, a common occurrence for most people who undergo total knee arthroplasty surgery. There are many choices in functional balance tests such as the 6 minute walk test or dynamic gait index. However, the Tinetti balance tool has been shown to have good intertester reliability including between novice and experienced clinicians in addition to be a reliable tool for predicting falls in community dwelling adults.[25]

Other concepts that are being discovered as reliable predictors of positive outcomes are self-efficacy and patient-centered care. Self-efficacy is defined as a person having the confidence to believe he/she can do something that is difficult, such as competing in a sports event or recuperating from an illness.[27] A study by Moon and Backer[28], specific to recovery after total joint replacements, found that persons with increased positive levels of self-efficacy correlated with outcomes of longer distance ambulation and ability to perform an

increased number of lower extremity exercises. Patient-centered care promotes the patient being at the center of care, with all of the healthcare providers and interventions focused on securing the best outcomes for each patient. This concept ensures the patient's preferences and needs as well as goals, are truly at the core of the treatment focus. Use of the patient interview during the evaluation and examination process is one way ensure the patient's needs and goals are central to the established plan of care. Goal setting in patient-centered language incorporating the findings from the patient interview is another important aspect of patient-centered care.[26]

No discussion of tests, measures and interventions is complete without addressing documentation. Use of electronic documentation has been shown to be a best practice for all facilities and clinicians. Efficiency and accuracy improve when using an integrated electronic health record process which can be easily modified to include necessary additions/deletions necessary to ensure best practice guidelines are being utilized.[29]

A study by Larsen et al[30] has shown that utilizing a rehabilitation protocol and providing accelerated care after total joint arthroplasty can reduce costs. Skilled nursing facilities tend to have greater variances in length of stay (LOS) and intensity of therapy as well as treat an older population with more co-morbidities and lower socioeconomic status than other types of PAC settings.[10,19] However, in the years ahead SNF's must manage their costs more effectively while promoting patient-centered care. Skilled nursing facilities will also find it necessary to justify intensity of care with clear outcome measures.[5,31] A study by Munin et al[32] has shown that patients who began rehabilitation on day 3 post-operatively had a shorter mean LOS (11.7 +/- 2.3 days; $p<0.01$) than those who started rehabilitation at day 4

or 5 with no increased cost in service delivery. Patients who receive physical therapy after a TKA improve in all aspects of function and attain therapeutic benefits from treatment.[33]

Clinical practice guidelines can assist in treatment planning and decision making as well as be used for quality assessment. When guidelines are appropriately utilized they can lead to both changes in practice as well as improved patient outcomes.[9,34] The *Guide to Physical Therapist Practice* (the Guide)[35] is such an example of practice guidelines, however the Guide does not provide specific clinical practice for one diagnosis or differentiate between the particular delivery settings. The need to ensure all patients who entered our skilled nursing facility for post acute rehabilitation following total knee arthroplasty were provided with the most effective and efficient examination, evaluation and intervention strategies was important to our rehabilitation staff at McLean Health Center. The purpose of this case report is to describe the process of establishing and implementing evidence-based clinical practice guidelines for patients who have undergone an elective total knee arthroplasty and are receiving therapy in a SNF post-acute setting.

Facility Description

McLean Health Center is a 150 bed skilled nursing facility that is comprised of a 30 bed post acute neighborhood and 4 other long term care neighborhoods. The post acute neighborhood receives over 550 admissions per year. Patients who have a primary diagnosis of status post TKA comprise approximately 25% of the caseload annually. The staff therapists working within the post acute unit possessed a range of experiences and qualifications which could affect competency in performing clinical examination, evaluation, prognosis and intervention in a post acute level of care. There was no standardization of total joint protocols, specifically total knee protocols, within the department nor did we have an

