Factors That Influence the Choice to Undergo Surgery for Shoulder and Elbow Conditions

Chetan S. Modi MSc, FRCS (Tr&Orth),
Christian J. H. Veillette MD, MSc, Rajiv Gandhi MD, MSc,
Anthony V. Perruccio PhD, Y. Raja Rampersaud MD

Received: 25 July 2013 / Accepted: 21 October 2013 / Published online: 2 November 2013
© The Association of Bone and Joint Surgeons® 2013

Abstract

Background Knowledge of the factors that influence the willingness of patients considering elective orthopaedic surgery is essential for patient-centered care. To date, however, these factors remain undefined in the orthopaedic population with shoulder and elbow disorders.

Questions/purposes In a cohort of patients seeking surgical consultation for shoulder or elbow conditions, we sought to identify factors that influenced the willingness and decision to undergo surgery.

Methods In this prospective study, 384 patients completed a questionnaire collecting socioeconomic and health status data before consultation from June 2009 to December 2010. An additional 120 patients who were offered surgery after consultation completed a second questionnaire on their

perceptions and concerns regarding surgery. Logistic regression analyses were used to identify factors influencing the willingness and decision to undergo surgery.

Results Lower income (odds ratio [OR], 0.02; CI, 0.02–0.08; $p < 0.001$) and living alone (OR, 0.25; CI, 0.08–0.77; $p = 0.015$) were negative predictors of willingness to consider surgery. Physical functioning did not influence willingness ($p = 0.994$). A greater perceived level of the likelihood of surgical success by the patient (OR, 41.84; CI, 5.24–333.82; $p < 0.001$) and greater fluency in the English language (OR, 28.39; CI, 3.49–230.88; $p = 0.002$) were positive predictors of willingness. Willingness to consider surgery as a possible treatment option before the consultation was a predictor of patients' ultimate decisions to undergo surgery (OR, 4.56; CI, 1.05–19.76; $p = 0.042$). Patients expressing concern about surgery being an inconvenience to daily life, however, were less likely to decide to proceed with surgery (OR, 0.12; CI, 0.02–0.68; $p = 0.017$).

Conclusions Many of the identified factors may act as barriers to potentially beneficial surgical interventions. Although most are not modifiable, an awareness of the influence of individual demographics and possible perceptions of patients' choices may show that more in-depth questioning and provisions for cultural differences may be required during the consultation to enable patients to make fully informed decisions. Future studies using qualitative methods would provide a greater in-depth understanding of patients' perceptions regarding surgery and their decision to proceed. Larger or more homogeneous cohorts also would enable additional identification of these factors for different shoulder and elbow conditions.

Level of Evidence Level II, prognostic study. See the Instructions for Authors for a complete description of levels of evidence.

Each author certifies that he or she, or a member of his or her immediate family, has no funding or commercial associations (eg, consultancies, stock ownership, equity interest, patent/licensing arrangements, etc) that might pose a conflict of interest in connection with the submitted article.

All ICMJE Conflict of Interest Forms for authors and *Clinical Orthopaedics and Related Research* editors and board members are on file with the publication and can be viewed on request.

Each author certifies that his or her institution approved the human protocol for this investigation, that all investigations were conducted in conformity with ethical principles of research, and that informed consent for participation in the study was obtained.

C. S. Modi, C. J. H. Veillette (✉), R. Gandhi,
A. V. Perruccio, Y. R. Rampersaud
Division of Orthopaedic Surgery, Toronto Western Hospital,
University Health Network, 399 Bathurst Street, Toronto,
ON M5T 2S8, Canada
e-mail: christian.veillette@uhn.ca; orthonet@gmail.com

Introduction

Elective surgery is a substantial part of an orthopaedic surgeon's workload. Patients can choose the time and place and whether to have surgery for almost every condition that orthopaedic surgeons treat. The decision often can seem overwhelming to many patients, even more so when there are differences in socioeconomic status, language, or culture between the surgeon and the patient. Understanding the factors that influence patients' choices can help surgeons communicate better with their patients. These factors can be summarized into three groups, as posited by the Anderson model [2, 10], which includes predisposing factors such as sociodemographics and health beliefs, enabling factors including health insurance, living circumstances, and social support, and the type of health condition, including its individual physical and psychosocial impact for which treatment is offered.

It also is important to acknowledge that an individual's predetermined willingness to consider surgery as a treatment option may vary considerably and play a significant role in the final decision after consulting with a surgeon. Therefore a patient may have a notion regarding how they would react if surgery were offered as a treatment, and this may not differ after consultation depending on some of the factors already discussed.

A comprehensive understanding of the predisposing factors, enabling factors, and type of health condition influencing the willingness and decision to undergo surgery would aid in enhancement and provision of patient-centered care and shared decision-making in multicultural societies. These aspects of patient choice have been studied extensively in patients considering hip and knee arthroplasties [4, 6, 7, 10–16, 18] but not, to our knowledge, in patients with shoulder and elbow conditions.

