

Health care costs after total knee arthroplasty for satisfied and dissatisfied patients

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Background: Evidence suggests that up to 21% of patients are dissatisfied after total knee arthroplasty (TKA), but the link between dissatisfaction and use of health care resources is unknown. The objective of this study was to compare costs after TKA between satisfied and dissatisfied patients.

Methods: This was a secondary analysis of a randomized clinical trial among patients who underwent primary TKA at our institution between 2015 and 2018. We estimated rates of satisfaction with pain relief and with return to function 1 year postoperatively. Patients prospectively reported use of health care resources 6 weeks, and 3, 6, 9 and 12 months after surgery. We compared costs between satisfied and dissatisfied patients from a public payer and a societal perspective.

Results: We included 156 patients in our analysis, of whom 42 (26.9%) were dissatisfied with pain, and 57 (36.5%) were dissatisfied with function. There was no significant difference in costs between patients dissatisfied with pain or function compared to satisfied patients from a health care payer perspective. From a societal perspective, patients dissatisfied with pain incurred a mean cost of \$21 156.18, compared to \$13 453.84 for satisfied patients (mean difference \$7702.34, 95% confidence interval [CI] -89.43 to 15 494.11). Similarly, patients dissatisfied with function incurred a mean cost of \$19 007.70, compared to \$13 523.83 for those who were satisfied (mean difference \$5483.87, 95% CI -526.34 to 11 494.10).

Conclusion: Dissatisfied patients incurred greater costs than satisfied patients during the first year after TKA. The results justify further evaluation of factors contributing to patient satisfaction that may help to reduce the economic burden of TKA.

Contexte : Selon des données probantes, jusqu'à 21 % des patients sont insatisfaits à la suite d'une arthroplastie totale du genou (ATG), mais le lien entre l'insatisfaction et le recours à des ressources de soins de santé est inconnu. L'objectif de cette étude était de comparer les coûts à la suite d'une ATG chez les patients satisfaits et les patients insatisfaits.

Méthodes : Il s'agissait d'une analyse secondaire d'un essai clinique randomisé chez des patients ayant subi une ATG primaire dans notre établissement entre 2015 et 2018. Nous avons estimé les taux de satisfaction quant au soulagement de la douleur et à la reprise des activités 1 an après l'opération. Les patients ont signalé de façon prospective le recours à des ressources de soins de santé 6 semaines, 3 mois, 6 mois, 9 mois et 12 mois après l'intervention chirurgicale. Nous avons comparé les coûts chez les patients satisfaits et les patients insatisfaits du point de vue sociétal et selon la perspective du payeur public.

Résultats : Au total, 156 patients ont été inclus dans notre analyse, dont 42 (26,9 %) étaient insatisfaits quant au soulagement de la douleur et 57 (36,5 %) quant à la reprise des activités. Selon la perspective du payeur de soins de santé, il n'y avait aucune différence significative entre les coûts chez les patients satisfaits et ceux chez les patients insatisfaits concernant le soulagement de la douleur ou la reprise des activités. Du point de vue sociétal, les patients insatisfaits quant au soulagement de la douleur ont assumé un coût moyen de 21 156,18 \$, comparativement à 13 453,84 \$ chez les patients satisfaits (différence moyenne 7702,34 \$; intervalle de confiance [IC] de 95 % -89,43 à 15 494,11). De même, les patients insatisfaits quant à la reprise des activités ont assumé un coût moyen de 19 007,70 \$, comparativement à 13 523,83 \$ chez les patients satisfaits (différence moyenne 5483,87 \$; IC de 95 % -526,34 à 11 494,10).

Conclusion : Les patients insatisfaits ont assumé des coûts plus élevés que les patients satisfaits durant la première année qui a suivi l'ATG. Les résultats obtenus justifient une évaluation plus poussée des facteurs de satisfaction des patients, qui peuvent aider à réduire le fardeau économique de l'ATG.