objective way to measure the outcomes of that diagnostic group. Additionally, we could not state that patients who had undergone a total knee replacement were receiving more thorough examinations, evaluations, treatment planning and interventions than were provided at other skilled nursing facilities. This SNF is a privately owned non-profit, located in an area of the country that has a high number of orthopedic surgeons operating in multiple acute hospitals that were rapidly growing in the field of total joint surgery. After completing a market analysis it was decided that becoming a center of excellence in total joint aftercare was a reasonable goal. However, in order to accomplish this, we needed to establish clinical practice guidelines for total joint replacements. The facility had already established a good reputation in the region with referrals from local surgeons and hospital discharge planners. Incorporating treatment protocols into our already established multidisciplinary team became a high priority. The SNF was already utilizing an integrated electronic health record process for all documentation that could be easily modified to include any necessary changes for best practice.[29] Time from planning, evidence gathering, and staff education to implementation of clinical practice guidelines for rehabilitation after total knee arthroplasty in our facility was 9 months during 2008.

Practice Guideline Development

A committee was established consisting of the Rehabilitation Director and Supervisor, both of whom were physical therapists (PT), an occupational therapist (OT), a home care nurse and a post-acute nurse. Additional subject matter experts were called upon to ensure thoroughness of all aspects of the discovery and staff education processes. The goal was to research and establish evidence-based guidelines for management of patients' status post TKA surgery who were admitted to this SNF. The facility was staffed with a post-acute

multidisciplinary team which included PT and PTA staff, OT and occupational therapy assistants (COTA), rehabilitation aides, nursing care (consisting of a combination of advance practice, registered and licensed practical nurses and certified nursing assistants), social work and physicians (comprised of the patient's orthopedic surgeon and our facility Medical Director who oversaw the post-acute unit). Other disciplines such as speech therapy, dietary and psychiatry, while not part of the core team, were referred to on an individual case basis.

The discovery process (Tab. 1) was multi-pronged and included the first step of determining the local surgeons' post-operative protocols and what the expected outcomes were for a patient after participating in a post-acute rehabilitation program. A brief survey was developed that was used during a verbal interview, done in person if possible, with the orthopedic surgeon or a representative (Physician Assistant or office manager). The findings of this survey were compiled into a surgeon total joint protocol spreadsheet which included the surgeon's expected outcomes, preferences regarding weight bearing, exercise parameters and precautions, anticoagulation therapy, lab workups, follow up office visits, daily nursing care and acceptable levels of function (including involved knee ROM) at discharge. The majority of the surgeons' preferences were for the patient to return home after surgery to receive their post-acute rehabilitation in their home. However, they acknowledged that almost half of their patients would not be able to safely achieve that goal due to co-morbidities or complications from or following surgery. SNF post-acute care was identified as being necessary and appropriate for those patients who could not rehabilitate at home.

The next step in the process was to identify the necessary physical therapy evaluation and examination tools, using the Guide as one primary reference. CMS requires all Medicare Part A SNF PT evaluations be on the Fox-Thompson evaluation form as it is provided and in

its entirety. No alterations to this form are allowed although therapists can add comments to explain findings or add an addendum if they wish. CMS allows a variance in tools used to obtain the data. Review of the examination process included ROM, pain assessment scales, an appropriate functional mobility tool and a balance tool. Goniometric assessments, the gold standard for PT and OT evaluation of joint ROM, were already in place. Pain assessments using the NRS were currently being utilized as a component of the standard examination so those were continued as well. The functional assessment portion, included use of the verbal descriptors of the Iowa Assistance Scale which had been shown to be evidence-based with good inter-rater and intra-rater reliabilities.[24] The Tinetti had been adopted as the primary inpatient rehabilitation balance outcomes assessment tool, therefore it made sense to continue to use it for our TKA initial and discharge evaluations. Use of patient interview during the initial evaluation process to incorporate patient-centered goals into the established plan of care had been adopted in the months prior and was being performed by both PT and OT during their respective evaluations. Since these tools were already in place, no further additions were needed for the standard examination. However, in reviewing our current initial and discharge reports, via quarterly audits, it was determined that all therapists were not consistently using these evidence-based /outcomes based tools in their discharge evaluations. Additional staff education would be required to ensure every therapist on the post-acute team utilized the same tools for their initial and discharge evaluations.

