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Current Trends in Discharge Disposition and Post-discharge Care After Total Joint Arthroplasty

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Abstract
Purpose of Review The purpose of this manuscript is to review published literature over the last 5 years to assess recent trends and influencing factors regarding discharge disposition and post-discharge care following total joint arthroplasty. We evaluated instruments proposed to predict a patient's discharge disposition and summarize reports investigating the safety in sending more patients home by reviewing complications and readmission rates.
Recent Findings Current literature supports decreased length of hospital stay and increased discharge to home with cost savings and stable readmission rates.
Summary Surgeons with defined clinical pathways and those who shape patient expectations may more effectively control costs than those without defined pathways. Further research is needed analyzing best practices in care coordination, managing patient expectations, and cost-effective analysis of home discharge while at the same time ensuring patient outcomes are optimized following total joint arthroplasty.

Keywords Discharge disposition · Post-discharge care · Total joint arthroplasty

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Introduction

With one million total joint arthroplasty procedures performed in the USA in 2010, total hip and total knee arthroplasties represent some of the highest Center for Medicare and Medicaid Service (CMS) expenditures under the Diagnosis-Related Group (DRG) payment system [1, 2]. Evidence suggests that with the aging baby boomer population, an accelerated demand for total joint arthroplasty (TJA) can be expected over the next several decades [3]. While length of hospital stay following TJA has decreased over time [4, 5], a corresponding increase in discharge to acute rehabilitation and skilled nursing facilities has occurred. Annual inpatient rehabilitation services have been estimated to cost more than $3 billion following TJA [6, 7]. Increased demand for TJA and a paradigm shift in discharge destination is presently juxtaposed with an evolving reimbursement landscape. Bundled Payment for Care Improvement (BPCI) was initiated by CMS with a goal of decreasing cost, improving quality, and coordinating care among healthcare providers [8]. Private insurance carriers may model their reimbursement models accordingly and the traditional fee for service model will likely become obsolete.

Total hip arthroplasty (THA) and total knee arthroplasty (TKA) are predictable, clinically successful operations comprising a substantial procedural cost to the Medicare budget [9]. These procedures are now the focus of cost containment. Surgeons, hospitals, and post-acute care providers will be incentivized to coordinate care, streamline inefficiencies by decreasing cost and improve outcome quality for patients undergoing joint replacement. Strategies for cost containment include focusing on length of hospital stay in addition to discharge location following TJA. Iorio et al. recently reported on their 1-year experience from a large high-volume academic center of 721 patients undergoing unilateral primary total knee and total hip arthroplasty after implementing a BPCI model 2.

They concluded that the adopted BPCI resulted in decreased length of stay and increased discharge to home with stable readmission rates resulting in overall cost savings [10•].

The purpose of this manuscript is to review published literature over the last 5 years to assess recent trends and influencing factors regarding discharge disposition and post-discharge care following TJA. We will also evaluate instruments proposed to predict a patient's discharge disposition, report on cost containment efforts, and explore the safety in sending more patients home by analyzing complications and readmission rates.

Primary TJA

Reports suggest that nearly 40% of the total cost for an episode of care following TJA occurs after hospital discharge [11]. Following a multivariable analysis of 372 primary TJA patients, Halawi et al. found that patient expectation of discharge destination was the most important predicator of final disposition following total joint arthroplasty [12]. The authors suggest that this represents an opportunity by providing better preoperative education to shape and manage patient expectations and promote a feeling of safety and readiness to discharge home by incorporating the determination of discharge destination in the preoperative clinic visit. With patient expectation as an important predictor of final discharge destination following total joint arthroplasty, physician-led education and encouragement for a home discharge is a possible avenue for cost-savings without compromising safety or patient-reported satisfaction.

