

SHORT COMMUNICATION

Preoperative Physical Therapy Results in Shorter Length of Stay and Discharge Disposition Following Total Knee Arthroplasty: A Retrospective Study

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Objective: Total knee arthroplasty is an effective surgical approach used to treat arthritis and knee trauma. Its utilization has grown, as has the accompanying financial impact, resulting in an equal need to advance physical therapy practice. One emerging approach improving patient outcomes and reducing cost is the inclusion of a preoperative physical therapy visit. The aim of this study was to quantify the economic impact of a standardized preoperative physical therapy visit in the health-care setting.

Design: This study is a retrospective review of 1,043 adult patients who underwent total knee arthroplasty.

Methods: Patients who underwent total knee arthroplasty were divided into those who received a prehab compared with those who did not.

Results: Preoperative physical therapy resulted in a marked decrease in length of stay, with 37.1% of preoperative physical therapy patients leaving inpatient care on post-operative day 1 compared to 27.0% of the no preoperative physical therapy controls ($p \leq 0.001$). Preoperative physical therapy also improved discharge disposition, with 41.6% of preoperative physical therapy patients returning home and utilizing outpatient services compared to 23.2% of controls ($p \leq 0.001$). No effect on duration of care was observed.

Conclusion: These data suggest that a single preoperative physical therapy visit improves key outcomes, both clinically and financially, following total knee arthroplasty.

Key words: prehabilitation; preoperative physiotherapy; physical therapy modalities; health economics; health care costs; arthritis.

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LAY ABSTRACT

Total knee replacement is an effective approach to treat arthritis and knee injury. Demand for this surgery is growing rapidly, as is the need to implement cost-effective approaches to deliver high-quality patient care. To address this need, physical therapists have begun implementing a clinical visit before surgery, or prehabilitative therapy, which is focused on functional skill training, home safety preparation and education. However, it is unclear how the visit impacts key cost drivers, such as the length of time patients stay in the hospital following surgery. Therefore, we evaluated 1,043 patients who underwent total knee replacement, and found that patients who participated in prehabilitative therapy left the hospital faster, resulting in significant cost savings. Moreover, patients were also more likely to return home, rather than remain in a skilled care facility or require costly home-health care services. This study suggests utilization of prehabilitative therapy prior to total knee replacement substantially reduces cost.

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Osteoarthritis and knee trauma often cause unremitting pain and decreased mobility leading to substantial difficulty in carrying out even basic physical functions. Total knee arthroplasty (TKA), or total knee replacement, is an effective surgical approach to manage these conditions. TKA results in improved clinical outcomes (e.g. decreased pain, stiffness and increased knee mobility) (1), restoring the quality of life of patients by increasing the likelihood that they are able to independently return to everyday activities, return to work, and improve social functioning. There has been a marked increase in the uti-

lization of TKA, estimated to be 600% by 2030 (2), due to an increasing obese and aged population, broader range of approvable indications, significant surgical advancements, and increased number of procedures performed in younger populations (3).

The growing prevalence of TKA, and the accompanying financial impact, has resulted in an equal need to advance related therapeutic approaches. Chief among those is physical therapy, which plays a pivotal role in achieving the clinical benefits of TKA. Historically, physical therapy has been provided post-operatively as the standard of care for patients who underwent TKA before returning to their normal daily activities. Regimens have typically included patient-specific exercises, manual techniques, education focused on short- and long-term self-management, gait training, stretching, functional skill training, and management of pain and swelling. Despite the well-documented benefits of the surgery with post-operative physical therapy, the timelines for recovery continue to be long and biomechanical deficits often do not fully normalize (4). Therefore, new approaches have been employed to improve all aspects of rehabilitation, including preoperative physical therapy in the current study. Additionally, there is an evolving reimbursement strategy with the initiation of the Comprehensive Care for Joint Replacement (CJR) by Medicare (5), a model that holds hospitals financially accountable for the quality and cost of these procedures. These costs continue to increase markedly as high risk payment models, such as bundled care, are employed across health care systems (6). Because joint arthroplasties are collectively the greatest Medicare inpatient medical expense (7), a single inpatient day decrease in length of stay has been estimated to be \$1,800 in savings per patient (8), and publicly available Aurora Health Care chargemaster data lists a \$2,009 daily room charge when averaged across all system hospitals (9). As a result there is an increasing focus on exploring improvements during pre-, peri- and post-operative care that concurrently improve patient outcomes and decrease economic burden.

One recent approach is the inclusion of pre-operative physical therapy, or prehab. Prehab is a clinical visit completed prior to surgery, and is focused on gait and functional skill training, home safety preparation and education (10). The overall goal of prehab implementation is to improve TKA clinical and financial outcomes, in part coming from its potential role in decreasing length of stay (11).

In the current retrospective study, we comprehensively examined the economic impact of standardized prehab in the health care setting, using a single physical therapy visit to determine if it improved patient outcomes and cost burden for TKA patients. We compared the outcomes between TKA patients who underwent prehab to those who did not. Our outcomes were to determine if prehab decreased the length of hospital stay,

improved discharge disposition and decreased duration of care. Additionally, we determined if prehab improved utilization of home health and outpatient therapy visits when compared to the no prehab group. Collectively, we provide data that demonstrates substantial financial savings through prehab utilization.