Third, the literature was searched for evidence-based PT interventions following total knee arthroplasty. Multiple searches were performed using APTA Hooked on Evidence, Pub Med/Medline and Cochrane databases with the search names being “Total Knee Arthroplasty, Total Knee Rehabilitation, Knee Surgery, Physiotherapy and/or Physical

Therapy". To be more complete, interventions for musculoskeletal injuries of the knee were also searched. The literature supported that increased repetitions of various exercises were needed to affect a maximum positive outcome both for quadriceps strength and for active knee ROM.[36] Use of continuous passive motion (CPM) machines to improve ROM after TKA surgery had been found either to be inconclusive or ineffective in the research.[37] During the survey of local surgeons, mixed responses to the use of CPM machines as an adjunct to hands-on PT interventions was discovered. The surgeons that referred to the facility on a regular basis knew the patient would receive an aggressive PT program. As such, they did not order the CPM, but would accept our request for CPM use in situations with very limited ROM. Surgeons who had not previously had experience with our program, or had a negative idea of SNF rehabilitation more often automatically ordered the CPM. Research on cryotherapy and electrical stimulation (TENS and/or NMES) discovered both interventions had been found to exert either a neutral or positive effect on both pain and edema management following TKA. Cryotherapy had been part of our current interventions and was kept, while electrical stimulation interventions were added to the guidelines.[17,19-20,23]

Step 4 was a review of our current processes, such as when the initial PT evaluation was performed, use of evidence-based assessment tools at discharge, current frequency of PT and OT treatments for patients with a total knee arthroplasty and overall use of OT in terms of type of interventions, frequency of therapy and patient education. The combined analysis of the literature review with review of the surgeon protocols demonstrated that promoting use of OT, early mobility and education, early independence, and frequent therapy sessions utilizing a functionally based approach, along with an increased exercise regime, should result in improved functional outcomes.

Prior to this discovery process, 100% of the PT evaluations were performed on day two after admission from the hospital. PT frequency and treatment time did not have standardized amounts other than attempting to provide the patient approximately sixty minutes per treatment day. OT involvement with patients undergoing TKA rehabilitation was focused on activities of daily living related to bathing, dressing and toileting with less emphasis on home management, upper extremity strength and endurance. Patients were given a home exercise program toward the end of the length of stay rather than early in the rehabilitation process. Independence was given close to discharge with the rational being that the patient should be at his or her maximum level of function to ensure optimal safety. Chart review prior to the evaluation had always been done but the therapists did not know surgeon protocols or preferences other than what was stated in the discharge summary from the hospital. This stage also comprised a review of criteria for discharge and the discharge planning process.

Departmental goals were to provide effective rehabilitation for patients admitted from the hospital after total knee arthroplasty. For fiscal reasons, there needed to be efficiency in the delivery of service as well as quality driven services. Step 5 would add the educational components to all staff involved in direct patient care in order to ensure the entire multidisciplinary team had the skills, knowledge and understanding of the clinical practice guidelines. Education related to exercise protocols, using the American College of Sports Medicine (ACSM) guidelines, would also be included.[36]

Application of the Clinical Practice Guidelines

Step 1: A list of protocols by surgeon was established and put into a spreadsheet for all staff (therapists, students and nursing/medical staff) to refer to upon admission and

throughout the patient length of stay. The protocols not only included rehabilitation guidelines but also any nursing and medical guidelines as well. Additionally, the PT staff revised the home exercise programs to include specific protocols by surgeon and to increase the number of repetitions to a minimum of twenty per exercise.

