# Are patients willing to pay for total shoulder arthroplasty? Evidence from a discrete choice experiment

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**Background:** Total shoulder arthroplasty (TSA) is a common treatment to decrease pain and improve shoulder function in patients with severe osteoarthritis (OA). In Canada, patients requiring this procedure often wait a year or more. Our objective was to determine patient preferences related to accessing TSA, specifically comparing out-of-pocket payments for treatment, travel time to hospital, the surgeon's level of experience and wait times.

**Methods:** We administered a discrete choice experiment among patients with end-stage shoulder OA currently waiting for TSA. Respondents were presented with 14 different choice sets, each with 3 options, and they were asked to choose their preferred scenario. A conditional logit regression model was used to estimate the relative preference and willingness to pay for each attribute.

**Results:** Sixty-two respondents completed the questionnaire. Three of the 4 attributes significantly influenced treatment preferences. Respondents had a strong preference for an experienced surgeon (mean 0.89 ± standard error [SE] 0.11), while reductions in travel time (–0.07 ± 0.04) or wait time (–0.04 ± 0.01) were of less importance. Respondents were found to be strongly averse (–1.44 ± 0.18) to surgical treatment by a less experienced surgeon and to paying out-of-pocket for their surgical treatment (–0.56 ± 0.05).

**Conclusion:** Our results suggest that patients waiting for TSA to treat severe shoulder OA have minimal willingness to pay for a reduction in wait time or travel time for surgery, yet will pay higher amounts for treatment by an experienced surgeon.

**Contexte :** L'arthroplastie totale de l'épaule est un traitement courant visant à atténuer la douleur et à augmenter la fonction de l'épaule chez les patients atteints d'arthrose grave. Au Canada, l'attente est souvent d'un an ou plus pour cette intervention. Notre objectif était de cerner les préférences des patients concernant l'accès à l'arthroplastie, particulièrement en ce qui a trait aux déboursés personnels pour le traitement, à la durée du trajet vers l'hôpital, à l'expérience du chirurgien et au temps d'attente.

**Méthodes :** Nous avons mené une expérience avec choix discrets auprès de patients atteints d'arthrose de l'épaule au stade terminal actuellement en attente d'une arthroplastie totale. Les répondants ont reçu 14 ensembles de choix différents, comportant chacun 3 options, et devaient choisir leur scénario préféré. Nous avons utilisé un modèle de régression logit conditionnelle pour estimer la préférence relative et la disposition à payer pour chaque caractéristique.

**Résultats :** En tout, 62 répondants ont rempli le questionnaire. Trois des 4 caractéristiques ont significativement influencé les préférences de traitement. Les répondants avaient une forte préférence pour un chirurgien expérimenté (moyenne de 0,89 ± écart-type de 0,11), alors que la réduction de la durée du trajet (–0,07 ± 0,04) ou du temps d'attente (–0,04 ± 0,01) était moins importante. Les répondants se sont révélés très réfractaires (–1,44 ± 0,18) à se faire opérer par un chirurgien peu expérimenté et à payer de leur poche leur traitement chirurgical (–0,56 ± 0,05).

**Conclusion :** Nos résultats semblent indiquer que les patients en attente d'une arthroplastie totale de l'épaule pour traiter une arthrose grave sont très peu disposés à payer pour réduire le temps d'attente ou la durée du trajet, mais qu'ils sont prêts à desserrer les cordons de leur bourse pour être opérés par un chirurgien chevronné.

Shoulder osteoarthritis (OA) is a debilitating disease present in approximately one-third of patients older than 60 years.[1] Pain and loss of function from shoulder OA have a susbtantial impact on these patients' lives. Recent studies have demonstrated decreased health-related quality of life (HRQoL) scores for patients with shoulder OA when compared with population norms.[2,3]

In less severe cases of shoulder OA, nonoperative treatments, such as physiotherapy, analgesics and non-steroidal anti-inflammatories, may be effective in reducing pain. Less invasive surgical procedures, such as arthroscopic débridement, have also been used for less severe stages of shoulder OA.[4] However, once the patient progresses to end-stage shoulder OA, the recommended treatment is total shoulder arthroplasty (TSA).[1,5] A recent meta-analysis found that treatment of shoulder arthritis with TSA leads to significant improvement in both generic and joint-specific HRQoL scores.[6]

Owing to budget constraints in the publicly funded Canadian health care system, operating room access and costly surgical implants are frequently rationed. These constraints can cause patients with shoulder OA to wait more than a year to receive this effective surgery. Unfortunately, it has been demonstrated in other arthritic populations that a patient's condition and quality of life deteriorate while on a wait list.[7] Additionally, the eventual outcome of the TSA may be compromised by progressive joint stiffness and muscle atrophy. When faced with substantial wait times, patients may consider other options for accessing necessary surgical care.

