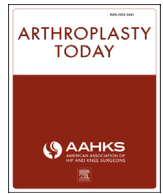




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Is a shortened length of stay and increased rate of discharge to home associated with a low readmission rate and cost-effectiveness after primary total knee arthroplasty?

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ABSTRACT

We computed the average length of hospital stay; the rate of discharge to a rehabilitation facility, home with health care, or home with outpatient physical therapy; the all-cause readmission rate within 30 days of discharge per year; and cost savings for 2328 consecutive patients treated with a unilateral primary total knee replacement between 2009 and 2014. The average length of hospital stay per year shortened from 2.0 to 1.3 days ($P < .0001$); the rate of discharge per year to a rehabilitation facility decreased from 41% to 1% and increased from 9% to 53% to home with outpatient physical therapy ($P < .0001$); and the rate of readmission within 30 days per year did not change ($P = .38$). The cost savings averaged \$3245 per patient. Accordingly, a shorter length of hospital stay and an increased rate of discharge to home was not associated with an increased rate of readmission within 30 days and was cost-effective.

Level of Evidence: Level IV, Therapeutic study

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Introduction

The aging population wants to maintain an active lifestyle, which is increasing the demand for total knee arthroplasty. Based on 2003 estimates, the demand for total knee arthroplasty will grow 673% by the year 2030, which burdens the cost of health care born by the government and insurers [1]. Coordination between physicians, hospitals, patients, and care providers at home is needed to provide safe, cost-effective, and high-quality transitional care from hospital to home [2,3]. The all-cause rate of readmission within 30 days of discharge per year is one measurement of safety and cost-effectiveness and is the metric the Affordable Care Act

intends to use to administer financial incentives and penalties to improve coordination of care from hospital to home [3]. Accordingly, a shortening of the average length of hospital stay per year would be considered safe and cost-effective as long as there is no associated change in the rate of readmission within 30 days of discharge per year [4].

It is controversial whether shortening the average length of hospital stay and increasing discharge from a rehabilitation facility to home with either health care or outpatient physical therapy is safe and cost-effective. Medicare data showed that a 7% reduction in the average length of hospital stay from 4.1 to 3.8 days in 2007 after total knee arthroplasty was not associated with an increase in the rate of readmission within 30 days [5]. Whereas very short lengths of stay were associated with discharge to more costly rehabilitation facilities, which might have been avoided by discharge to home or had the patients remained in the acute care hospital for an additional 1 or 2 days [6]. Another unintended complication from discharging patients to a rehabilitation facility in place of home is a higher risk of unplanned readmissions within 90 days of discharge after adjustment of differences in sex, age, and American Society of Anesthesiologists scores between the rehabilitation facility and home groups [7,8].

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The present study determined for 2328 patients treated with a unilateral primary total knee replacement from 2009 to 2014 whether (1) the average length of stay per year shortened, the rate of discharge to home per year increased, and the all-cause 30-day readmission rate per year changed; (2) how our hospital's average length of stay, discharge disposition, and 30-day readmission rate per year compares to percentile rankings of comparative hospitals in a national database; and (3) the cost savings per patient achieved by shortening the average length of stay and increasing the rate of discharge to home.

Material and methods

An institutional review board determined that this quality control study required no approval because protective health information was not used. We queried the electronic database of a 162-bed, nonspecialty community hospital (Methodist Hospital, Sacramento, CA) and identified 2328 consecutive patients treated with a primary unilateral total knee arthroplasty from January 1, 2009 to October 1, 2014 by 1 surgeon. During this time interval, all the total knee arthroplasties performed by this surgeon were performed at this facility. Included were all patients with a primary unilateral total knee arthroplasty, with no exclusions for severity of illness, severity of deformity, or type of knee diagnosis. We recorded demographics, the type and number of diagnoses per patient as determined by the International Classification of Diseases, Ninth Edition (ICD-9-CM) Code assigned on discharge. We categorized the number of diagnoses per patient as 0 to 4, 5 to 9, 10 to 14, 15 to 19, 20 to 24, and >24. Software categorized an All-Patient Refined Diagnosis-Related Groups Severity of Illness (APR-DRG SOI) to each patient, which is a weighted index that is intended to reflect a patient's medical health as 1: minor, 2: moderate, 3: major, and 4: severe (DataVision Web Application; Midas+ Solutions, Tucson, AZ; www.midasplus.com).