Step 2: Alterations to the PT and OT initial and discharge documentation in our electronic data system were made. The documentation system now allowed for choices in assigning diagnostic codes, which would allow us to track outcomes by diagnosis from this point forward. There was a focus on primary evaluation procedures that have been established in the literature such as: pain ratings, range of motion, balance and functional mobility (bed mobility, transfers, ambulation distance, ambulation assistance and stair climbing). Pain was assessed with the NRS, active knee flexion in sitting, knee extension in supine, functional mobility with the Iowa Level of Assistance Scale descriptors and balance using the Tinetti scale. All other aspects of the initial evaluation, examination and discharge evaluation such as manual muscle testing remained the same with the TKA population as with all other patient diagnoses. All therapy staff (PT and OT) was educated to ensure all data was evaluated and recorded at both the initial and discharge time frames. These criteria were also added to the quarterly audit form to ensure full compliance.

Step 3: PT interventions were compiled from the literature search findings and best practice evidence available. The team devised a multi-level approach to develop the process, incorporating basic principles from the Guide as a baseline for TKA treatment.[35] Patients with the primary diagnosis of TKA would receive a combination of functional mobility training and therapeutic exercise for passive, active assistive and active ROM with increasing challenges in repetitions and resistance as the patient tolerated. PT frequency was

standardized at 90-120 minutes per day a minimum of six days per week with a minimum of 45 minutes of therapy one day per week. Home exercise instruction packets were customized to each patient depending on surgeon preferences and each patient's abilities. Additional interventions were the use of ice packs and affected leg elevation following every PT session and as requested by the patient. The use of electrical stimulation was also included in the new PT intervention guidelines, either in the form of TENS for pain management or NMES for quadriceps strengthening. Also in the guidelines frequency, intensity and duration of exercise were increased. The number of repetitions for either the upper or lower extremity exercise program was increased to a minimum of twenty each time the specific exercises were performed, up to two to three times per day. Interventions also included standing therapeutic exercise, standing balance retraining and core/abdominal exercises. Based on the literature findings and the surgeons' preferences the mandatory or pre-planned use of CPM was discontinued, only using it if the surgeon ordered it or as an adjunct to our treatment interventions in cases where the knee ROM was slow to improve. The utilization of occupational therapy services was increased to promote higher level home management and more intensive upper extremity strengthening via the addition of group upper extremity exercise classes and kitchen/home management classes as well as incorporating use of standing activities into the treatment plan. OT also added baseline visual testing and the mini mental screening to their examinations to be more thorough in their evaluation process.

Step 4: As noted previously, research has shown that early mobilization is essential for successful outcomes, which precipitated our decision to begin conducting our evaluations on day of admission whenever possible.[11] Accomplishing this was a function of the time of day the patient was admitted and their medical and psychological status upon admission. The

goal of rapid independence in functional mobility also began on day of admission so that any patient who demonstrated safe mobility and stable vital signs was given independence with toileting and short distance ambulation (in the patient's room) with the appropriate assistive device. Studies have found that rehabilitation based in function appear to have better outcomes 3-4 months post discharge versus pure strengthening or flexibility exercises.[33] Our standard of practice was re-designed to provide all patients with a primary diagnosis of TKA a functionally-based seven day per week PT treatment plan. OT frequency increased to a minimum of three to five times per week and entailed a combination of self-care training, home management, upper extremity exercise and functional standing task training. Discharge planning was implemented at the initial evaluation to obtain information on the patient's home and social support as well as their personal goals and wishes. The social worker and nursing staff worked with the patient as well to obtain needs and concerns for a safe discharge home. In the discovery process, we obtained the surgeon's minimal knee ROM preferences for discharge. These, plus the findings in the research, allowed us to set a minimum knee flexion AROM of 90 degrees for discharge. However, staying in line with the facility's core beliefs of patient-centered care, patient preference must always be taken into account and this was planned into the guidelines as well. If a patient was functionally independent and medically stable, he or she could be discharged with less than 90 degrees of active knee flexion if an earlier discharge was chosen other than the team had identified. The staff embraced these concepts as important to positive outcomes and patient satisfaction. To further reinforce these values, we moved education of the home exercise program from the end of the patient's LOS to the beginning, introducing the program by day two to promote independence and understanding of the program by discharge.