Schwarzkopf et al. reported that, in a database study of 28, 611 primary TKA patients, 45.9% were discharged to home with home healthcare services, 29.9% discharged to skilled nursing facilities (SNF), and 24.2% discharged home without home health care [13]. They found Black, Asian, and other races to be more likely to be discharged to a SNF or home with home healthcare resources. Further, Medicare patients were more likely to be discharged to a SNF. According to the CMS Year 2 Annual report 2013 to 2014, there was a small decrease in discharge of inpatient orthopedic Medicare beneficiaries to institutional post-acute care (PAC) which includes SNF, inpatient rehabilitation facilities (IRF) or long-term care facility (63 to 61%). However, among BPCI participating hospitals, the use of institutional PAC declined 4.9% greater than the comparison population [2]. The CMS Year 2 Annual report also concluded that there were no statistically significant differences between the populations in hospital readmission rates and the emergency department visits within 30 or 90 days of hospital discharge and mortality within 30 days of hospital discharge between the BPCI participating hospitals and the comparisons.

Schwarzkopf et al. also investigated factors influencing discharge disposition after THA in 14,326 patients. Patients with more comorbidities, Medicare insurance benefits, and higher age as well as Black and Asian race were discharged to PAC at a greater frequency [14]. A progressive swell in patient discharge to PAC with increasing age has also been demonstrated by Gholson et al. after multivariate analysis of 107,300 primary TJA patients from 2011 to 2013 who were recorded in the American College of Surgeons National Surgical Quality Improvement Program database (ACS-NISQIP) [15]. They found that the average age of patients discharged to a PAC was 70.9 years old while those discharged to home averaged 64.25 years old. Keswani et al. also utilized the ACS-NSQIP database and identified patient risk factors for PAC placement [16•]. Bivariate analysis identified that patients discharged to PAC tended to be older, female, functionally dependent with a BMI >40 kg/m^2. Following multivariate analysis, however, they found that the strongest predictors for PAC discharge were renal disease (OR 2.4) prior dependent functional status (OR 2.04), BMI >40kg/m^2 (OR 1.50), severe adverse event before discharge (OR 1.40), ASA class 3/4 (OR 1.40), pulmonary disease (OR 1.39), bleeding-causing disorders (OR 1.35), diabetes (OR 1.28), steroids for chronic conditions within 30 days of surgery (OR 1.21), hypertension (OR 1.20), and history of smoking (OR 1.18).

Race was found to influence discharge destination in another recent study. A state database study of 129, 522 patients concluded that blacks were found to have a 2.04, 2.86, and 1.31 greater odds ratio for discharge to IRF, SNF, and home with services compared with whites respectively, following elective total knee arthroplasty [17]. Socioeconomic status also seems to influence post-discharge disposition. Inneh et al. reported that low to middle household income is strongly associated with an increased discharge to an institution following lower extremity joint arthroplasty although the reasons are unclear but may relate to variance in support and resources available that would facilitate home discharge [18]. A retrospective study comparing 50 consecutive home discharge and 50 consecutive SNF discharge patients demonstrated slower preoperative timed get up and go test, lower EQ-5D, living alone, higher ASA physical classification, increased hospital length of stay, and increased post-operative pain on day 1 and day 2, and decreased distance walked on post-operative day 1 was associated with discharge to skilled nursing facilities [7].

Predicting Discharge Disposition After Primary Total Joint Arthroplasty

Several authors have published on institutional practices and tools designed to accurately predict a patient's discharge disposition for improved resource utilization (Table 1).

Table 1 A comparison of discharge disposition prediction tools

Author	Tool description	Study design	Results
Menendez et al. [22]	The Activity Measure for Post-Acute Care "6-Clicks" Mobility Score is collected post-operatively within 24 h by physical therapists evaluating 6 basic inpatient mobility tasks on a 4-point scale	Retrospective cohort study of 744 elective primary TJA patients assessing performance of 2 predictive models using multivariate logistic regression analysis	"6-Clicks" score predicted discharge disposition modestly better than the base model based on age, sex, and medical comorbidities and procedure type (C-statistic 0.777 versus 0.716). "6-Clicks" was more predictive for TKA than THA (0.771 versus 0.776)
Hansen et al. [20]	The Risk Assessment and Prediction Tool (RAPT) is a 6-item preoperative survey that scores: age, sex, preoperative walking distance, use of gait aid, community supports, and presence of a caregiver on return home	Retrospective cohort study in which RAPT scores collected prospectively from 3213 primary TJA patients were analyzed by binary logistic regression	The predictive accuracy of the RAPT was 78%. RAPT more accurately predicted patients who are discharged home than those discharged to PAC. Scores <7 and >10 had predictive accuracy >83% and comprised 54% of the patients
Barsoum et al. [4]	The Predicting Location after Arthroplasty Nomogram (PLAN) is a survey and physician input-based preoperative paper tool that weights 17 different variables selected by multidisciplinary expert consensus	Retrospective review of 517 patient charts undergoing primary, revision, and bilateral TKA for which the nomogram was analyzed by logistic regression and bootstrap sampling	PLAN was generally very accurate with an externally validated C-statistic of 0.861. The model underestimated the probability of not going home in low-risk patients and over-estimated the probability of not going home in high-risk patients
Gholson et al. [15]	The NSQIP discharge calculator is a weighed scoring of 5 routinely collected preoperative variables: patient age, non-elective THA for fracture, dependent functional status, living location other than home before surgery, and elevated ASA class	Variables from 107,300 patients in the NSQIP database meeting univariate p value <0.1 were analyzed with a multivariate logistic regression model	The created model had a C-statistic of 0.7. The model is effective in determining the probability of discharge disposition and can help identify the patients who would benefit from targeted interventions to decrease the change of discharge to a facility

