

Patient willingness to contribute to the cost of novel implants in total joint arthroplasty: the Canadian experience

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Background: In Canada, health care is covered by provincial health insurance programs; patients do not directly participate in paying for their acute care expenses. The aim of this study is to assess the willingness of Canadian patients to contribute to the costs of novel total joint arthroplasty implants.

Methods: We administered a questionnaire to patients attending an outpatient arthroplasty clinic in Ontario. In the questionnaire, the longevity and risk of complications of a “standard” implant were described. We asked if participants would be willing to contribute to the cost of 3 novel implants that had differing longevities and risks of complications compared with the standard implant.

Results: One hundred and fifteen patients completed our questionnaire. Up to 62% of patients were willing to contribute a copayment to get an implant with greater longevity. Willingness to pay decreased to 40% for an implant with greater longevity but an increased risk of complications. Forty percent of participants were willing to pay for an implant with the same longevity as the standard implant but a decreased risk of complications. Participants with a higher income were more willing than other participants to contribute to the cost of a novel implant with greater longevity or lower complication rates.

Conclusion: This study demonstrated that up to 62% of our sample of patients in Ontario were willing to share the costs of a novel total joint replacement implant. Willingness to pay was associated with the proposed benefits of the implant and certain patient characteristics. Our study shows that a high proportion of Canadian patients may be willing to copay to have access to new technologies.

Contexte : Au Canada, les soins de santé sont assurés par les régimes provinciaux d'assurance maladie; les patients ne participent pas directement au paiement des soins de santé actifs. Le but de cette étude était de vérifier si les patients canadiens sont prêts à contribuer au paiement de prothèses d'un type nouveau pour les arthroplasties totales.

Méthodes : Nous avons administré un questionnaire à des patients d'une clinique externe d'arthroplastie en Ontario. Dans le questionnaire, on décrivait la durée de vie et les risques de complications associés à une prothèse « standard ». Nous avons demandé aux participants s'ils étaient ouverts à l'idée de contribuer au paiement de 3 prothèses d'un nouveau type, comportant une durée de vie et des risques de complications différents de ceux de la prothèse standard.

Résultats : Cent quinze patients ont répondu à notre questionnaire. Jusqu'à 62 % des patients se sont dits prêts à contribuer à une forme de copaiement pour obtenir une prothèse plus durable. La volonté de payer diminuait à 40 % pour une prothèse plus durable mais comportant plus de risques de complications. Quarante pour cent des participants se sont dits prêts à payer pour une prothèse de même durée de vie que la prothèse standard, mais comportant moins de risques de complications. Les participants ayant un revenu plus élevé étaient davantage disposés à contribuer au paiement d'une prothèse d'un nouveau type plus durable et comportant moins de risques de complications comparativement aux autres participants.

Conclusion : Cette étude a démontré que jusqu'à 62 % de notre échantillon de patients ontariens étaient prêts à partager les coûts d'une nouvelle prothèse pour arthroplastie totale. La volonté de payer était associée aux avantages présumés de la prothèse et à certaines caractéristiques des patients. Notre étude montre qu'une forte proportion de patients canadiens seraient prêts à s'engager dans un copaiement pour avoir accès à de nouvelles technologies.

Total joint arthroplasty (TJA) is performed commonly in North America as a treatment for end-stage osteoarthritis of the hip and knee. Today's patients are less willing to accept a reduction in their activity level, and they turn to TJA to maintain their quality of life.¹ TJA is a highly successful² and cost-effective procedure for patients with severe osteoarthritis of the hip and knee.³ It is estimated that by 2026, over 6 million Canadians will have symptomatic arthritis, up from 4 million in 2000. Thus, there will be an ever-increasing burden on Canada's publicly funded health system as the population will expect quality of care to be maintained.⁴

