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Quality of Recovery, Postdischarge Hospital Utilization, and 2-Year Functional Outcomes After an Outpatient Total Knee Arthroplasty Program

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ABSTRACT

Background: Outpatient total knee arthroplasty (TKA) has been made possible with advances in perioperative care and standardized clinical inpatient pathways. While many studies report on benefits of outpatient programs, none explore patient-reported outcome measures. As such, our goals were to compare the short-term quality of recovery; highlight postdischarge hospital resources utilization; and report on 2-year functional outcomes scores.

Methods: This was a prospective comparative cohort study of 43 inpatients (43 TKAs) and 43 outpatients (43 TKAs) operated on by a single surgeon between September 28, 2010 and May 5, 2015. All patients were given a diary to complete at 1, 3, 7, 14, and 28 days postoperatively; we collected 90-day complications, readmissions, and emergency department visits; Knee Injury and Osteoarthritis Outcome Score and Western Ontario and McMaster Universities Osteoarthritis Index scores were completed preoperatively and 2 years postoperatively. SPSS (IBM, version 22.0) was used for all statistical analyses.

Results: Quality of recovery (QoR-9) was similar in the outpatient TKA group compared with the inpatient group. No statistically significant differences were observed for Knee Injury and Osteoarthritis Outcome Score and Western Ontario and McMaster Universities Osteoarthritis Index subscores ($P > .05$). There was 1 readmission in both outpatient and inpatient groups. Six inpatients and 8 outpatients returned to the emergency department for any reason within 90 days, with no statistical significance observed between the 2 groups ($P = .771$).

Conclusion: Outpatient TKA in selected patients produced similar short-term and 2-year patient-reported outcome measures and a comparable 90-day postdischarge hospital resource utilization when compared to an inpatient cohort, supporting further investigation into outpatient TKA.

Advances in perioperative care and standardized clinical inpatient pathways have shortened length of stay and lowered postoperative morbidity after total knee arthroplasty (TKA) [1,2]. More recently, further developments have allowed for performing outpatient TKA, while maintaining the same quality standards applied to inpatient cases [3]. While cost savings have been confirmed in studies, other potential benefits have yet to be determined [4,5]. Concerns regarding the safety of same-day discharge after TKA, as determined by the rate of complications, have been alleviated by several small studies in both selected and unselected patients who were screened for known risk factors of early complications [3,6–10].

Despite the suggested safety of outpatient TKA in a selected population, there is no published data to our knowledge of patient-reported outcome measures (PROM) from patients undergoing outpatient TKA. In this era aimed at patient-centered care, it is imperative not only to ensure the safety of outpatient TKA but also to ensure that these patients have similar patient-reported

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This study was reviewed and approved by the institutional ethics committee.

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outcomes both in the early postoperative period as well as following full recovery from surgery when compared to patients admitted postoperatively.

Throughout this article, we report on the features of our outpatient pathway, which has undergone rigorous development and refinement by a multidisciplinary team. We were interested in examining the short-term outcomes of these patients, and thus, the primary objective of our study was to compare PROMs between inpatients and outpatients, specifically via the quality of recovery (QoR-9) tool; a validated and reliable measure of subjective postoperative recovery. The secondary objective was to examine the short-term postdischarge hospital resource utilization of the outpatient program against that of inpatients by comparing the frequency of emergency department (ED) visits and readmissions in the first 90 days after surgery.

Methods

This prospective comparative cohort study was approved by our institutional research ethics board before commencement.

Program of Outpatient TKA

An accelerated TKA recovery clinical pathway was first developed through a consensus approach and formal meeting with clinical investigators in orthopedic surgery, acute pain service, nursing, anesthesia, transfusion medicine, and physiotherapy. This was protocolled, refined, and evaluated in 43 inpatients before beginning the outpatient program in September 2012 and formed the comparison cohort for the eventual outpatient group. The clinical pathway included modifications to preoperative patient education by emphasizing early and milestone-driven rapid discharge, specifically including a multimodal analgesia regimen of preoperative oral acetaminophen 1000 mg, 200 mg of celecoxib, and 50 mg of pregabalin, specifically excluding opioids. Regional anesthesia with spinal bupivacaine was used when possible. A subvastus approach [11] was performed unless the preoperative flexion was less than 90°, patient body mass index (BMI) was over 40 kg/m^2, or there was presence of patella baja, previous high-tibial osteotomy, or post-traumatic osteoarthritis with infrapatellar contracture. Intravenous tranexamic acid (1 g) was used routinely at the start of the case to minimize blood loss and prevent postoperative hemarthrosis [12,13]. Tourniquet was only used for cementation of final implants, to minimize ischemic time and postoperative blood loss [14]. Periarticular infiltration of the knee was performed at the conclusion of the TKA with a solution containing ropivacaine, ketorolac, morphine, and epinephrine, as described by Busch et al [15]. Standardized postoperative pain management included regular administration of acetaminophen, celecoxib, pregabalin, and as-required use of hydromorphone. Patients were prescribed apixaban 2.5 mg twice daily for venous thromboembolism prophylaxis to start on the first postoperative day. Finally, we encouraged the use of a commercially available compressive cryotherapy device for its positive effect on pain scores and analgesic use [16].