We therefore sought to investigate the influence of demographic and socioeconomic characteristics, health status, and perceptions relating to the success and risk of surgery on the willingness to undergo surgery in a cohort of patients with shoulder and elbow conditions who presented for consultations. Our second aim was to investigate the influence of willingness, knowledge of the planned procedure, and concerns regarding surgery on the decision to undergo surgery after consultation in the subset of patients who were offered surgery.

Patients and Methods

Four hundred fifty-five patients seeking an orthopaedic surgical consultation for shoulder or elbow problems at an academic hospital in Toronto, Canada, were invited to participate in this prospective study from June 2009 to

December 2010. Inclusion criteria required the patients to be at least 18 years old. Patients were excluded if they were incarcerated, unable to complete questionnaires, institutionalized in a nonvoluntary and/or dependent residence, lacked competence to provide informed consent, or had any emergent musculoskeletal, traumatic, or myelopathy-related conditions. The study was approved by the University Health Network Research Ethics Board. Written informed consent was obtained from all study participants.

Of the 455 patients, 34 did not meet the inclusion criteria and 37 declined to participate. A total of 384 patients therefore were included in the study.

Willingness to Undergo Surgery

Consenting patients completed a questionnaire before consulting with the surgeon. The questionnaire (Appendix 1) elicited demographic and socioeconomic characteristics including age, sex, level of education, annual household income, ethnicity, living status, and level of English language comprehension and fluency. Health status measures included a list of comorbidities for which participants indicated whether they were present, the SF-36 Version 2 which assessed general physical and mental health [22], and height and weight to calculate BMI. The questionnaire also included questions regarding grade of willingness to choose surgery (very willing; somewhat willing; somewhat not willing; not willing; unsure) as a treatment option and perceptions relating to level of surgical success and risk (Table 1). Six patients (1.6%) did not state their level of education, 20 (5%) their total annual household income, and seven (1.8%) their ethnicity. Analysis was made on individuals with complete data. Of the 384 patients, 308 (80.2%) expressed willingness to consider surgery as a treatment option and 76 (19.8%) expressed either unwillingness or being unsure. The clinical diagnoses were comparable between the patients who were willing to consider surgery and those who were either unwilling or unsure (Table 2).

We analyzed the data by comparing the demographic and socioeconomic characteristics, health status, and perceived levels of success and risk between patients expressing definite willingness to undergo surgery and those either unwilling or unsure. Continuous data were compared using a t-test for normally distributed data and categorical data were reported with frequencies and groups compared using either a chi-square test or Fisher's exact test when at least one cell had an expected value less than 5. Multivariate logistic regression modeling was performed to identify factors associated with willingness to undergo surgery (dichotomous outcome: willing versus unwilling or unsure). The covariates were age, sex, joint (shoulder or

Table 1. Characteristics of study patients by willingness to undergo surgery (before consultation)