The health care system costs associated with TJA are projected to increase over the next decades. When it comes to crucial decision-making in the lead-up to hip or knee replacement surgery, patients are increasingly enquiring about implant options and different surgical techniques, with the goal of minimizing complications and maximizing outcomes and implant longevity. This is attributed mostly to increased direct patient marketing and the availability of online information. Patients' decisions are influenced by different emotional and psychological biases that affect their ability to behave as "rational consumers."⁵ In terms of prosthesis costs and patient willingness to contribute to the expense, previous studies found that patients would be willing to pay a higher fee to obtain a proposed "better" prosthesis than their insurance provider was willing to cover.⁶

Given increasing cost restrictions and government-imposed budgets, there is concern among orthopedic surgeons that high-performing total joint implants may not be available to patients with unique needs (younger age, obesity, higher physical demands) without special request. If manufacturers do not have the potential to acquire market share for their new products, there is growing concern that innovation will be stifled even though there have been significant advances in arthroplasty research over the past few decades. For this reason, we felt it important to evaluate the willingness of our patient population to contribute to the cost of the surgery in exchange for the ability to select an implant with more desirable characteristics, including improved longevity and reduced complication rates.

The aim of this study was to assess the willingness of Canadian patients to contribute to TJA implant costs, within a single-payer health care system where patients currently do not contribute directly to their health care costs. Our hypothesis is that patients are willing to contribute, in the form of a copayment, to the cost of their implants to have access to new technologies that they see as superior to the option that is routinely available. In this study, we assessed patients' willingness to directly contribute to the cost of an implant that may have greater longevity or may be associated with reduced surgical complications.

We believe that understanding the degree to which patients are willing to contribute to the cost of novel

implants that are claimed to offer superior outcomes or decreased complications may be useful to health care payers and providers.

METHODS

Design and sample

A cross-sectional survey among patients attending an orthopedic tertiary medical centre was conducted in the outpatient arthroplasty clinic at a university-affiliated hospital in Toronto, Ontario. Patients were eligible for inclusion in the study if they presented to the outpatient clinic, were able to read and speak English, were between 21 and 89 years of age and were willing to participate. All patients who met these inclusion criteria were invited to participate by a research assistant in the waiting area of the clinic. We did not discuss or offer any educational material about implant prices or the costs of the TJA surgery. This study was approved by the Mount Sinai Hospital Research Ethics Board.

Survey instrument

Demographic information collected in the survey (available in Appendix 1, available at cansurg.ca/007118-a1) included the following: self-reported ethnicity, age, education level, sex, insurance status and income. We asked patients to respond to the question "How comfortable would you be with your hospital/surgeon selecting your implant?" with their degree of confidence on a scale of 0–100, with 100 being the highest.

We assessed patients' willingness to pay and their preferences related to different implant characteristics. We described features of a "standard implant" including longevity of approximately 15 years and risk of short-term complications estimated at 3% during the first postoperative year (Table 1). We asked if the study participants would be willing to contribute to the cost of their implant in the form of a copayment if they were offered 3 novel implants that had the following characteristics: (a) longevity of 25 years with the same (3%) risk of short-term complications, (b) longevity of 25 years with an increased (5%) risk of short-term complications and (c) standard longevity (15 yr) with a lower (1%) risk of short-term complications.

Table 1. Characteristics of devices presented to patients in the willingness-to-pay questionnaire

Device	Longevity, yr	Risk of early complications, %
Standard implant	15	3
Novel implant 1	25	3
Novel implant 2	25	5
Novel implant 3	15	1

Specific pricing was not presented to the survey participants. Participants entered the dollar value of the copayment they were willing to make as free text into the survey.

Statistical analysis

We described the percentage of patients who were willing to pay for the newer implants in each of the scenarios, and the results were classified by sex, age group, education level and income level. The association between these covariates and willingness to pay was tested with χ^2 tests.

RESULTS

One hundred and fifty patients at the outpatient arthroplasty clinic were screened for study eligibility and approached to participate in the study. One hundred and fifteen patients (76.7%) met the eligibility criteria and completed the questionnaire (Table 2). Forty-eight percent were male; the mean age was 60.77 years (range 26–86 yr); 85% were white. Fifty-four percent of participants indicated that they had a college degree.