Outpatients were routinely scheduled as the first or second case of the day. They were discharged the same day after meeting a number of performance criteria deeming them suitable for discharge: tolerance of oral fluids, stable vital signs, ability to walk, and transfer independently including stairs, a Numeric Pain Rating Scale (NRS-11) with activity of 5/10 or less, and satisfaction with pain control. The pathway included a preoperative dose of either cefazolin or vancomycin (if allergic to cefazolin) and a second intravenous dose of antibiotic postoperatively before discharge home. Outpatients received one nursing visit from our local home care service on the first postoperative day (POD) for a wound dressing change if required, and a physiotherapy visit on POD1 and POD3, before patients continued with outpatient physiotherapy visits.

Study Participants and Demographics

Forty-three inpatients (43 knees) and 43 outpatients (43 knees) were prospectively consented and enrolled into the study from August 2010 to January 2015 and from September 2012 to May 2015, respectively. The following inclusion criteria were applied to both inpatients and outpatients: patients undergoing primary TKA for end-stage osteoarthritis of the knee, an American Society of Anaesthesiologists Physical Status Classification system score of 3 or less with a stable medical profile, and a BMI under 45 kg/m^2, as complications after TKA have been shown to increase exponentially past this cut-off [17]. Patients selected for the inpatient pathway were also required to reside within a 60-minute drive of the hospital and in a setting where local home care services were available. This cohort of inpatients were selected to minimize confounding factors as they underwent the same milestone-driven rapid-discharge protocol developed for the outpatient pathway, with the exception of being admitted to the hospital. All patients were asked to complete the Knee Injury and Osteoarthritis Outcome Score (KOOS) and Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) questionnaires at baseline.

Outcome Measures

Patients in both groups were given patient diaries in which they detailed quality of recovery scores (QoR-9), daily pain scores by NRS-11, quantity of opioid used, and satisfaction with pain control (0-10) on postoperative days 1, 3, 7, 14 and 28. Primarily, we wished to determine postoperative quality of recovery, as such we selected the QoR-9 questionnaire as our primary outcome measure, which is

Table 1
Baseline Characteristics of Inpatients and Outpatients.

Variable	Inpatient Knees (N = 43)	Outpatients Knees (N = 43)	*P* Value
Sex (male:female)	22: 21	29: 14	.124
Age, mean (range)	62.5 (51.2-74.0)	62.5 (50.4-75.0)	.951
Body mass index, mean (range)	30.4 (23.5-41.6)	28.6 (23.7-35.8)	.030
History of coronary artery disease (no:yes)	38: 3	43: 0	.071
Chronic obstructive lung disease (no:yes)	42: 1	43:0	.303
Diabetic (no:yes)	40: 3	42:1	.283
Charlson comorbidity index (age adjusted)			
1	0	0	
2	11	14	.476
3	20	23	.518
4	10	3	.04
5	1	3	.306
Preoperative scores			
KOOS symptoms	44.8 (17.9)	43.5 (17.5)	.72
KOOS Pain	47.6 (15.1)	56.3 (59.1)	.354
KOOS ADL	53.5 (17.7)	54.8 (18.1)	.731
KOOS Sport & Rec	19.7 (14.4)	22.6 (17.4)	.413
KOOS QoL	25.7 (15.7)	23.3 (15.0)	.479
WOMAC Pain	53.3 (16.3)	52.3 (17.0)	.784
WOMAC Stiffness	44.4 (17.9)	44.0 (17.1)	.922
WOMAC Function	52.5 (18.9)	55.8 (16.8)	.397
WOMAC Total	51.2 (15.7)	51.9 (15.4)	.838

ADL, activities of daily living; KOOS, Knee Injury and Osteoarthritis Outcome Score; QoL, Quality of Life; WOMAC, Western Ontario and McMaster Universities Osteoarthritis Index; ADL, Function in daily living.