Predicting a patient's risk for requiring PAC after TJA may decrease hospital length of stay and increase discharge to home. The Risk Assessment and Prediction Tool (RAPT) consists of the questions regarding age, sex, preoperative walking distance, use of gait aid, community support, and presence of a caregiver at home administered preoperatively to predict level of care required post-operatively following TJA [19]. Hansen et al. used this tool to assess 3213 patients undergoing TJA from 2006 to 2011. They found predictive accuracy in 80% of THA patients and 77% of TKA patients [20].

Barsoum et al. reported on a novel institutional nomogram, the Predicting Location after Arthroplasy Nomogram (PLAN), completed preoperatively to plan discharge and found that age greater than 85 years, bilateral procedures, caregiver assistance, home environment, preoperative ambulatory status, and female gender had the largest potential effect on likelihood of necessitating discharge other than home [4]. London et al. performed an administrative database analysis of total hip and knee arthroplasty patients to determine predictors of patient discharge location [21]. They suggest that both patient and surgeon level variables are predictive of being discharged to home after TJA. Interestingly, they utilized the PLAN tool created by Barsoum et al. and suggest that patients who are exposed to its use combined with coordination with a rehabilitation nurse had 45% increased odds of being discharged home compared with patients not exposed to the protocol. The authors posit that cost-saving opportunities exist for individual episodes of care for patients discharged home with or without home health care.

Menendez et al. published recently on the utility of the Activity Measure for Post-Acute Care "6-Clicks" Mobility score. The 6-Clicks Mobility score is collected post-operatively by physical therapist within the first 24 h following THA and TKA by evaluating basic mobility tasks the inpatients perform. The authors retrospectively reviewed 744 patients undergoing knee and hip arthroplasty and concluded that the 6-Clicks score predicted discharge disposition better than a comparison model utilizing age, sex, medical comorbidity type, and procedure type [22].

Early Discharge and Destination Affect on Complications and Readmissions

Concerns regarding the interplay between shorter hospital lengths of stay coupled with an increasing rate of home discharge and the relationship to post-operative complications and readmissions after primary TJA prompted several recent investigations. Gholson et al. reported that 30-day mortality was more than ten times higher in patients discharged to a PAC rather than home, and any complication was three times higher in the non-home discharge group [15]. Keswani et al. compared post-discharge adverse events by discharge destination [16•]. Bivariate analysis revealed that serious adverse

events (PAC 3.0%, home 1.7%), unplanned readmission (PAC 5.0%, home 2.8%), and infectious complications (PAC 1.3%, home 0.9%) were all significantly higher in patients discharged to a PAC compared to home. Within PAC, IRF and SNF were independently evaluated and, interestingly, no significant difference in overall rates of severe adverse events, minor adverse events, or unplanned readmissions for IRF compared with SNF was identified.

Decreasing hospital length of stay after TJA has been a focus over the last decade as a proxy to decrease the cost associated with an episode of care. Sibia et al. recently reported on 381 primary TKA patients and showed that female gender, older age, ASA score 3 or 4, atrial fibrillation, prior TKA on the contralateral side, and not ambulating on the day of surgery were preoperative characteristics owing to longer than 1-day length of stay in the hospital [23].