Fifty-seven percent reported an annual income between \$30 000 and \$100 000. Of these participants, 24% had an income between \$30 000 and \$50 000, 18% had an income between \$50 000 and \$80 000 and 15% had an income between \$80 000 and \$100 000. All of the participants were enrolled in Ontario’s public health insurance system. None of the patients had any private insurance.

Table 2. Participant characteristics (n = 115)

Characteristic	No. (%)*
Age group	
< 60 yr	53 (46)
60–70 yr	29 (25)
> 70 yr	33 (29)
Sex, %	
Male	48
Female	52
Ethnicity, %	
White	85
Other	15
Education, %	
Less than college	26
Some college	20
College graduate	54
Income, %	
< \$30 000	16
\$30 000–\$50 000	24
\$50 000–\$80 000	18
\$80 000–\$100 000	15
> \$100 000	27

Note: Percentages may not add up to 100% in each category because of missing values.
*Unless indicated otherwise.

When asked about their comfort level with their hospital or surgeon selecting their implant on a scale of 0–100, participants reported the most confidence in having their surgeon make the decision (82/100; standard deviation [SD] 15.50) and moderate confidence in having their hospital select the implant (49/100; SD 30.24) (Table 3).

Sixty-two percent of participants (71/115) were willing to pay a supplement that would allow them to choose an implant with a proposed longevity of 25 years (rather than the standard 15 years), without any increase in the risk of complications (novel implant 1) (Table 4). The average amount they were willing to pay was \$3378 (range \$100–\$10 000) (Table 5).

Participants’ willingness to pay a supplement to choose their implant decreased to 40% (46/115 participants) when the implant had a proposed longevity of 25 years but was associated with an increased risk of complications (5%, rather than the 3% risk with the standard implant) (novel implant 2). The average amount they were willing to pay was \$3665 (range \$100–\$10 000).

Forty percent (46/115 participants) were willing to pay a supplement for an implant proposed to have the standard longevity of 15 years but a decreased risk of complications, from 3% to 1% (novel implant 3). The average amount participants were willing to pay was \$2483 (range \$100–\$10 000).

Women and men were almost equally likely to be willing to pay a copayment for novel implants (e.g., 32% women and 31% men were willing to contribute to the cost of novel implant 1; note that the percentages may not add up to 100% because of missing values). Younger patients were more likely to be willing to pay for novel implants. When asked if they would be willing to add a copayment for an implant that had increased longevity but also an increased risk of complications (novel implant 2), 23% of participants younger than 60 years of age were willing to pay, compared with 11% of those between 60 and 70 years of age (Table 4). When level of education was correlated with willingness to pay regardless of the implant in question, a wide acceptance was noticed ($p < 0.05$); there was no correlation between level of education and willingness to pay (Table 6). Level of income was a relevant variable for 2 of the 3 types of novel implants of the study. (Table 7). Patients with a higher level of income were more willing to pay a copayment for an implant that had greater longevity and greater risk than the standard

Table 3. Participants’ degree of confidence in having their hospital or surgeon select their implant

Decision-maker	Participants’ degree of confidence*	Standard deviation
Surgeon	82	15.50
Hospital	49	30.24

*On a scale of 0–100, with 100 representing the highest degree of confidence.

Table 4. Participants' willingness to pay a copayment for novel implants, stratified by patient characteristics

Characteristic	Proportion of participants willing to pay, %		
	Novel implant 1 (greater longevity, same risk*)	Novel implant 2 (greater longevity, greater risk*)	Novel implant 3 (same longevity, lower risk*)
All participants	62	40	40
Sex			
Male	31	24	22
Female	32	17	19
Age			
< 60 yr	29	23	19
60–70 yr	18	11	8
> 70 yr	15	10	15
Education			
Less than college	13	10	8
Some college	12	7	7
College graduate	38	27	28
Income			
< \$30 000	5	3	4
\$30 000–\$50 000)	17	11	11
\$50 000–\$80 000	8	6	8
\$80 000–\$100. 000	8	7	5
\$100 000–\$150 000	8	6	4
> \$150 000	11	9	9

*Compared with the standard implant.

implant (novel implant 2) ($p = 0.04$) and for an implant that offered the same longevity as the standard implant but a lower risk (novel implant 3) ($p = 0.06$).