The objective of this study was to determine patient preferences for accessing TSA surgery in Ontario, Canada. Specifically, we sought to determine preferences toward paying out of pocket for surgery, travelling increased distances, or being treated by surgeons with varying levels of experience in exchange for a shorter wait time to receive a TSA.

## Methods

### Study design

The study used a discrete choice experiment (DCE) to estimate the access to treatment preferences of patients waiting for an elective TSA. The methodology is based on random utility theory, which states that consumers have a preference for and derive utility from underlying attributes rather than the specific good or service.[8] Discrete choice experiments are becoming increasingly popular in health services research, with the recognition that the attractiveness of health interventions for a patient often depend on more than just the possible health outcome.[9,10] These experiments have also been proven to be an effective tool in accounting for patient preferences when allocating scarce health care resources.[11,12]

### Attributes and levels

The attributes and corresponding levels (Table 1) used in this study were developed using qualitative methods. We conducted semistructured interviews among patients with shoulder OA who were currently waiting for TSA treatment until data redundancy was obtained. Four attributes and their corresponding levels were then selected through a consensus process with patients and orthopedic surgeons to ensure content validity. The 4 designated attributes included travel time to the hospital for surgical treatment, the wait time for surgical treatment, the surgeon's experience level and a potential out-of-pocket cost for surgical treatment. The travel time attribute levels were selected to reflect current referral patterns and patient proximity to alternative

| Scenario 2: If these were your only options, which would you choose? Please check the box corresponding to your choice. | | | |
|---|---|---|---|
| | **Choice A** | **Choice B** | **Choice C** |
| Travel time to the hospital | 2 hours | 6 hours | Neither: I would not choose either of these options |
| Wait time from deciding to have surgery to the day of surgery | 12 months | 24 months | |
| Hospital/surgeon experience compared to the hospital/surgeon to whom you were initially referred | Less experience | Similar experience | |
| Surgery surcharge | $0 Fully covered by provincial health insurance | $1000 | |

I would choose: ☐ Choice A  ☐ Choice B  ☐ Choice C

**Fig. 1.** Example of a sample choice set.

treatment centres. We used willingness to pay thresholds described in elective surgery literature to develop the out-of-pocket payment levels. The surgeon's level of experience was a common theme noted in the semi-structured interviews. The wait list levels were based on the experience of current patients. By changing the attribute levels in the 14 hypothetical comparisons, we were able to use the respondents' stated choices in each question to estimate their underlying relative preference for the included attributes.

## Participants

We recruited adult patients with end-stage shoulder OA waiting for TSA surgery to complete the DCE questionnaire. All participants were recruited from a single surgeon's practice located in metropolitan Ontario. Participants were mailed the DCE questionnaire along with demographic and clinical outcome questionnaires. Health-related quality of life was measured with the Euroqol-5D (EQ-5D) instrument, and shoulder function was assessed with the Quick Disabilities of Arm, Shoulder, and Hand (quickDASH) questionnaire. We obtained informed consent from all study participants, and the study protocol was approved by the St. Michael's Hospital Research Ethics Board.

## Questionnaire development

We used Sawtooth CBC/SSI Web version 6.4.2 software (Sawtooth Software, Inc.) to develop the DCE questionnaire. In each choice set, study participants were asked to choose 1 of 3 options: 2 different hypothetical scenarios to receive TSA or a status quo option where TSA treatment is declined. A sample choice set is available in Figure 1. The status quo option was included to account for individuals who did not prefer either of the 2 alternatives presented in the choice set and would rather continue to live with their shoulder OA. Each hypothetical scenario included varying levels of the 4 attributes. Each respondent was asked to complete 14 choice sets.

## Statistical analysis

We analyzed the DCE responses using a conditional logit model (STATA software version 13.1, StataCorp).[13]

### Table 1. Attributes and attribute levels

| Attribute | Attribute level |
|---|---|
| Travel time to the hospital for surgery, h | 0.5 |
| | 2 |
| | 6 |
| Wait time from deciding to have surgery to the day of surgery, mo | 1 |
| | 6 |
| | 12 |
| | 24 |
| Surgeon's level of experience | Less experience |
| | Similar experience |
| | More experience |
| Out-of-pocket cost for surgical treatment, Can$ | 0 |
| | 1000 |
| | 2500 |
| | 5000 |