The final phase in the application of the guidelines (Tab. 2) was to provide staff with education and skill competency where necessary. Staff included all PT and OT staff as well as the remainder of the multidisciplinary team for maximum carryover and outcomes. Monthly education over a six-month period was provided on evidence-based best practice for TKA in addition to the surgeons' protocols that had already been put in place. The management team identified articles related to TKA treatment and staff were divided into small groups to critique the literature for best outcomes. Each group had at least one staff member who was well versed in the literature review process. Next, a video of TKA surgery was shown to ensure the rehabilitation staff was up to date on the exact process a patient undergoes when having elective knee replacement surgery. This video was emailed to any staff member who could not attend the group viewing. Month three focused on evidence review. An associate professor from a local PT program guided staff through the process of developing an appropriate clinical question and performing a basic review of literature to support the expected outcome. We also obtained use of their library for ongoing research. The following two months allowed time for staff, working again in small groups, to devise their own clinical questions related to TKA treatment and find appropriate literature to then share their findings with each other. In month six the evidence was compiled to determine treatment areas the staff was lacking in knowledge or skill. In light of the variance in skill level among therapists we invited a PT who specialized in electrical stimulation to provide an in-service and loaner units for staff education and patient trial. Staff then designed electrical stimulation protocols for TKA treatment of pain and swelling and also for strengthening. The DPT student assigned to our facility during that time frame provided a review of the current literature on the topic and additional research support.

The facility promoted community education and was supportive of instituting a Healthy Joint Lecture Series with the initial focus on TKA surgery and treatment as an educational service to both our staff and the neighboring community. Guest lecturers were the local orthopedic surgeons. We used our "Rehab Reunion" annual celebration to showcase former patients who had successfully completed their post-acute TKA rehabilitation and were back to pre-operative work and hobbies.

We were team oriented in our development and implementation of the TKA clinical practice guidelines and changes. The entire process encouraged staff input and direction. Staff with masters degrees or those interested in research were utilized as 'leads' to assist other staff less comfortable with finding and interpreting research; the multidisciplinary team was included in the education of the rehabilitation changes as well as the surgeon protocols and preferences. Additionally, this organization promotes educational advancement and evidence-based practice in all disciplines so the post-acute team was already willing and interested to identify needs and implement changes.

Outcomes

In order to measure if the service delivery changes had any meaningful effect, comparison data was taken using patients who had undergone a unilateral TKA and had completed a post acute rehabilitation stay at our facility within the three months just prior to beginning the discovery process (late 2007) and the three months just following full implementation of the guidelines (early 2009). Initial and discharge measures being compared at both time frames would be: AROM of the involved knee extension and flexion (using goniometry measurements) and pain levels using the NRS. The Tinetti balance scores could be used to compare data at initial evaluations in the two time frames but discharge data

could not be compared as staff had not been reassessing balance status at discharge before the guideline implementation. Staff productivity and patient length of stay during both three month periods would also be compared to assess if there was an alteration in departmental efficiencies or if the changes to the program created an alteration in length of stay.

The expectation was that by altering service delivery to the TKA population, we would see an improvement in outcomes achieved in a more cost-effective manner. Through implementation of consistent evaluation and intervention protocols and outcomes assessments, it was hypothesized that there would be an increase in staff productivity and a decrease in average length of stay in the 2009 group as compared to the 2007 group. Utilizing evidence-based interventions to decrease edema, increase ROM and decrease pain was expected to show a decrease in patient reported pain levels between initial and discharge evaluations as well as an increase in active knee range of motion.