Table 2
Patient-Reported Outcome Measures of Inpatients and Outpatients.

Variable	Inpatients (N = 43)	Outpatients (N = 43)	*P* Value
QoR-9 (standard deviation)			
POD#1	13.9 (2.8)	15.4 (2.0)	.013[a]
POD#3	15.6 (2.5)	16.4 (1.8)	.300
POD#7	16.2 (2.1)	16.4 (1.8)	.629
POD#14	16.4 (2.0)	15.8 (2.2)	.129
POD#21	16.6 (2.0)	16.2 (3.1)	.593
POD#28	16.8 (1.8)	16.4 (3.0)	.448
Satisfaction with pain control (standard deviation)			
POD#1	7.8 (2.5)	8.0 (2.0)	.996
POD#7	7.6 (2.2)	7.8 (2.0)	.824
POD#14	7.4 (2.6)	8.0 (2.0)	.237
POD#21	7.7 (2.6)	8.2 (2.0)	.546
POD#28	8.2 (2.6)	8.1 (2.1)	.371
Average pain scores NRS-11 (standard deviation)			
POD#1	3.2 (2.2)	3.6 (1.5)	.204
POD#7	3.0 (1.9)	2.9 (1.9)	.892
POD#14	2.9 (1.9)	2.9 (2.1)	.863
POD#21	2.4 (1.8)	2.3 (1.8)	.801
POD#28	2.0 (1.9)	2.1 (1.7)	.605
Hydromorphone milligram equivalents used: median (range)			
POD#1	4 (20)	6 (15)	.327
POD#3	4 (18)	4 (14)	.755
POD#7	2 (24)	4.5 (15)	.707
POD#14	1 (24)	2.0 (20)	.344

NRS-11, Numeric Pain Rating Scale; POD, postoperative day.
[a] Significance set at $P < .05$.

a simple, validated, and reliable questionnaire containing 9 questions [18] (see Appendix A). Secondarily, we wanted to evaluate the metrics revolving around safety of outpatient TKA with a particular focus on repeated visits to the ED and readmissions within 90 days. A 90-day timeframe coincides with the Comprehensive Care for Joint Replacement model, which holds hospitals financially accountable for postoperative complications and readmissions in the first 90 days postarthroplasty [19]. To track this information, we queried our institutional database for all readmissions, complications, and ED visits in both hospital campuses followed by a manual database search for verification and finally by confirmation from a research personnel who tracked the patients in the first year postoperatively. Thirdly, we wanted to evaluate the functional outcomes of patients at 2-year follow-up using the KOOS and WOMAC questionnaires.

Statistical Analysis

All data were analyzed using IBM SPSS Statistics, version 22.0. Normality of each variable was assessed using the Shapiro-Wilk Test. The Mann-Whitney *U* and Kruskal-Wallis tests were used for scale data. Fisher exact and chi-square tests were used for categorical data. Missing data were excluded from the analysis. Statistical significance was set at $P < .05$.

Results

Forty-three patients met our defined postoperative multidisciplinary criteria for same-day discharge from the postanesthesia care unit and were discharged home and compared with 43 inpatients. Inpatient and outpatient groups were similar based on age and sex, although the inpatient group had a higher mean BMI than the outpatient group (30.4 vs 28.6 with $P = .030$) (Table 1). Patients were also balanced for known risk factors for complications after TKA: coronary artery disease, chronic obstructive pulmonary disease, and diabetes [9]. There were no statistical differences in tourniquet time or use of cold compression device ($P = .202$, $P = .158$, respectively). There were no significant differences in baseline KOOS and WOMAC questionnaires at baseline in all subscores.

Quality of Recovery

Patients correctly completed their 28-day QoR-9 questionnaires at 98% of the timepoints. QoR-9 on POD1 was statistically significantly better in the outpatient TKA group (mean: 13.9, standard deviation = 2.8) as compared to the inpatient group (mean: 15.4, standard deviation = 2.0) ($P = .013$). This 1.50 point difference exceeds Myles et al [20] minimal clinically important difference of 0.92 for the QoR-9 scale. The other outcome measures were not statistically or clinically significantly different between the 2 groups at any timepoint (Table 2).