METHODS

The Aurora Health Care Institutional Review Board approved this single-health care system retrospective study. Charts were reviewed for patients who underwent TKA from September 2015 through March 2017. Patients of at least 18 years of age who had TKA were included. There were 221 patients who had a prehab visit and 822 who did not. Patients were excluded if the TKA was due to trauma, if they were living in a nursing, skilled-care or assisted living facility as their primary residence, if they had a unicompartmental TKA, hemi-arthroplasty, or bilateral TKA, or if they had a previous TKA on the same or contralateral limb in in the previous 2 years. All patients underwent surgery at the same facility and experienced a similar post-operative guideline. Patient demographic analysis revealed no differences between treatment groups (**Table I**).

The electronic medical record review included the following variables: discharge disposition (returning home following hospitalization with outpatient versus home care services, or entering a subacute rehabilitation facility), total duration of care (day of surgery until discharge date from outpatient physical therapy), number of outpatient therapy visits, length of hospital stay, attendance of preoperative therapy visit, number of home therapy visits, age, sex, home zip code, and if there were other adults in the household. These data were collected as part of routine clinical care.

Statistics

All the category variables were described as frequency and percentage. Continuous variables were described as mean and standard deviation. For category variables, chi-square and/or Fisher exact tests, wherever appropriate was used. Depending

Table I. Comparison of patient baseline and rehabilitation utilization for total knee arthroplasty

	No prehab group	Prehab group	p-value
<i>Demographic characteristics</i>			
Age, years, mean (SD) [range]	66.74 (9.77) [33–95]	65.71 (8.91) [42–89]	0.89
Sex, % (n)			0.95
Woman	60.71 (499)	60.18 (133)	
Men	39.29 (323)	39.82 (88)	
Household, % (n)			0.27
Living alone	20.32 (167)	16.74 (37)	
Living with others	79.68 (655)	83.26 (184)	
<i>Rehabilitation utilization variable</i>			
Duration of care, mean (SD) [min–max]	70.42 (27.52) [5.00–133.00]	70.85 (28.18) [8.00–123.00]	0.87
Total units, mean (SD), n			0.61
Home or self-care	17.87 (6.59), 191	18.00 (5.94), 92	
Home-health care services	21.33 (7.09), 508	21.11 (9.30), 110	
Skilled nursing facility	26.94 (8.52), 123	24.74 (9.48), 19	
Frequency, % (n)			0.23
Alone		Other	
Home or self-care	17.16 (35)	29.56 (248)	
Home-health care services	54.90 (112)	60.31 (506)	
Skilled nursing facility	27.94 (57)	10.13 (85)	

SD; standard deviation.

on the distribution of the continuous variable *t*-test was used for comparison of the groups. For all statistical tests an alpha of 0.05 was used and all statistical analysis was done using SAS version 9.4, SAS Institute, Cary, NC.

RESULTS

Reduced inpatient length of stay following preoperative physical therapy

Shortening length of stay following total knee arthroplasty reduces cost, decreases the threat of acquired infection and increases opportunities for patients to better engage in functional recovery at home (12, 13). Therefore, in the current study we categorized length of stay by 1, 2, and 3 or more days post-surgery. We found a marked decrease in length of stay in our prehab cohort. More specifically, 37.1% of prehab patients left inpatient care by day one compared to 27.0% of those who did not participate in prehab. Discharge at day two was nearly identical, 48.9% and 48.8% in prehab and no prehab controls, respectively. In agreement, 14.0% of prehab discharged at day 3 compared to 24.2% of no prehab controls (overall $p \leq 0.001$; **Fig. 1A**). These data suggest decreased length of stay for patients who have participated in a prehab visit compared to those who have not. Financially, this potentially translates into large savings within a health care system.

Discharge disposition

Prehab improved the discharge disposition in patients who underwent TKA. Discharge disposition was measured as the percentage of people who either returned home with outpatient services, returned home with home care services, or required a subacute rehabilitation facility stay. We found 41.6% of prehab patients returned home with outpatient services compared to 23.2% of those who did not participate in prehab. Moreover, 49.8% of prehab

patients required home-health care services compared to 61.8% of those without prehab, and 8.6% of prehab patients entered skilled nursing facility compared to 15.0% of those without prehab ($p \leq 0.001$; **Fig. 1B**).

Duration of care

We also focused on the total degree of post-operative treatment, which included post-operative physical therapy visits and total duration of care. We were able to analyze patients who remained within our health care systems. As standard practice, patients self-selected their preferred physical therapy site, and their participation in physical therapy was tracked. We wanted to better understand if the primary impact of prehab was greatest in early postoperative recovery, or if the decreased length of stay and improved discharge disposition would translate into longer-term improvements as well. Interestingly, no differences were observed in total duration of care between patients with prehab, 70.8 ± 28.2 days, compared to those without prehab 70.4 ± 27.5 days ($p \leq 0.87$; **Fig. 1C**). Patient rehabilitation utilization was also similar between these groups, with no difference between the number of home health visits utilized when broken down by discharge disposition ($p \leq 0.61$; Table I).