DISCUSSION

This study established that between 40% and 62% of Canadian patients are willing to contribute to the costs of novel TJA implants. Willingness to share the expense of their total joint replacement was associated with the proposed benefits of the novel implants and with certain patient demographic characteristics. These results are of relevance as patients' direct contribution to the cost of new implants may help single-payer systems deal with the ever-growing costs related to introduction of these technologies.

A similar study conducted by Schwarzkopf and colleagues in the United States included over 195 patients and revealed that 45% of patients were willing to pay a copayment for a device with increased longevity.⁷ Willingness to pay decreased to 26% when there was an increased risk of complications,

and 29% of participants were willing to pay for a decreased risk of complications.⁷ There are several differences between that US study and the present one. Older patients (aged > 70 yr) in our study were more reluctant to contribute to the cost of novel implants with increased longevity: 15% were willing in our study compared with 23% in the American study. For an implant with increased longevity without an increased risk of complications (novel implant 1), 18% of patients between 60 and 70 years of age in our study were willing to participate in the cost, compared with 40% in the US study. For an implant with greater longevity and greater risk, 11% of participants aged 60–70 years in our study were willing to pay compared with 21% in the US study.

In our study there was no difference between the level of education and willingness to pay. Wide acceptance was noticed ($p < 0.05$) in all groups regardless of level of education. Surprisingly, when level of income was correlated with willingness to pay, wide acceptance was noticed for novel implant 2 ($p = 0.04$) and novel implant 3 ($p = 0.06$).

Tucker and colleagues asked over 600 patients in Florida, "If your insurance did not cover the entire surgeon fee, what is the most you would be willing to pay out-of-pocket to have the surgery performed?" and "If you were scheduled for a 'standard' total hip or knee arthroplasty, what is the most you would be willing to pay out-of-pocket for an 'advanced technology' arthroplasty?"⁸ The average amounts of out-of-pocket expenses patients reported being willing to pay were US\$2000 (range US\$800–US\$4750) and US\$2000 (range US\$1000–US\$5000), respectively. In

Table 5. Amounts that participants were willing to pay for the 3 different types of novel implants

Device	Amount, \$		
	Average	Highest	Lowest
Novel implant 1	3378	10 000	100
Novel Implant 2	3665	10 000	100
Novel Implant 3	2483	10 000	100

our Canadian study the average amount that patients were willing to add as a copayment to increase the longevity of their implant was \$3378 (range \$100–\$10 000). Among those who were willing to pay for an implant with greater longevity but with the same complication rate as the standard implant, the average amount was \$3365 (range: \$100–\$10 000). Among participants who were willing to pay for an implant with the same longevity as the standard implant but a lower complication rate, the amount was \$2483 (range \$100–\$10 000). In our study 62% of patients reported they would be willing to pay a copayment for an implant that would last 25 years instead of 15 years.

Cross and colleagues evaluated 109 patients who needed total hip replacements and 129 patients who needed total knee replacements in Australia.⁹ Seventy-one percent of the patients who needed total hip replacements were willing “to pay something,” 11% were not willing to pay anything and 18% did not answer the question. Among patients who needed total knee replacements the response rates were 70%, 16% and 14%, respectively. For both groups of patients, a lower postoperative pain score was a significant predictor for willingness to pay.

In the study by Schwarzkopf and colleagues, 80% of participants responded “No” when asked if they would be

satisfied with a “standard of care” prosthesis and 86% responded “Yes” when asked if they would pay for a higher than “standard of care” prosthesis.⁶ In that study, patients were not satisfied with the “standard of care” implants when newer technologies were available, regardless of their economic status. Eighty-six percent were willing to share the cost of the novel implant.