### Table 2. Characteristics of questionnaire respondents (n = 62)

| Characteristic | No. (%)* |
|---|---|
| Female sex | 33 (53.2) |
| Age, mean ± SD | 70.9 ± 9.62 |
| Home region | |
| Toronto | 27 (43.5) |
| York | 5 (8.1) |
| Peel | 4 (6.5) |
| Nipissing | 4 (6.5) |
| Peterborough | 3 (4.8) |
| Simcoe | 3 (4.8) |
| Other | 16 (25.8) |
| Marital status | |
| Married | 41 (66.1) |
| Widowed | 7 (11.3) |
| Separated/divorced | 6 (9.7) |
| Single (never married) | 5 (8.1) |
| Not disclosed | 3 (4.8) |
| Education | |
| Elementary | 4 (6.5) |
| Some secondary | 11 (17.7) |
| Completed secondary | 11 (17.7) |
| Some postsecondary | 7 (11.3) |
| Completed postsecondary | 16 (25.8) |
| Completed graduate degree | 10 (16.1) |
| Not disclosed | 3 (4.8) |
| Employment status | |
| Full-time | 12 (19.4) |
| Part-time | 8 (12.9) |
| Homeworker | 9 (14.5) |
| Retired | 29 (46.8) |
| Not disclosed | 3 (4.8) |
| Annual household income, $ | |
| < 20 000 | 8 (12.9) |
| 20 000–39 999 | 10 (16.1) |
| 40 000–59 999 | 6 (9.7) |
| 60 000–79 999 | 7 (11.3) |
| 80 000–99 999 | 6 (9.7) |
| > 100 000 | 11 (17.7) |
| Not disclosed | 14 (22.6) |
| Clinical characteristics and history | |
| Duration on wait list, mean ± SD, yr | 1.40 ± 0.77 |
| Duration of shoulder pain, median [IQR], yr | 4 [2.5–8] |
| EQ-5D score, median [IQR] | 0.61 [0.51–0.80] |
| QuickDASH score, mean ± SD | 50.9 ± 18.11 |

IQR = interquartile range; SD = standard deviation.
*Unless indicated otherwise.

Travel time (in h), wait time (in mo) and cost (per $1000) were entered into the model as continuous variables and were assumed to be linear. The surgeon's level of experience was coded using effect coding.[14] The reference level for the model was the status quo option (no surgical treatment). The respondents' relative preferences (or utility) for each of the attributes are represented by the magnitude and direction of the regression coefficients. The ratio of the coefficients (marginal rate of substitution) shows trade-offs that the respondents would be willing to make between the attributes. We calculated willingness to pay for each attribute using the ratio of the attribute's coefficient to the cost coefficient. Willingness to pay can provide useful interpretations for the preference estimates, as they indicate how much the respondents, on average, are willing to pay for a marginal change in 1 of the attribute levels.

## RESULTS

Of the 137 patients who met the eligibility criteria, 62 (45%) respondents completed the questionnaire. The mean age of participants was 70.9 ± 9.62 years. Fifty-three percent of participants were women, 44% resided within the city of Toronto, 26% had completed post-secondary education, 47% were retired and 18% had an annual household income of more than $100 000 (Table 2). Respondents had been on the wait list for surgery for an average of 16.8 months and had experienced shoulder pain for an average of 6.14 years. The median HRQoL EQ-5D score of the participants was 0.61 (interquartile range [IQR] 0.51–0.80), and the mean QuickDASH score was 50.9 ± 18.11, denoting significant disability.

We used a conditional logit model to determine the mean preference estimates of each attribute (Table 3). The preference estimates for cost, surgeon experience and wait time were statistically different from zero at $\alpha = 0.01$. Respondents had a strong positive preference for treatment by an experienced surgeon (mean 0.89 ± standard error [SE] 0.11), while reductions in travel time to the hospital for treatment (–0.07 ± 0.04) or time on the surgical wait list (–0.04 ± 0.01) were of less importance. Respondents were found to be strongly averse (–1.44 ± 0.18) to surgical treatment by a surgeon with less than average experience and to paying out of pocket for their surgical treatment (–0.56 ± 0.05).

The willingness to pay value enables potential trade-offs to be analyzed using marginal rates of substitution. For our analysis, cost is coded as a continuous variable and assumed to be linear. The reference level for the cost variable in our model was set to $1000 for coherent framing of the comparisons. The results suggest that respondents were willing to pay $128.50 to reduce their travel time to the hospital for surgical treatment by 1 hour and $76.40 to have their wait time for surgical treatment decreased by 1 month. All else being equal, respondents preferred to drive more than 7 hours to the hospital for surgical treatment or wait more than 13 months than pay $1000 out of pocket for their surgical treatment. Respondents were willing to drive an additional 3 hours to the hospital for surgical treatment or wait an additional 5.5 months to have their treatment performed by an experienced surgeon as opposed to treatment by a surgeon of average experience.

## DISCUSSION

This study sought to evaluate patient preferences for accessing TSA in Ontario, Canada. Our results suggest that patients waiting for TSA to treat severe shoulder OA are generally unwilling to pay for a reduction in their wait time or travel time for surgery. Patients are willing to pay a 33% premium for surgical treatment by an experienced surgeon. It should also be noted that patients demonstrated a strong aversion to treatment from a less experienced surgeon, preferring to opt out of surgical treatment entirely.