Total knee arthroplasty (TKA) is an effective surgical intervention for patients with advanced osteoarthritis, providing reduced pain, and improved function and quality of life. Despite these benefits, historical evidence suggests that up to 21% of patients report they are dissatisfied after TKA.¹⁻¹¹ This substantial proportion of dissatisfied patients has led many to investigate potential predictors of satisfaction. Several factors have been suggested to influence patient satisfaction, including unmet preoperative expectations, preoperative pain, low Western Ontario and McMaster Universities Osteoarthritis Index scores 1 year postoperatively and postoperative complications necessitating hospital readmission.²

The link between satisfaction level and use of health care resources is unknown. Osteoarthritis is a leading contributor to use of health care resources, with an estimated \$10 billion spent in direct costs in Canada each year.¹² The prevalence of knee osteoarthritis is increasing rapidly, resulting in a rising demand for care and substantial impact on health care budgets. Furthermore, it is estimated that patients with knee osteoarthritis incur about \$17 billion in indirect costs each year, mostly owing to time away from paid employment or reduced productivity as a result of their condition.¹²

Total knee arthroplasty is a proven intervention for advanced knee osteoarthritis and is among the 3 most common inpatient operations performed annually in Canada.¹³ In 2018–2019, 75 345 knee replacement procedures were performed in Canada, representing a 5-year increase of 22.5%.¹³ Furthermore, it is estimated that the in-hospital costs alone for TKA are \$9046, with greater costs among patients with higher body mass index (BMI).¹⁴ Patients who are dissatisfied after TKA may contribute substantially to the economic burden, incurring additional health care costs as a result of increased appointments, out-of-pocket costs to manage pain and time away from work.

Therefore, the primary objective of this study was to compare the use of health care resources after TKA between satisfied and dissatisfied patients. We hypothesized that dissatisfied patients incur greater costs than satisfied patients at 1 year postoperatively.

METHODS

We conducted a secondary analysis of a randomized clinical trial among patients who underwent primary TKA at our institution between 2015 and 2018.¹⁵ The purpose of the trial was to compare patient-specific instrumentation and conventional surgical instrumentation for TKA in terms of early implant migration, alignment, surgical resources, patient outcomes and costs in patients with obesity (BMI > 30) with symptomatic end-stage osteoarthritis of the knee. Patients were followed prospectively for 1 year after surgery. All patients provided informed consent, and the study was approved by our institution's health research ethics board.

Satisfaction

Patients completed the Knee Society Clinical Rating Score (KSS)¹⁶ 1 year postoperatively. The KSS incorporates a patient-reported outcome measure that includes domains of functional activity, expectations and satisfaction. The satisfaction domain consists of 5 questions: 2 relating to satisfaction with pain after surgery, and 3 relating to satisfaction with functional activity after surgery. Patients are asked to rate their satisfaction level for each question on a 5-item scale ranging from "Very satisfied" to "Very dissatisfied."

Use of health care resources

Patients were asked to report use of health care resources 6 weeks, and 3, 6, 9 and 12 months after surgery. Resources included any emergency department visits, inpatient hospital admissions, primary care physician or specialist visits, health care or clinic visits, medical tests or procedures, diagnostic imaging, medication and assistive device use since their discharge after surgery. Patients also reported any resulting time lost from employment or from homemaking or volunteer activities, as well as assistance required with daily activities related to their surgery. Costs incurred after surgery and before discharge from the hospital, including the prosthesis and inpatient hospital stay, were not included. Costs related to the patient-specific instrumentation were also not included.

Sources of cost data

We obtained unit costs for publicly funded resource use from our institutional costing department, provincial fee schedules and drug benefit formularies.^{17,18} We used the Ontario Ministry of Health (MOH) Schedule of Benefits¹⁷ to collect direct costs such as physician, clinic and emergency department visits, and Ontario Drug Benefit Formulary¹⁸ to collect the cost of drugs. For patients aged 65 years or older, prescription medication costs were included in the MOH perspective. We obtained direct costs of related procedures, such as irrigation and débridement, from the Ontario Case Costing Initiative (<https://data.ontario.ca/dataset/ontario-case-costing-initiative-occi>). Patients were asked to report out-of-pocket costs for additional health care resources that are not covered by the provincial health care plan during the study period.

We used the average Canadian wage reported by Statistics Canada¹⁹ to place a monetary figure on time off from paid employment, for both patients and their caregivers. We used the current minimum wage value¹⁹ to place a monetary figure on time lost for those who were retired, as well as time away from volunteer and homemaking activities. All costs are reported in 2020 Canadian dollars.

Statistical analysis

We categorized patients as satisfied or dissatisfied for pain and function separately using the satisfaction subscale of the KSS. Patients were considered to be in the dissatisfied group if any of their responses were “Neutral,” “Dissatisfied” or “Very dissatisfied.” Those who responded “Very satisfied” or “Satisfied” to all questions were classified in the satisfied group.