Sharkey and colleagues found that 84.8% would be willing to pay for an implant with increased longevity if their insurance would not pay for it and 97.1% felt that quality should be “the primary determinant of implant choice.”¹⁰

A Canadian study by O’Hara and colleagues examined patient preferences related to access to total shoulder arthroplasty, comparing out-of-pocket payments for treatment, travel time to hospital, the surgeon’s level of experience and wait times.¹¹ A majority of the 62 patients had a strong preference for an experienced surgeon and were willing to pay directly for treatment by such a surgeon.

In the current study, 62% of the Canadian participants were willing to contribute a copayment to receive an implant with longer longevity. If the associated complication rate rose from 3% to 5%, willingness to pay decreased to 40%. Our group of patients had a higher level of confidence in their surgeon’s ability to choose

Table 6. Participants’ willingness to contribute to the cost of novel implants according to education level

Education level	No. of participants			
	Total	Willing to contribute to cost of novel implant		
		Implant 1	Implant 2	Implant 3
Did not graduate from high school	7	4	2	1
High school graduate	23	10	9	8
Attended college	24	14	9	9
College graduate	61	42	31	32
<i>p</i> value*		< 0.05	< 0.05	< 0.05
Total	115	70	51	50

*Determined by χ^2 test.

Table 7. Participants’ willingness to contribute to the cost of novel implants according to income level

Income	No. of participants			
	Total	Willing to contribute to cost of novel implant		
		Implant 1	Implant 2	Implant 3
> \$30 000	18	7	3	4
\$30 000–\$50 000	28	19	12	13
\$50 000–\$80 000	21	10	7	9
\$80 000–\$100 000	17	12	10	7
\$100 000–\$150 000	15	12	8	7
> \$150 000	16	12	9	10
<i>p</i> value		0.26	0.04	0.06
Total	115	72	49	50

*Determined by χ^2 test.

the proper implant than in their hospital's ability to make this choice.

Our study is a robust survey of the patient population of a large downtown arthroplasty clinic with comprehensive demographic data. Our findings can be used to inform decision-making about implant selection in Canada.

Limitations

One potential weakness of this study is the small sample size. Although the cohort was limited to a single institution, our participants had a broad range of ages (21–89 yr) and we documented the income and ethnicity of the population in an effort to normalize the sample. The age range of the participants in our study does not reflect the full age range of patients undergoing TJA. We should have focused on patients 50–80 years old. Many patients did not answer the questionnaire entirely. A sample from a single tertiary care institution may have some inherent biases and may not reflect the Canadian population as a whole. Our patient population was relatively middle class (on the basis of income data) and primarily white. Future studies of willingness to pay for implant technology should include a broader range of the population of Ontario, and a future questionnaire should mark a clear distinction between not being willing to pay more if the complication rate increases versus willingness to pay more to decrease complications.

CONCLUSION

In this sample of Canadian patients, between 40% and 62% of participants were willing to contribute to the costs of novel implants for TJA. Younger patients with a higher income were more willing to contribute an added copayment for a novel prosthesis. In Canada, the provincial health insurance system covers all acute care costs. The Canadian patients in this study were slightly more willing to pay for what is perceived as a better implant than participants in a similar US study. This information is of significant value to single-payer systems experiencing increasing acute care costs.

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Competing interests: R. Schwarzkopf reports owning stocks in Intellijoint Surgical and Gauss Surgical and receiving consulting fees from Smith & Nephew and Intellijoint Surgical. D. Backstein reports owning stocks in Intellijoint Surgical and receiving consulting fees and royalties from MicroPort Orthopedics. No other competing interests were declared.

Contributors: R. Schwarzkopf and D. Backstein designed the study. A. Fuhrmann acquired the data, which all authors analyzed. A. Fuhrmann, R. Batash and D. Backstein wrote the article, which all authors reviewed and approved for publication. All authors agreed to be accountable for all aspects of the work.

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