Emergency Department Visits and Readmissions

Within the first 90 days postoperatively, there was 1 readmission in the inpatient group and 1 in the outpatient group. One inpatient was readmitted for a manipulation under anesthesia for

Table 3
Emergency Department (ED) Visits Summary for Inpatients and Outpatients.

Patient Group	Postoperative Day (POD) Number	Reason for Visit	Outcome from ED Visit
Inpatient	POD 27	Syncope	Cardiac workup, observation, reassurance, and discharge from the ED.
	POD 1	Syncope	Hydration, observation, reassurance, and discharge from the ED.
	POD 62	Leg swelling	Discharge from ED after Doppler ultrasound revealed a ruptured Baker's cyst, and no DVT.
	POD 86	Wished to discuss endoscopy results	Discussed recent endoscopy results with gastroenterologist
	POD 6	Palpitations	Diagnosed with paroxysmal atrial fibrillation and discharged home with an outpatient cardiology referral
	POD 64	Blurry vision	Outpatient ophthalmology referral
Outpatient	POD 0	Syncope	Hydration, observation, reassurance, and discharge from the ED.
	POD 0	Syncope	Hydration, observation, reassurance, and discharge from the ED.
	POD 14	Acute deep MRSA infection	Admission for irrigation and debridement with liner exchange.
	POD 14	Leg swelling and pain	Discharge from ED after Doppler ultrasound revealed no DVT. Outpatient repeat ultrasound 6 d later also negative.
	POD 14	Severe knee pain at night	Administered pain control (hydromorphone 1 mg oral) and discharged home.
	POD 36	Painless redness surrounding wound	Contact dermatitis secondary to cream application vs superficial infection. Oral cephalexin prophylaxis
	POD 0	Dressing saturated with blood	Hemarthrosis milked out and pressure dressing applied. Observation for 2 h. Discharged from ED with no further issues.
	POD 8	Benign prostate hypertrophy and recent biopsy	Discussed recent biopsy results with urologist and reassured

DVT, deep vein thrombosis; MRCA, methicillin-resistant *Staphylococcus aureus*.

arthrofibrosis on POD44 which successfully restored functional knee flexion to 110°. An otherwise healthy outpatient required admission POD 14 for an acute methicillin-resistant *Staphylococcus aureus* prosthetic joint infection. His past surgical history was significant for a retained synthetic ligament from a previous ligamentous reconstruction of the knee. He had received prophylactic cefazolin at the time of his initial arthroplasty. He presented with a 2- to 3-day history of increased pain and drainage. After open debridement with liner exchange and intravenous daptomycin, he remains free of infection at over 3 years postoperatively with a well-functioning TKA.

There was a total of 3 ED visits in the inpatient group and 7 in the outpatient group that were related to the surgery within 90 days (Table 3). There were 4 ED visits not related to the surgery (3 inpatients and 1 outpatient). There was no statistically significant difference between inpatients and outpatients in all ED visits ($P = .771$) and no difference when only including ED visits related to surgery ($P = .178$). Four patients (2 inpatients, 2 outpatients) presented to the ED following syncope. They were hydrated, reassured, and discharged home from the ED. One inpatient and 1 outpatient presented with unilateral leg swelling. Deep vein thrombosis was ruled out with Doppler ultrasonography, and they were discharged from the ED. One outpatient returned to the ED after noticing that his dressing was saturated with blood, and fortunately, this was resolved with a compression dressing, and he was discharged home without further issues. One outpatient presented on POD 36 for redness surrounding his incision and diagnosed with contact dermatitis secondary to a cream he was applying to his incision but was given a short course of oral antibiotics for possible cellulitis. One outpatient presented to the ED on POD 14 for postoperative pain presenting after office hours which resulted in discharge home after obtaining adequate pain control.

Patients were followed up closely during the study period and did not have ED visits or readmissions at other hospitals as per our research ethics board.

Functional Outcomes

Sixty-three of the 86 patients correctly completed the full 2-year KOOS and WOMAC scores (73%). There were no statistically significant differences between inpatients and outpatients on all KOOS and WOMAC subscores and total scores at baseline, at 1-year or at 2-year follow-up ($P > .05$). Both groups significantly improved between baseline and 2-year follow-up ($P < .001$) (Tables 4 and 5).