Following implementation of the TKA clinical practice guidelines, staff productivity increased significantly. Comparison between the two time frames shows productivity to have changed from 70.5% to 87.2%, an increase of 16.7% in less than one year. (Tab. 3) One hypothesis for this is that the established guidelines provide the therapist with a more definitive outline for evaluation and intervention, causing increased efficiencies. The additional groups and overall increased utilization of occupational therapy allowed for more efficient use of OT time while actually being able to reach more patients during their length of stay. Comparison data taken on patients in the SNF before the guidelines were implemented versus after showed the latter group had lower knee ROM and balance scores on initial examination.

Patient outcomes showed a smaller improvement between the two comparison samples. Mean evaluation data for active knee range of motion was 67 degrees in the 2009 group as compared to 70 degrees in the 2007 group. (Tab. 4) While evaluation data showed minimal differences, discharge knee range of motion was similar in the two comparison samples. Patient reported pain levels (Tab. 5) improved by 1 point on the NRS rating scale between evaluation and discharge in both samples, although the 2009 group reported less pain at initial evaluation (NRS level 5/10 in 2009 versus 6/10 in 2007). Tinetti balance scores (Tab. 6) were compared solely at initial evaluation due to incomplete data being available prior to 2009. Of note are the lower Tinetti evaluation scores in the 2009 population (mean of 7/16). Sample size was different in the 2 time frames with 52 patients meeting the established comparison criteria in 2007 and 40 in 2009.

Mean length of stay (Tab. 7) increased by 2.6 days from 8.3 days in 2007 to 10.9 days in 2009. This increased length of stay could have been due to patients being discharged from the hospital earlier or being admitted at a lower level than had been done previously. As noted earlier, most surgeons we interviewed stated their preference was to discharge the patient home after a TKA. They tended to only refer the more medically unstable or lower functioning patients for admission to a SNF for post-acute rehabilitation. The other component to this could have also been the patients themselves who chose SNF for their post-acute rehabilitation, either because they lived alone or lacked the confidence that they could succeed and be safe at home immediately following surgery. These factors could have directly affected the average length of stay. Despite having lower ROM and Tinetti scores on examination, the 2009 group met the discharge goals established in the practice guidelines. This may have accounted for the additional 2.6 day LOS noted in the 2009 comparison

sample. The addition of a more thorough evaluation and plan of care process with establishment of clinical practice guidelines could also have been a component to an increased LOS in 2009. Significant advances to pain control have been made in a short time frame and this could have contributed to the 2009 patient sample reporting less pain on admission.

Discussion

Economic changes as well as a move toward pay for performance are creating a need for more outcome-based treatment approaches in the post acute setting for patients who have undergone knee arthroplasty surgery.[5,7] This was the impetus for McLean rehabilitation department to undertake a discovery process to research and establish clinical practice guidelines for patients following total knee arthroplasty who were admitted to our post acute SNF setting. As part of this process, we met with local surgeons to obtain their respective protocols and preferences and combined those with best practices for PT evaluation, examination and interventions as well as OT interventions. The entire post-acute multidisciplinary team was involved in the process. Our goals were to provide effective and efficient care to all patients receiving post-acute rehabilitation, with this initial focus on those that were admitted following elective total knee surgery.

The hypothesis of increased staff productivity with more clearly defined practice guidelines was supported by the data. Patient outcomes, also hypothesized to improve, did so but to a smaller degree. The mean length of stay increased versus decreasing as had been proposed. The average length of stay in 2009 was 10.9 days. This LOS was still well below current research by DeJong et al[10] that showed the average LOS in a post acute SNF was 15 days.