Cost savings may indeed be realized with more home discharge and short hospital length of stay; however, Rossman et al. suggest that cost containment must include avoiding unnecessary utilization of the emergency department (ED) [24]. These authors note that while decreased length of stay after TKA is not associated with increased readmission rates, data may underestimate the overall unplanned hospital return events such as presenting for medical attention to the ED without readmission to the hospital. They found that ED events were common (12% of patients); however, they were significantly less common among patients who were discharged earlier and who were discharged to home following TKA. Bini et al. demonstrated that a 2-day length of stay did not increase readmission compared to a 3-day length of stay following TKA [25]. Trimba et al. examined total joint arthroplasties from California, Florida, Nebraska, and New York to estimate the frequency of hospital readmissions and ED visits after discharge for TJA, to describe the timing and most common diagnoses associated with those events, and to determine if including ED visits in existing "readmission" measures impacted a hospital's perceived quality [26]. They reported on 272,853 discharges from 517 hospitals. ED visits (5.8%) were slightly more common than hospital readmissions (5.1%) with the incidence highest in the immediate post-operative period. They conclude that by focusing on hospital readmission alone, quality measures only capture nearly half of the hospital-based acute care encounters after discharge.

An older study compared the 90-day hospital readmission rates between patients who were discharged home with health services versus those discharged to SNF following primary total joint arthroplasty. Bini et al. demonstrated patients discharged to a SNF had higher odds of hospital readmission compared with those discharged home (OR 1.9) for THA and (OR 1.6) for TKA [27].

Ramos et al. reported on 3533 patients who were analyzed according to discharge disposition home with health services, IRF and SNF [28]. After controlling for age, gender, and comorbidities, THA patients sent to IRF had more than three times the risk of readmission within 30 days after surgery. However, in the TKA cohort, patients sent to IRF did not have a statistically significant difference risk for readmission as compared to SNF or home discharge, with an overall cohort readmission rate of 2.5%.

Yao et al. evaluated risk factors and timing of post-discharge complications between home-discharged primary total hip and total knee patients and stratified them to identify those who would benefit from higher-level care [29]. Readmission rates from 50,376 THA and 71,293 TKA patients discharged to home were 3.1 and 3.5%, respectively. Those at risk for severe complications were found to be older, smokers, obese, and functionally dependent. After controlling for patient demographics, comorbidities, and severe adverse events predischarge, the strongest independent predictors for post-discharge complications in home discharged TJA patients included severe adverse events predischarge, avascular necrosis (THA), fracture etiology (THA) age, male gender, functional status, BMI >40 kg/m^2, smoking, diabetes, pulmonary disease, chronic heart failure, hypertension, steroids for chronic conditions, bleeding-causing disorders, and increased ASA score (3 or 4).

Cost Containment

Non-home discharge after TJA can add significant cost in the post-operative period and strategies to curtail such destination in appropriate patients has been a recent focus, especially given the impending universal bundle care payment model. Slover et al. examined the cost profile of different post-acute care strategies for joint replacement utilizing a decision analysis [30•]. They concluded that extended acute hospital care to facilitate and allow home discharge may be financially beneficial rather than shorter length of stay and discharge to subacute or inpatient rehabilitation facilities in a bundled care payment model. Their model suggests that patients could be kept for up to 5.2 days extra of acute care hospitalization if they are discharged home with home-health services rather than an inpatient rehabilitation facility and still maintain a lower cost of care.

A novel form of defined clinical pathway, called a Perioperative Surgical Home (PSH), has recently been described and implemented as a patient-centered model to improve healthcare delivery and reduce cost [31–34]. The PSH is a multidisciplinary rapid recovery pathway comanaged by orthopedic and anesthesia services. After prospectively following 180 THA patients managed with PSH model and compared to a matched cohort, Chimento et al. found that significantly more patients were discharged to home rather than PAC (83 versus 71%) under the PSH [31]. Cyriac et al. found

that after implementation, during the second year period during which there were 328 primary TJAs, there were significantly more patients discharged home that to PAC when compared with the first year of the initiative [32].