Discussion

Outpatients reported statistically and clinically significant improved quality of recovery on the first POD after TKA than inpatients, as reported by the QoR-9 questionnaire. The difference of 1.50 is clinically important as determined previously by Myles et al who established a difference of 0.92 as the minimal clinically important difference [20]. Postoperative opioid analgesic requirements, pain scores, and satisfaction with pain relief were similar in the 2 groups, which suggests that the quality of postoperative care in a well-coordinated outpatient TKA program is not compromised. This finding is consistent with the literature that has reported that an outpatient TKA program is a safe alternative in TKA patients [1,2]. This result supports outpatient TKA by suggesting that the quality of recovery is similar to that of inpatients.

Table 4
KOOS Patient-Reported Outcome Measures for Outpatients and Inpatients at Minimum 2-y Follow-up.

Timepoint	KOOS Symptoms			KOOS Pain			KOOS ADL			KOOS SR			KOOS QoL		
	Outpatient	Inpatient	*P* Value	Outpatient	Inpatient	*P* Value	Outpatient	Inpatient	*P* Value	Outpatient	Inpatient	*P* Value	Outpatient	Inpatient	*P* Value
Preoperative	46.4 (17.6)	44.8 (17.9)	.881	56.3 (59.0)	47.6 (15.1)	.809	54.8 (18.1)	53.5 (17.7)	.650	22.6 (17.4)	19.8 (14.4)	.574	23.3 (15.0)	25.7 (15.7)	.53
One-year follow-up	73.1 (15.5)	79.2 (17.3)	.114	82.1 (16.2)	83.8 (18.0)	.592	86.2 (13.9)	85.4 (17.6)	.818	60.2 (25.8)	54.7 (27.2)	.536	57.4 (25.9)	70.9 (23.2)	.051
Two-year follow-up	80.2 (12.3)	79.6 (17.6)	.567	88.1 (13.4)	88.7 (14.8)	.504	89.5 (13.2)	88.1 (16.5)	.965	61.5 (25.7)	64.0 (23.1)	.772	69.4 (19.3)	76.0 (24.2)	.099
P Value	<.001*	<.001*		<.001*	<.001*		<.001*	<.001*		<.001*	<.001*		<.001*	<.001*	

SR, sport and recreation; KOOS, Knee Injury and Osteoarthritis Outcome Score; QoL, Quality of Life.
* *P*-value <0.05.

Table 5
WOMAC Patient-Reported Outcome Measures for Outpatients and Inpatients at Minimum 2-y Follow-Up.

Timepoint	WOMAC Pain			WOMAC Stiffness			WOMAC Function			WOMAC Total		
	Outpatient	Inpatient	*P* Value	Outpatient	Inpatient	*P* Value	Outpatient	Inpatient	*P* Value	Outpatient	Inpatient	*P* Value
Preoperative	52.2 (17.0)	53.3 (16.3)	.961	44.0 (17.1)	44.4 (17.9)	.942	55.8 (16.9)	52.5 (18.9)	.501	51.9 (15.4)	51.2 (15.8)	.725
One-year follow-up	88.1 (13.0)	87.1 (17.3)	.780	75.0 (13.7)	80.7 (18.5)	.139	86.2 (13.9)	85.5 (17.6)	.818	84.6 (12.0)	85.1 (16.8)	.43
Two-year follow-up	92.6 (12.0)	87.7 (21.3)	.316	82.3 (16.4)	82.5 (20.0)	.659	89.5 (13.2)	88.2 (16.5)	.954	89.3 (12.5)	87.9 (15.9)	.931
P Value	<.001*	<.001*		<.001*	<.001*		<.001*	<.001*		<.001*	<.001*	

WOMAC, Western Ontario and McMaster Universities Osteoarthritis Index.
* *P*-value <0.05.

Emergency Department Visits and Readmissions

Our secondary objective was to compare the postoperative resource utilization between the 2 cohorts. We selected patients who resided close to the hospital, had stable health, and were a willing caregiver at home and who accepted the clinical pathway. Nausea requiring additional treatment before discharge was the most common reason for a delay in discharge. In our population, there were early challenges with vasovagal episodes and nausea precluding ambulation. This was mitigated successfully with hydration, encouraging preoperative clear fluid intake, and restriction of oral opioids to pain scores of 5/10 or more at rest. Our findings suggest that the return to ED and readmissions were not statistically different between inpatients and outpatients. We do acknowledge the possibility of a type II error which further higher powered studies may help confirm.