A number of factors could have affected the outcomes. The PT staff performing the examinations and treatments was not the same in the two time frames compared nor did the same staff member perform the initial and discharge evaluations on each patient. Patient age and co-morbidies were not taken into account yet these factors could skew the data significantly. There were also a different number of patients that fit the criteria in the 2 comparison time frames. It is difficult to state for certain that this did or did not affect the outcomes. Prior level of function (PLOF) was not included in the outcomes measured for this case report but they could have an effect on outcomes in each group assessed. Economical factors could also be in play, as the national economy changed significantly between 2007 and 2009, with many people having lost jobs or had alterations to their medical benefits. As such, patients may have waited longer to have surgery which could have resulted in PLOF being lower in the 2009 population, thereby creating the smaller positive outcomes for each of the areas compared in 2009 versus 2007. Additionally, acute care practice of discharging patients earlier and more medically fragile continues to increase as the hospitals are met with their own financial challenges. Surgeon preference to refer to SNF only the more complicated cases would also affect the length of stay and examination findings. Pain after surgery appeared to be better managed by medical staff with many options available to patients starting immediately after surgery and continuing throughout their entire rehabilitation process. This could explain the finding that patients reported lower pain at evaluation in 2009 than in 2007.

This case report outlining the process and implementation of a clinical practice guideline for TKA treatment in a post-acute SNF setting could be used as a basis for further case studies. It would be beneficial to determine the effects of prior level of function, age, co-

morbidities and hospital complications on the functional and physical outcomes related to post-acute SNF rehabilitation after TKA. Another interesting avenue to pursue could be the relationship between prior work or recreational hobbies and outcomes from TKA surgery. A more detailed look at cost per patient day versus overall length of stay is also warranted.

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Table 1

Practice Guideline Development for Total Knee Arthroplasty (TKA)

1. Committee goal to research and establish evidence-based guidelines for management of patients who had undergone total knee arthroplasty surgery and who were admitted to this SNF.

2. Reviewed areas of strength and areas for growth needed to incorporate evidence-based best practices into practice guidelines (modified SWOT analysis of this particular diagnostic group).

3. Conducted in-person interviews with local orthopedic surgeons to obtain their post-operative protocols and expected outcomes.

4. Spreadsheet created with the surgeon preferences and total joint protocols including expected outcomes, preferences regarding weight bearing, exercise parameters and precautions, anticoagulation therapy, lab workups, follow up office visits, daily nursing care and acceptable levels of function (including involved knee ROM) at discharge.

5. Identified necessary examination tools for PT (used at both initial and discharge evaluations) to be knee range of motion, strength, pain assessment scale, functional mobility and balance. Modified current PT and OT processes as was necessary. Adjusted frequencies for service delivery as well.

6. Modified electronic documentation to include all evidence-based examinations and interventions as well as initial and discharge evaluation forms. Added a daily communication note between therapy and nursing to ensure carryover of level of assistance needed for functional mobility, or patient independence if allowed.

7. Modified existing quarterly audit tool for review of proper documentation standards at initial and discharge time frames.

8. Established criteria for discharge from the SNF to home or a lesser level of care.

9. Designed standards for weekly discharge planning meetings.

10. Created education plan to ensure direct patient care staff had the skills, knowledge and understanding of the established clinical practice guidelines. Invited guest lecturers including PT professors, PT clinicians and orthopedic surgeons to participate. Included viewing of live video of a TKA surgery.

11. Home exercise programs and therapeutic exercise protocols designed based on the American College of Sports Medicine (ACSM) guidelines. Electrical stimulation protocols were also created and staff was provided education and practice time to ensure competency.

Table 2

Clinical Practice Guidelines for TKA in the SNF Post-Acute Setting

1. Surgeon protocols followed for each patient; surgeon to be contacted by nursing to obtain clarification of inconsistencies or concerns.

2. PT evaluation completed on day of admission if patient can tolerate; examination data evaluated at both initial and discharge time frames.

3. Functional mobility measured using Iowa Level of Assistance Scale in descriptive format.

4. Active knee ROM measured via goniometry for seated knee flexion and supine extension.

5. Balance measured using Tinetti balance scale; assigned score of 0-16; a lower score indicating potential fall risk and consult with nursing to decide if alarms or more frequent nursing checks are recommended.