Characteristic*	Willing (n = 308)	Unwilling/ unsure (n = 76)	Overall (n = 384)	p value (CI)
Age, mean $\pm$ SD (years)	49.8 $\pm$ 15.1	55.2 $\pm$ 15.8	50.8 $\pm$ 15.4	0.008 (1.41–9.34) [†]
Sex (male:female)	196:112	38:38	234:150	0.031 [†]
Joint, number (%)				0.197
Shoulder	267 (86.7)	70 (92.1)	337 (87.8)	
Elbow	41 (13.3)	6 (7.9)	47 (12.2)	
Education, number (%) (n = 378)				0.005 [†]
Less than high school	21(6.9)	11 (15.3)	32 (8.5)	
High school diploma	74 (24.2)	20 (27.8)	94 (24.9)	
Postsecondary degree/technical or trade certification	126 (41.2)	19 (26.4)	145 (38.4)	
Graduate degree	85 (27.8)	22 (30.6)	107 (28.3)	
Annual household income, number (%) (n = 364)				< 0.001 [†]
< \$30,000	36 (12.2)	22 (32.4)	58 (15.9)	
\$30,000–\$44,999	29 (9.8)	16 (23.5)	45 (12.4)	
\$45,000–\$59,999	52 (17.6)	4 (13.2)	61 (16.8)	
\$60,000–\$99,999	69 (23.3)	10 (14.7)	79 (21.7)	
> \$100,000	110 (37.2)	11 (16.2)	121 (33.2)	
Ethnicity, number (%) (n = 377)				0.001 [†]
White	247 (81.0)	46 (63.9)	293 (77.7)	
Nonwhite	58 (19.0)	26 (36.1)	84 (22.3)	
Living status, number (%)				0.810
Alone	65 (21.1)	17 (22.4)	82 (21.4)	
With family/significant other	243 (78.9)	59 (77.6)	302 (78.6)	
English comprehension, number (%)				< 0.001 [†]
Very good/good	300 (97.4)	69 (90.8)	369 (96.1)	
Fair	7 (2.3)	7 (9.2)	14 (3.6)	
Poor	1 (0.3)	0 (0)	1 (0.3)	
English fluency				< 0.001 [†]
Fluent	304 (98.7)	68 (89.5)	372 (96.9)	
Not fluent	4 (1.3)	8 (10.5)	12 (3.1)	
Comorbid conditions, number (%)				0.813
0	130 (42.2)	29 (38.1)	159 (41.4)	
1–2	132 (42.9)	35 (46.1)	167 (43.5)	
≥ 3	46 (14.9)	12 (15.8)	58 (15.1)	
BMI, mean $\pm$ SD (kg/m ²)	27.2 $\pm$ 6.2	27.6 $\pm$ 4.9	27.2 $\pm$ 6.0	0.563 (0.95–1.75)
SF-36 physical component score, mean $\pm$ SD	58.2 $\pm$ 7.3	57.5 $\pm$ 7.3	58.0 $\pm$ 7.3	0.482 (1.19–2.52)
SF-36 mental component score, mean $\pm$ SD	47.2 $\pm$ 5.0	46.3 $\pm$ 5.8	47.1 $\pm$ 5.1	0.175 (0.40–2.20)
Perceived success of surgery				<0.001 [†]
High	102 (33.1)	3 (3.9)	105 (27.3)	
Moderate	62 (20.1)	4 (5.3)	66 (17.2)	
Low	2 (0.6)	12 (15.8)	14 (3.6)	
Unsure	142 (46.1)	57 (75.0)	199 (51.8)	
Perceived risk of surgery				< 0.001 [†]
High	5 (1.6)	3 (3.9)	8 (2.1)	
Moderate	42 (13.6)	8 (10.6)	50 (13.0)	
Low	102 (33.1)	9 (11.8)	111 (28.9)	
No risk	34 (11.0)	3 (3.9)	37 (9.6)	
Unsure	125 (40.6)	53 (69.8)	178 (46.4)	

* Number of patients stated when the response rate was less than 100%; [†]significant.

Table 2. Clinical diagnoses by willingness to undergo surgery

Diagnosis	Willing* (n = 308)	Unwilling/ unsure* (n = 76)	Overall* (n = 384)	p value
Osteoarthritis of shoulder	70 (22.7)	19 (25.0)	89 (23.2)	0.652
Inflammatory–shoulder	8 (2.6)	0 (0)	8 (2.1)	0.365
Rotator cuff (impingement/partial/full tear)	145 (47.1)	43 (56.6)	188 (48.9)	0.175
Labral/instability	24 (7.8)	2 (2.6)	26 (6.8)	0.130
Adhesive capsulitis	9 (2.9)	5 (6.6)	14 (3.6)	0.164
Biceps–shoulder	11 (3.6)	1 (1.3)	12 (3.1)	0.473
Osteoarthritis of elbow	22 (7.1)	5 (6.6)	27 (7.0)	0.863
Inflammatory–elbow	6 (1.9)	0 (0)	6 (1.6)	0.603
Lateral epicondylitis	7 (2.3)	1 (1.3)	8 (2.1)	0.940
Medial epicondylitis	2 (0.6)	0 (0)	2 (0.5)	1.000
Biceps–elbow	3 (1.0)	0 (0)	3 (0.8)	1.000
Osteochondritis	1 (0.3)	0 (0)	1 (0.3)	1.000

* Values are number followed by percentage in parentheses.

elbow), education, income, ethnicity, living status, English language comprehension and fluency, comorbidity, BMI, SF-36 scores, and perceived level of success and risk.

Decision to Undergo Surgery

One hundred and twenty patients from the total cohort of 384 were offered surgical treatment after consultation and completed a second questionnaire (Appendix 2) designed to elicit their understanding of the planned procedure, the expected levels of postoperative pain and activity limitation, specific concerns about surgery, the quality of the consultation (patient satisfaction with their involvement in the decision-making process), and whether they had decided to have surgery (Table 3). Of these patients, 97 (80.8%) decided to have surgery and 23 (19.2%) were either unsure or decided against surgery (Fig. 1). The clinical diagnoses are comparable between the patients who decided to undergo surgery and those who either decided against surgery or were unsure (Table 4).

We compared patients' knowledge and specific concerns regarding surgery between those deciding to proceed with surgery and those either unsure or deciding against surgery. Multivariate logistic regression modeling was performed to identify the factors associated with the decision to undergo surgery (dichotomous outcome, decided to have surgery versus decided against surgery or unsure). The modeling was performed using two sequential steps with the intent of evaluating the independent contribution of the sets of variables. In the first step, the factors considered were age, sex, joint (shoulder or elbow), willingness to have surgery, understanding of the procedure, and expected level of postoperative pain and activity limitation. In the second

step, the specific patients' concerns (Table 3) were added to the model. Significance was set at a probability less than 0.05. All analyses were performed using SPSS statistical software package, Version 21 (IBM Corp, New York, NY, USA).