The following is a brief description of the delivery of the perioperative care and surgical technique. Each patient received an instructional handout and was asked to attend a free, hospital-sponsored, preoperative patient education class. Surgical treatment consisted of a kinematically aligned total knee arthroplasty. Patient-specific guides (OtisKnee; OtisMed, Inc., Hayward, CA) were used on the first 270 knees in 2009, and generic or manual instruments were used on the subsequent 2058 knees [9–11]. In the knees with varus deformities and most valgus deformities, the posterior cruciate, medial collateral, and lateral collateral ligaments were not released. In the knees with severe fixed valgus deformities, pie-crusting technique with use of a spinal needle incrementally lengthened the lateral collateral ligament. A lateral retinacular release was performed in those knees with a chronically dislocated patella and maltracking after implantation of the components. All components were cemented, and surgery was performed under a general anesthetic without regional or peripheral nerve blocks. All patients received an intraoperative injection of 30 cc of 0.5% bupivacaine with epinephrine and 30 mm of ketorolac, which the knee retained because ligaments were infrequently released. Postoperatively, pain was managed with intravenous and oral anticoagulants as tolerated. Each patient not on anticoagulant before admission received prophylaxis against deep vein thrombosis and pulmonary embolism with the use of aspirin 325 mg p.o. bid on the day of surgery and continued for 30 days postoperatively. Those patients that discontinued an anticoagulant before admission were managed with coumadin with a target international normalized ratio of between 1.5 and 2.0 and were converted back to their preferred method of anticoagulation after 21 days. The patients were encouraged to ambulate on the day of surgery and attend a joint replacement education class the following day. The

patient determined the day of discharge by ambulating independently with a walker, climbing stairs, and feeling relief of pain with use of oral pain medications and by requesting to go home.

Our main outcomes were the average length of hospital stay per year; rate of discharge to a rehabilitation facility, to home with health care, or to home with outpatient physical therapy per year; and all-cause rate of readmission within 30 days of discharge per year (Table 1). The length of hospital stay was calculated as the difference between the dates of discharge and admission. We compared these outcomes and measures per year to percentile rankings of comparative hospitals in a national database, which included approximately 166,000 total knee arthroplasties and 700 hospitals as of December 2014 (DataVision Web Application; Midas+ Solutions, Tucson, AZ). We computed cost savings per patient achieved by shortening the average length of stay and increasing the rate of discharge to home with health care or to home with outpatient physical therapy per year with use of 2014 costs provided by the hospital (Table 2).

Statistical analyses

We used descriptive statistics (mean, standard deviation, 95% confidence interval [CI] of the mean) and univariate analyses to examine the association between the treatment year (January 1, 2009–October 1, 2014) and patient characteristics, outcomes, and measures of interest. Chi-square tests and Fisher's exact tests (for expected or observed values <5) determined whether the categorical variables of sex, race, severity of illness on discharge (1–4), number of discharge diagnoses (6 groups), discharge disposition (3 groups), and the incidence of readmission within 30 days. A one-factor analysis of variance determined whether the average age and average length of hospital stay per year changed. A post hoc Tukey's test determined the significance of differences between years. Software performed the statistical analyses (JMP version 10.0.2 for the Macintosh; SAS Institute, Inc., Cary, NC; www.jmp.com).

Results

Between January 1, 2009 and October 1, 2014, we noted the yearly change in the characteristics of the study population (Table 3), which showed no change in the average age, or distribution of race or sex; a slight decrease in the severity of illness from a change in the distribution of the category of illness; and a slight increase in the number of diagnosis per patient from a change in the distribution of the category of the number of diagnosis.

We observed a 35% reduction in the average length of hospital stay per year from 2.0 ± 0.7 (95% CI, 1.9–2.1) days in 2009 to 1.3 ± 0.6 (95% CI, 1.2–1.3) days in 2014 ($P < .0001$; Table 1). Our hospital's average length of hospital stay per year was shorter than the top 5th percentile of all comparative hospitals in the national database from 2009 to 2014 (Fig. 1).

Comparing from 2009 to 2014, the rate of discharge to a rehabilitation facility per year decreased from 41% to 1%, the rate of discharge to home with health care per year decreased from 50% to 42%, and the rate of discharge to home with outpatient physical therapy per year increased from 9% to 53% ($P < .0001$; Table 1). Our hospital's rate of discharge to home per year with either health care or outpatient physical therapy was higher than the top 95th percentile of all comparative hospitals in the national database from 2010 to 2014 (Fig. 2).

The rate of readmission within 30 days per year of 1.3% in 2009 and 0.9% 2014 did not change ($P = .38$), and the average rate over these 6 years was 1.1% (range: 0.3%–1.3%). There was a broad range of diagnoses at the cause of the readmission (Table 1). Our hospital's rate of readmission within 30 days of discharge per year was

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