6. Pain measured using Numerical Rating Scale.

7. Vital signs including oxygen saturation, blood pressure and heart rate taken per national standards.

8. Manual muscle test completed per therapy standards.

9. Plan of care including goals and time frame established in consideration of patient's goals and personal needs.

10. Patient given approval for independence as soon as vitals are stable and patient has demonstrated safe functional mobility in room and bathroom (requires PT and OT agreement).

11. Functional status and level of assistance needed updated daily by PT and OT for nursing care carryover.

12. PT sessions 90-120 minutes per day 6x/week plus 45 minutes once per week.

13. OT evaluation completed within 24-48 hours of admission; interventions to include home management and upper extremity group classes plus individual ADL treatment sessions; total treatment sessions of 3-5x/week.

Table 2 (continued)

14. PT interventions to include increased repetitions of therapeutic exercise (minimum of 20 repetitions per exercise), functional mobility training and home exercise instruction beginning on day 2; all following specific surgeon protocols for each patient; can include electrical stimulation if PT evaluates as appropriate; can include CPM either if surgeon orders or is contacted for approval in cases of poor knee ROM (less than 70 degrees); PT to evaluate/establish CPM settings.

15. Nursing to provide pain management via medication management and patient education; nursing to apply ice to involved extremity following every PT session, encourage elevation of involved extremity; nursing to apply CPM per MD order once PT evaluates and sets parameters.

16. Nursing to be primary contact between rehabilitation staff and surgeon; takes verbal or written orders from surgeon and alerts rehabilitation of such orders as needed. Therapists may send surgeon a faxed list of questions for clarification of orders.

17. Social work involved from admission for patient advocacy, compiling of support system & needs for safe discharge home; also acts as intermediary between multidisciplinary team and insurance companies if needed.

18. Multidisciplinary team holds weekly meeting to discuss medical and rehabilitative status, including readiness for discharge, barriers to discharge; discharge date established or review set for following week.

19. Discharge once patient has achieved 90 degrees of active knee flexion, independence in functional mobility and has met goals established at initial evaluation or, per patient choice, when the patient is safe and medically stable enough for discharge to a lesser level of care.

20. All disciplines provide discharge instructions via written, verbal and demonstrative formats to patient and family/caregiver as needed; nursing reviews discharge recommendations, medications and all other medical information with patient on day of discharge; therapy discharge information sent to next provider.

Table 3
Staff Productivity Comparison between 2007 and 2009

	2007	2009	Difference between comparison groups
PT & OT staff productivity X12 weeks (# hours worked Divided by # treatment Minutes for each staff Therapist worked during 2 comparison times)	70.5%	87.2%	+16.7% increase

Table 4
Knee Active Range of Motion (AROM) Mean Outcomes from 2007 and 2009 Data

AROM knee (degrees)	Evaluation	Discharge	Improvement
	2007(n=52)		
Flexion	78	96	18
Extension	-8	-3	5
	2009(n=40)		
Flexion	*76*	93	17
Extension	*- 9*	-4	5

Table 5
Pain Mean Outcomes from 2007 and 2009 Data

Pain level Numerical Rating System (NRS) Patient reported 0-10 scale	Evaluation	Discharge	Improvement
	2007(n=52)		
Pain level (NRS scale)	6	5	+1
	2009(n=40)		
Pain level (NRS scale)	5	4	+1

Table 6

Tinetti Balance Score Mean Outcomes from 2007 and 2009 Examination Data

Tinetti balance test score Out of possible 16 points	2007 N=52	2009 N=40	Difference between comparison groups
Evaluation	8/16	7/16	-1

Table 7

Length of Stay Mean Outcomes from 2007 and 2009 Comparison Data

Length of Stay (days)	2007 N=52	2009 N=40	Difference between comparison groups
Mean	8.3	10.9	+2.6 days