We calculated mean total cost over the first year postoperatively from both an MOH and a societal perspective. The MOH perspective includes any direct costs covered by the publicly funded health care system, including physician, specialist and clinic visits, laboratory tests and medical procedures. In addition to these costs, the societal perspective includes use of all privately funded health care resources such as physical therapy, medication and assistive devices not covered by the provincial insurance plan, as well as indirect costs such as time away from paid employment, homemaking or volunteer activities, and caregiver assistance. We compared mean total costs 1 year postoperatively between the satisfied and dissatisfied groups.

We used descriptive statistics to report the proportions of patients who were satisfied and dissatisfied for both pain and function. We conducted an independent-sample *t* test to compare resource use between the 2 groups, and reported the mean difference in overall costs between groups with a 95% confidence interval (CI) around the estimate. If the data did not meet the assumptions of a *t* test, we compared means using nonparametric bootstrap-

ping. We performed a one-way sensitivity analysis in which we considered “Neutral” in the same category as “Satisfied.”

RESULTS

Seventeen participants from the original trial were not included in the present analysis owing to missing data. We thus included 156 patients in our analysis, of whom 111 (71.2%) were female (Table 1). The participants had a mean age of 61.97 years (standard deviation [SD] 6.07 yr) and a mean BMI of 38.09 (SD 6.48). Forty-two patients (26.9%) were dissatisfied with pain, and 57 patients (36.5%) were dissatisfied with function.

From an MOH perspective, patients dissatisfied with pain relief incurred a mean of \$283.85 (95% CI -\$840.79 to \$273.10) less than satisfied patients (Table 2). The mean cost for patients dissatisfied with return to function was \$784.12, compared to \$1082.08 for those who were satisfied (mean difference -\$297.96, 95% CI -915.08 to 319.17). Two patients in the satisfied group underwent additional procedures to treat infection, which contributed to the higher costs for this group.

From a societal perspective, patients dissatisfied with pain incurred a mean cost of \$21 156.18, compared to \$13 453.84 for satisfied patients (mean difference \$7702.34, 95% CI -89.43 to 15 494.11) (Table 2). Similarly, patients dissatisfied with return to function incurred a mean cost of \$19 007.70, compared to \$13 523.83 for those who were satisfied (mean difference \$5483.87, 95% CI -\$526.34 to 11 494.10). Although these differences are

Table 1. Baseline characteristics of patients who underwent primary total knee arthroplasty and satisfaction rates 1 year postoperatively

Characteristic	Overall n = 156	Satisfaction with pain		Satisfaction with function	
		Satisfied n = 114	Dissatisfied n = 42	Satisfied n = 99	Dissatisfied n = 57
Female sex, no. (%) of patients	111 (71.2)	78 (68.4)	33 (78.6)	70 (70.7)	41 (71.9)
Age, mean ± SD, yr	61.97 ± 6.07	62.47 ± 5.61	60.57 ± 7.06	62.45 ± 5.67	61.12 ± 6.69
Body mass index, mean ± SD	38.09 ± 6.48	38.68 ± 6.64	39.52 ± 6.05	38.83 ± 6.75	39.04 ± 6.02

SD = standard deviation.

Table 2. Cost of health care resources

Domain; perspective	Group; mean cost (SE), \$*		Mean difference (95% CI)	p value
	Satisfied	Dissatisfied		
Pain				
Health care payer	1049.65 (284.16)	765.78 (77.38)	-283.85 (-840.79 to 273.10)	0.3
Societal	13 453.84 (3975.47)	21 156.18 (3580.80)	7702.34 (-89.43 to 15 494.11)	0.05
Function				
Health care payer	1082.08 (314.87)	784.12 (61.76)	-297.96 (-915.08 to 319.17)	0.3
Societal	13 523.83 (3066.50)	19 007.70 (2867.51)	5483.87 (-526.34 to 11 494.10)	0.07

CI = confidence interval; SE = standard error.
*2020 Canadian dollars.

not statistically significant, their magnitude suggests that dissatisfied patients incurred greater costs than satisfied patients.

DISCUSSION

We found that 26.9% of 156 patients who underwent primary TKA at 1 centre between 2015 and 2018 were dissatisfied with pain relief 1 year postoperatively, and 36.5% were dissatisfied with return to function. Dissatisfied patients incurred greater costs than satisfied patients.