Cofactors potentially affecting recovery outcomes

Functional rehabilitation, attendance of post-operative physical therapy sessions and assistance with daily activities may, anecdotally, be improved by the support of household members. To determine the relationship of household members to postoperative rehabilitation in the current study, we categorized patients into two areas: 1) those living alone at home, or self-care, and 2) those living with others, home-health care services and skilled nursing. We reasoned that those living alone would be less likely to return home with outpatient services. Unex-

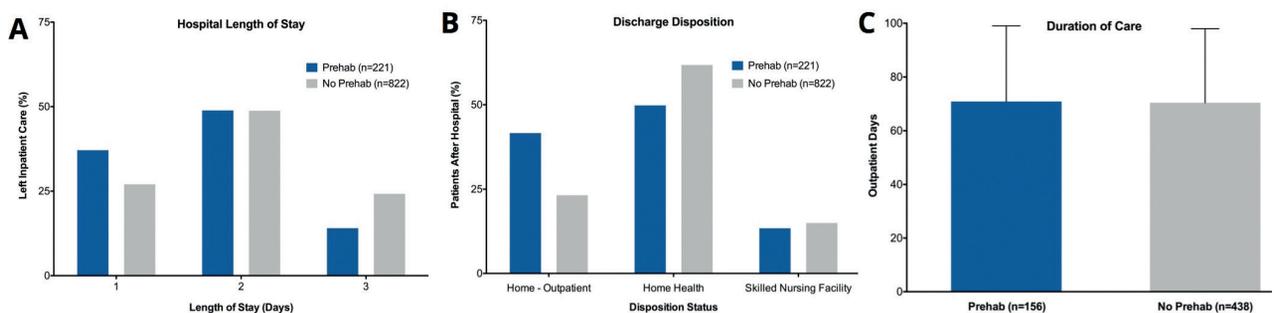


Fig. 1. Patients receiving prehabilitative therapy decreased post-acute care services. (A). Length of stay is reduced with prehab. 37.1% of the patients receiving prehab left inpatient care by day one compared to 27.0% of no prehab controls. Discharge at day two was 48.9% for prehab and 48.8% for those without prehab. Discharge at day three was 14.0% for prehab and 24.2% without prehab (overall $p \leq 0.001$). (B) Discharge disposition improves with prehab. We observed a substantial shift of patients returning home without additional services when compared to no prehab. 41.6% of prehab patients returned home for self-care compared to 23.2% of those without prehab. 49.8% of prehab patients required home-health care services compared to 61.8% of no prehab controls. 8.6% of prehab patients entered skilled nursing facility compared to 15.0% of those without prehab (overall $p \leq 0.001$). (C). No difference in total duration of care was observed between patients receiving prehab and those who did not. Patients receiving prehab had a total duration of care of 70.8 (28.2) days compared to those without 70.4 (27.5) days ($p = 0.87$).

pectedly, we found no association between living status and discharge disposition ($p=0.23$; Table I).

DISCUSSION

The goal of this study was to further examine the impact of a standardized prehab visit on the cost of care for patients undergoing TKA. The marked increase in TKA usage in osteoarthritic patients, coupled with substantial changes to cost has pushed providers to re-think how rehabilitative care is delivered. Medicare statistics from the CJR model demonstrate a cost of over \$7 billion dollars alone for the hospitalizations of total knee (and hip) replacements in 2014. In the current study, we conducted a retrospective medical records review to determine the effect of prehab on health care cost by reducing length of stay, and as a proxy to improved patient outcome, increasing the percentage of patients who went home and utilized outpatient rehabilitative services. Our results revealed a 1 day decrease of length of stay for 10.1% of TKA patients who had prehab. With bundled care reimbursement for the East North Central region, the location of the current study, set at \$21,173, a 1 day length of stay savings in 10% results in \$2,009/per patient (9), or \$2M for every 1,000 patients treated (5). Further per patient cost reduction through reduction in skilled nursing facility charges and decreased home health agency utilization results in additional savings. In sum, the central finding is that prehab shortened length of stay and discharge disposition to significantly improve cost burden and hospital margins (14), which we suggest leads to the ultimate goal of employing best practice to improve patient outcomes.

While not assessed in the current study, decreased length of stay and discharge disposition may also result in decreased risk of hospital acquired conditions (e.g., infection, falls) (13), increased bed availability and decreased risk of readmission (12) by going home with reduced length of stay compared to an acute stay at a skilled nursing facility. More challenging to classify, yet important for the healing process, is the physiological healing properties post-operatively. Indeed, a tight correlation between patient satisfaction during their hospital stay and post-operative Oxford knee score has been demonstrated (15). Thus, getting patients home faster and healthier may have a broader positive impact on their experience. Collectively, these findings firmly support the incorporation of a single prehab visit for all TKAs.

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