Tessier et al. hypothesized that surgeons with defined clinical pathways would be superior in improving discharge disposition home and decreasing cost. They utilized the Medicare Model 2 Bundled Payment for Care Improvement episode claims data including 77,008 patients from 68 independent orthopedic groups across the USA. Outcome measures included PAC cost, incident rates for utilization of all PAC, and readmission. Elective hip arthroplasty per episode cost differential was $3189 less for physicians with care pathways compared to those without pathways ($p < 0.001$), while elective knee arthroplasty per episode cost difference was $2466 less for physicians with care pathways compared to those without pathways ($p < 0.001$) [35].

Post-discharge care utilization was also identified as a potential source of cost containment without adversely affecting patient outcomes. Ponzio et al. reported on a strategy to reduce the utilization of home visiting nurse services after primary total hip arthroplasty [36]. The authors suggest that a highly coordinated, surgeon-driven rehabilitation protocol individualized to each patient could result in a more cost-effective approach to care without adversely impacting patient reported outcomes and satisfaction. They compared outcomes for 6 months prior to and the 6 months after eliminating home visiting nursing. End points included evaluating discharge to home rates, length of stay, complication rate, reoperation rate within 60-days, readmission rate within 30-days, charges of associated HVNS, and satisfaction measured by Hospital Consumer Assessment of Healthcare Providers. Their decision tree analysis suggested that a savings of $1177 per THA and $1647 per TKA may be realized when HVNS is eliminated when possible resulting in a >$1.3 billion savings annually in the USA.

Total Hip Arthroplasty Approach

L'Hommedieu et al. sought to answer the question if differences exist between the anterior and posterior hip approaches on post-acute care service utilization, readmission, or episodic cost following elective primary total hip arthroplasty [37]. A total of 26,773 patients were analyzed from Medicare claims data during the acute care period through 90-days post-discharge. The incidence of discharge to skilled nursing facility was 35.9 versus 31.9%, while home health agency utilization was 64.9 versus 63.6% for anterior versus posterior approaches, respectively. The authors reported negligibly higher average episode cost and all-cause readmission rate using the anterior approach ($22,517 and 9.3%, respectively) compared with the posterior approach ($22,068 and 7.7%, respectively) ($P = 0.138$) and concluded no significant difference in any measured outcome/performance parameter. Alecci et al. in a review of 419 patients receiving either a standard lateral approach or a direct anterior approach (DAA) reported greater home discharge in the DAA group [38]. Furthermore, similar results have been reported by Berand et al. after a retrospective review of 372 direct lateral approach and 258 anterior approaches concluding that more patients were discharged home in the anterior approach cohort [39].

Discharge Disposition after Revision TJA

While the majority of recent studies on discharge disposition have focused on primary TJA, Keswani et al. used ACS-NSQIP data to compare rates of adverse events in revision TJA patients [40]. They found infection, fracture and dislocation etiology, 2-component revision, functional status, history of smoking, diabetes, pulmonary disease, renal disease, and bleeding-causing disorders to be independent predictors of PAC. These patients had a 5.2% risk of unplanned readmission compared with 2.9% of patients discharged home. Within PAC discharge, inpatient rehab facility discharge was found to be an independent risk factor for 30-day post-discharge significant adverse events while SNF discharge was not found to be predictive of adverse events.

Conclusions

The orthopedic surgeon has a unique opportunity as the primary driver for the episode-of-care to shape patient expectations and navigate patients through an efficient post-operative rapid recovery. As suggested by Tessier et al., the orthopedic surgeon serves as an episode initiator who will endure clinical and financial responsibility for the patient's outcomes in a bundled care payment model [35]. Deliberate total joint protocols can yield cost savings without sacrificing patient care and outcomes. Clinical trends support decreased hospital length of stay while increasing safe, medically appropriate discharge-to-home, while ensuring select patients have access to higher levels of care following arthroplasty. Further research is needed in the development of tools and processes that can aid the orthopedic surgeon and the care team in determining medically appropriate patients for safe home discharge. Additionally, managing patient expectations regarding discharge disposition and recovery resources may result in the potential for far-reaching cost savings while maintaining excellent quality outcomes following total joint arthroplasty.

Compliance with Ethical Standards

Conflict of Interest Both authors declare that they have no conflict of interest.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

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