Although a previous study on outpatient TKA revealed an increased 90-day readmission risk [8], only 1 of 43 outpatients were readmitted in our study. This rate of 2.3% is lower than that of Berger et al, who reported a 10% readmission after outpatient TKA within a 3-month period (8 of 80) [6]. This is likely due to the unselected nature of their patients because readmissions are affected by patient risk factors [21,22]. Targeted exclusion criteria would likely minimize the incidence for an outpatient TKA population. In regard to our most serious complication, the patient that developed a deep infection requiring irrigation and debridement with liner exchange was asymptomatic until POD11. For this reason, we believe it is unlikely that this infection could have been prevented if he was in the inpatient group. Furthermore, patients were instructed to present to the ED at the operating hospital, and there were no known ED visits or readmissions at other hospitals.

Functional Outcomes

TKA improved KOOS and WOMAC scores in all sections in both groups. Our results did not reveal a significant difference in outcome scores at 2 years postoperatively, suggesting that outpatient and inpatient TKA produce similar midterm outcomes.

Limitations

The main limitation to this study is rooted in that the comparison groups of the study were not randomized but rather a sequential comparative cohort. As such, BMI was statistically significantly higher for the inpatient group and nearly 20% in this cohort had their surgery in the afternoon which may have influenced the 24-hour reported outcome measure. Nevertheless, the cohorts were balanced for most known relevant predictors for short-term morbidity outcomes, which was the focus of the study. It was a necessary limitation, as our Research Ethics Board would not sanction a randomized controlled trial at inception without demonstrating safety in our outpatient cohort. Despite this limitation, our study illustrates that it is feasible to create an outpatient pathway that can be expected to provide short-term and midterm outcomes comparable to the inpatient pathway. These findings may be significant for the surgeon considering developing a new outpatient TKA pathway at their institution. We now believe that there is sufficient experience and safety evidence to proceed with randomized trials. Further studies with larger sample sizes may be required to detect differences in rare but severe complications following TKA.

Conclusion

Our results suggest that the short-term quality of recovery is similar in outpatient TKA when compared to inpatient TKA. Although Berger et al [6] have previously investigated the safety of outpatient procedures, our study is the first to make a PROM comparison between inpatients and outpatients. We found no other significant difference in short-term PROMs (opioid analgesic requirements, pain scores, satisfaction with pain control) or 2-year functional outcomes (KOOS and WOMAC), suggesting that the short-term recovery and functional outcomes scores are comparable in both groups. In addition, we found an acceptable 90-day rate of readmissions and ED visits which was not significantly different between groups. Further studies are necessary to explore PROMs in outpatient populations.

References

[1] Kim S, Losina E, Solomon DH, Wright J, Katz JN. Effectiveness of clinical pathways for total knee and total hip arthroplasty: literature review. J Arthroplasty 2003;18:69–74.
[2] Vorhies JS, Wang Y, Herndon JH, Maloney WJ, Huddleston JI. Decreased length of stay after TKA is not associated with increased readmission rates in a national Medicare sample. Clin Orthop Relat Res 2012;470:166–71.
[3] Kolisek FR, McGrath MS, Jessup NM, Monesmith EA, Mont MA. Comparison of outpatient versus inpatient total knee arthroplasty. Clin Orthop Relat Res 2009;467:1438–42.
[4] Huang A, Ryu JJ, Dervin G. Cost savings of outpatient versus standard inpatient total knee arthroplasty. Can J Surg 2017;60:57.
[5] Aynardi M, Post Z, Ong A, Orozco F, Sukin DC. Outpatient surgery as a means of cost reduction in total hip arthroplasty: a case-control study. HSS J 2014;10:252–5.
[6] Berger RA, Kusuma SK, Sanders SA, Thill ES, Sporer SM. The feasibility and perioperative complications of outpatient knee arthroplasty. Clin Orthop Relat Res 2009;467:1443–9.
[7] Cross MB, Berger R. Feasibility and safety of performing outpatient unicompartmental knee arthroplasty. Int orthopaedics 2014;38:443–7.
[8] Lovald ST, Ong KL, Malkani AL, Lau EC, Schmier JK, Kurtz SM, et al. Complications, mortality, and costs for outpatient and short-stay total knee arthroplasty patients in comparison to standard-stay patients. J Arthroplasty 2014;29:510–5.
[9] Courtney PM, Rozell JC, Melnic CM, Lee GC. Who should not undergo short stay hip and knee Arthroplasty? Risk factors associated with major medical complications following primary total joint arthroplasty. J Arthroplasty 2015;30(9 Suppl):1–4.
[10] Berger RA, Sanders S, Gerlinger T, Della Valle C, Jacobs JJ, Rosenberg AG. Outpatient total knee arthroplasty with a minimally invasive technique. J Arthroplasty 2005;20(7 Suppl 3):33–8.
[11] Cushner FD. The subvastus approach to the knee. J Knee Surg 2003;16:52.
[12] Karaaslan F, Karaoglu S, Yurdakul E. Reducing Intra-articular hemarthrosis after Arthroscopic Anterior Cruciate ligament reconstruction by the administration of intravenous tranexamic acid: a prospective, randomized controlled trial. Am J Sports Med 2015;43:2720–6.