Our findings are consistent with those of previous research, which found that Canadians are relatively unwilling to pay to decrease their wait times for elective surgical procedures.[15] Our findings also support claims that, on average, Canadians place tremendous value on equity in the health care system.[16] It has been suggested

| Table 3. Conditional logit model relative preference estimates for each attribute* |||||||
|---|---|---|---|---|---|
| Attributes | Coefficient | SE | *p* value | 95% CI | WTP (Can$) |
| Travel time, hr | –0.0719 | 0.0377 | 0.06 | –0.1459 to 0.0020 | –128.50 |
| Wait time, mo | –0.0428 | 0.0080 | < 0.001 | –0.0584 to –0.0271 | –76.40 |
| Surgeon's level of experience | | | | | |
|   Less | –1.4463 | 0.1786 | < 0.001 | –1.7963 to –1.0962 | –2583.34 |
|   Similar | 0.6548 | 0.1199 | < 0.001 | 0.4197 to 0.8898 | 1169.53 |
|   More | 0.8907 | 0.1071 | < 0.001 | 0.6809 to 1.1005 | 1590.99 |
| Cost (Can$ 1000) | –0.5599 | 0.0548 | < 0.001 | –0.6672 to –0.4525 | Reference |
| CI = confidence interval; SE = standard error; WTP = willingness to pay.<br>*Log-likelihood = –632.36311, number of observations = 2604. |||||||

that patients are willing to wait, as long as all Canadians wait the same amount of time.

When compared with other studies that have investigated the willingness to pay among orthopedic patients,[17–20] our results stand out as an outlier. Even when compared with patients in other health systems with universally available publicly funded treatments,[15] the respondents in our study demonstrated far less willingness to pay for treating their severe shoulder OA. The willingness among study respondents to pay for treatment by a surgeon of average experience would fall short of covering the anesthesiologist and surgeon billing costs in Ontario and would cover less than one-tenth of the total treatment costs, including the implant, sundries and hospitalization expense.[21,22]

At the time of completing the questionnaire, our study respondents had been on the surgical wait list for an average of 16.8 months, had experienced shoulder pain for more than 6 years and experienced considerable disability (EQ-5D score of 0.61). Despite the profound disability and duration of shoulder pain, we were surprised that the willingness to pay for a decreased surgical wait time was relatively negligible. The rationale for this observation is not entirely clear and may represent the Canadian values already discussed; however, from a clinical perspective, it is possible that the arthritic shoulder was on the patients' nondominant limb or that they had become adept at performing most activities of daily living with their contralateral extremity. Furthermore, it is also possible that respondents had been disabled for such a long time and had subsequently been waiting for more than 1 year that they did not feel there was value in paying to reduce their surgical wait time.

### Limitations

The results of this study must be interpreted in the context of the study design. Participants were recruited from the wait list of a single surgeon based in a major urban centre with a high-volume upper-extremity referral practice; therefore, this sample may not be representative of patients on the surgical wait lists of community hospitals or of other surgeons. In addition, the DCE findings are based on the attributes included in the questionnaire. Although our attribute development process suggested these are important attributes to this study population, there may be other attributes of importance that were not included in the questionnaire design and therefore not accounted for in the final model. Finally, the study's sample size was unfortunately prohibitive in investigating the effect of time on a surgical wait list, time with shoulder pain, the level of disability and demographic characteristics on patient preferences for accessing surgical treatment. We suspect that variables such as age, employment status and income may affect patient preferences for surgical treatment, but we were unable to fully explore preference heterogeneity in this study. We recognize that this insight is of interest to providers and policy-makers, and further research in this area is required.

### Strengths

The strengths of our study include its novel design, its patient-centred focus and its relevance to policy-makers tasked with allocating surgical resources in Canada. The effective allocation of surgical resources continues to be a contentious issue. Our study applies a unique approach rooted in behavioural economics and market research to quantify the relative preferences of this patient population.

### Conclusion

The results of this study represent noteworthy findings for both surgeons and policy-makers. Significant surgical wait times continue to plague the Canadian health care system. The concept of surgical "centres of excellence" garners much attention as a mechanism for providing high-volume surgical output and expert care for common surgical procedures. Discussions have speculated whether Canadians would be willing to co-pay or travel a greater distance for an elective surgical procedure provided by a surgeon with procedural-specific expertise or minimal wait time. The results of our study suggest that patients value surgeon expertise, but wait time may not be as important to patients waiting for TSA. Our findings represent insight into patient preferences for a common elective surgical procedure. Our methodology is a valuable tool to align resources with patient preferences, and efforts to create strategies to provide patients with timely access to surgical care must be continued.

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