Bourne and colleagues² looked at patient satisfaction in a large cohort of patients who underwent primary TKA between 2001 and 2005, and found that 20.9% of patients reported they were dissatisfied 1 year postoperatively. Low preoperative Western Ontario and McMaster Universities Osteoarthritis Index scores, unrealistic patient expectations and complications necessitating hospital admission were significant predictors of patient dissatisfaction. More recently, Bryan and colleagues²⁰ reported on a longitudinal observational study designed and conducted to understand patient satisfaction with TKA 6 and 12 months after surgery. They found the overall dissatisfaction rate to be about 16% and that key drivers of satisfaction included pain, physical health and mental health. Similarly, in a survey of 556 patients who underwent hip or knee arthroplasty, Conner-Spady and colleagues²¹ found that 13% of those who had TKA were dissatisfied 1 year postoperatively. Patients who were very satisfied with their TKA procedure had a significantly greater proportion of their preoperative expectations met than dissatisfied patients (92% v. 12%).

The fact that the study participants included in this analysis had severe obesity may have contributed to the overall higher rate of dissatisfaction compared to estimates in the literature and thus may not be representative of the general TKA population. However, when we looked at satisfaction with pain relief and return to function separately, we found a substantially higher rate of dissatisfaction with return to function. Further research evaluating satisfaction specifically related to pain and function is warranted to confirm whether similar trends exist among all patients undergoing TKA.

Importantly, we found a sizable difference in the societal costs between dissatisfied and satisfied patients, although the difference was not statistically significant. The difference was largely due to greater indirect costs such as time away from paid employment for patients and their caregivers. This suggests that those who are dissatisfied may experience greater delays in return to work and reduced productivity, and may require a greater amount of caregiver support with activities of daily living such as shopping or heavier household chores such as vacuuming. As the original trial was not powered to detect a difference in costs, a larger sample may show a statistically significant

cost difference between satisfied and dissatisfied patients. Furthermore, given the nature of data on use of health care resources (some patients will have high health care costs, whereas others may incur zero costs), there is inherent variability, resulting in cost data that are highly skewed and not normally distributed.

Interestingly, from the MOH perspective, patients who were dissatisfied with pain and function actually incurred lower costs than satisfied patients; however, this difference was not statistically significant and may not be found in a larger sample. Two patients in the satisfied group had an infection after their TKA procedure that required an additional surgical intervention, and this contributed to the greater cost for this group. Despite requiring an additional intervention, these patients still indicated they were satisfied with their knee function 1 year postoperatively. This contradicts past evidence that the occurrence of postoperative complications requiring surgery is a significant predictor of dissatisfaction 1 year postoperatively.² When we excluded the data for these 2 patients from the analysis, the difference between groups was reduced, with lower MOH costs for the satisfied patients.

This study provides an updated estimate of patient satisfaction using prospectively collected patient-reported data 1 year after TKA. Furthermore, our results differentiate between satisfaction with pain and with function, which may provide insight into specific domains of patient outcomes affecting satisfaction, and identifies potential areas for improvement and future research. We also detailed patient-level costing to determine the economic impact of dissatisfaction after TKA. This may provide a basis for future research focusing on the most important economic components of the increased costs for patients dissatisfied with pain or function.

Limitations

Further study among a larger cohort of patients undergoing TKA will provide a more precise estimate of satisfaction.

The KSS questionnaire used to measure patient satisfaction includes “Neutral” as a possible response for each question. We took a conservative approach and categorized the “Neutral” responses as “Dissatisfied.” When we considered “Neutral” in the same category as “Satisfied,” the dissatisfaction rates decreased slightly but were still similar to existing estimates, which suggests no improvement in satisfaction level. Future evaluation should explore the meaning and appropriate interpretation of the “Neutral” response.

CONCLUSION

A substantial proportion of patients who underwent primary TKA were dissatisfied with their pain and function 1 year postoperatively. The dissatisfied patients incurred

greater overall costs than those who were satisfied in the first year after surgery, as a result of higher indirect costs (time lost from employment, or homemaking or volunteer activities, and caregiver assistance). Further research investigating factors that contribute to patient satisfaction after TKA may help optimize outcomes and decrease the very large overall economic burden of this common procedure.

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Contributors: L. Somerville designed the study. E. Vasarhelyi acquired the data, which J. Marsh, I. Joshi and B. Lanting analyzed. J. Marsh wrote the manuscript, which I. Joshi, L. Somerville, E. Vasarhelyi and B. Lanting critically revised. All authors gave final approval of the article to be published.

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