[13] Motififard M, Tahririan MA, Saneie M, Badiei S, Nemati A. Low dose perioperative intravenous tranexamic acid in patients undergoing total knee arthroplasty: a Double-Blind randomized Placebo controlled clinical trial. J Blood Transfus 2015;2015:948304.
[14] Alcelik I, Pollock RD, Sukeik M, Bettany-Saltikov J, Armstrong PM, Fismer P. A comparison of outcomes with and without a tourniquet in total knee arthroplasty: a systematic review and meta-analysis of randomized controlled trials. J Arthroplasty 2012;27:331–40.
[15] Busch CA, Shore BJ, Bhandari R, Ganapathy S, MacDonald SJ, Bourne RB, et al. Efficacy of periarticular multimodal drug injection in total knee arthroplasty. A randomized trial. J Bone Joint Surg Am 2006;88:959–63.
[16] Su EP, Perna M, Boettner F, Mayman DJ, Gerlinger T, Barsoum W, et al. A prospective, multi-center, randomised trial to evaluate the efficacy of a cryopneumatic device on total knee arthroplasty recovery. J Bone Joint Surg Br 2012;94(11 Suppl A):153–6.
[17] Adhikary SD, Liu WM, Memtsoudis SG, Davis 3rd CM, Liu J. Body mass index more than 45 kg/m as a cutoff point is associated with dramatically increased postoperative complications in total knee arthroplasty and total hip arthroplasty. J Arthroplasty 2015;31:749–53.
[18] Myles PS, Hunt JO, Nightingale CE, Fletcher H, Beh T, Tanil D, et al. Development and psychometric testing of a quality of recovery score after general anesthesia and surgery in adults. Anesth Analg 1999;88:83–90.
[19] Medicare program; Comprehensive care for joint Replacement Payment model for acute care hospitals Furnishing lower Extremity joint Replacement services. Final rule. Fed Regist 2015;80:73273.
[20] Myles PS, Myles DB, Galagher W, Chew C, MacDonald N, Dennis A. Minimal clinically important difference for three quality of recovery scales. Anesthesiology 2016;125:39–45.
[21] Belmont Jr PJ, Goodman GP, Waterman BR, Bader JO, Schoenfeld AJ. Thirty-day postoperative complications and mortality following total knee arthroplasty: incidence and risk factors among a national sample of 15,321 patients. J Bone Joint Surg Am 2014;96:20–6.
[22] Schairer WW, Vail TP, Bozic KJ. What are the rates and causes of hospital readmission after total knee arthroplasty? Clin Orthop Relat Res 2014;472:181–7.

Appendix A. Quality of Recovery 9 Scale

Quality of Recovery

Please enter in a score of 0, 1, or 2 that best describes how you have been feeling over the past 24 hours. Complete day 1 through 7 after your surgery.

Score system: 0 = not at all ☹ 1 = some of the time 2 = most of the time ☺

Quality of Recovery	Day 1 Date	Day 2 Date	Day 3 Date	Day 4 Date	Day 5 Date	Day 6 Date	Day 7 Date
Had a feeling of general well-being							
Had support from others (especially doctors and nurses)							
Been able to understand instructions and advice. Not being confused							
Been able to look after personal toilet and hygiene unaided							
Been able to pass urine ("waterworks") and having no trouble with bowel function							
Been able to breathe easily							
Been free from headache, backache or muscle pains							
Been free from nausea, dry-retching or vomiting							
Been free from experiencing severe pain, or constant moderate pain							
Total Score of 18							