Results

Willingness to Undergo Surgery

Annual household income, living status, fluency in English, SF-36 mental score, and the perceived likelihood of success of surgery were independent predictors of willingness to undergo surgery after multivariate analysis (Table 5). Lower annual household income (< \$30,000 and \$30,000–\$44,999 versus > \$100,000; adjusted OR, 0.08; $p < 0.001$) and living alone (adjusted OR, 0.25; $p = 0.015$) predicted unwillingness to undergo surgery. Fluency in English (adjusted OR, 28.39; $p = 0.002$), higher SF-36 mental score (adjusted OR, 1.19; $p = 0.023$), and greater perceived likelihood of success of surgery (adjusted OR, 41.84; $p < 0.001$) predicted willingness to undergo surgery. Univariate analysis also found that willingness to undergo surgery was associated with age (less willing with increasing age, $p = 0.008$), sex (males were more willing, $p = 0.031$), level of education (more willing with higher level, $p = 0.034$), ethnicity (greater willingness in whites compared with nonwhites, $p = 0.002$), increased comprehension of the English language ($p < 0.001$), and perceived level of risk of surgery (higher risk associated with being unwilling or unsure, $p < 0.001$) although these variables were not independent predictors after accounting for confounding variables (Table 1).

Table 3. Perceptions of patients offered surgery after consultation and decision to proceed

Factors	Decided to have surgery (n = 97)	Decided against surgery/unsure (n = 23)	Overall (n = 120)	p value
Age, mean $\pm$ SD (years)	49.1 $\pm$ 17.3	51.6 $\pm$ 15.4	49.5 $\pm$ 17.0	0.518
Sex (male:female)	64:33	14:9	77:43	0.668
Joint, number (%)				0.358
Shoulder	86 (88.7)	18 (78.3)	104 (86.7)	
Elbow	11 (11.3)	5 (21.7) [†]	16 (13.3)	
Willingness to have surgery preconsultation, number (%)				0.037 [†]
Willing	90 (92.8)	18 (78.3)	108 (90.0)	
Not willing/unsure	7 (7.2)	5 (21.7)	12 (10.0)	
Understanding of planned procedure, number (%)				0.991
Yes	73 (75.3)	17 (73.9)	90 (75.0)	
No/Unsure	24 (24.7)	6 (26.1)	30 (25.0)	
Expected level of postoperative pain, number (%)				0.679
Minimal	25 (25.8)	5 (21.7)	30 (25.0)	
Moderate	45 (46.4)	13 (56.5)	58 (48.3)	
Severe	27 (27.8)	5 (21.7)	32 (26.7)	
Expected activity limitation after recovery, number (%)				0.787
Mild	57 (58.8)	15 (65.2)	72 (60.0)	
Moderate	28 (28.9)	5 (21.7)	33 (27.5)	
Severe	12 (12.3)	3 (13.1)	15 (12.5)	
Specific concerns, number (%)				
“Going under the knife”	20 (20.6)	29 (24.2)	9 (39.1)	0.062
Pain	27 (27.8)	33 (27.5)	6 (26.1)	0.886
Effect on social activities	27 (27.8)	38 (31.7)	11 (47.8)	0.064
Inconvenience to daily life	33 (34.0)	48 (40.0)	15 (65.2)	0.006 [†]
Mobility restriction	55 (56.7)	66 (55.0)	11 (47.8)	0.442
Risks and complications	25 (25.8)	36 (30.0)	11 (47.8)	0.038 [†]
Am I a good candidate?	13 (13.4)	21 (17.5)	8 (34.8)*	0.029 [†]
Treatment benefit	47 (48.5)	58 (48.3)	11 (47.8)	0.957
Timing of surgery	26 (26.8)	35 (29.2)	9 (39.1)	0.242
Place where surgery or rehab will occur	10 (10.3)	16 (13.3)	6 (26.1)	0.080
Ability to cope—obligations to others	23 (23.7)	33 (27.5)	10 (43.5)	0.056
Ability to cope—lack of resources	12 (12.4)	17 (14.2)	5 (21.7)	0.316
Competence of surgeon	6 (6.2)	14 (11.7)	8 (34.8)*	0.001 [†]
Communication skills of surgeon	3(3.1)	7 (5.8)	4 (17.4)*	0.025 [†]
Involvement in decision-making, number (%)				0.385
Satisfied	86 (88.7)	18 (78.3)	104	
Indifferent	2 (2.1)	0 (0)	(86.7)	
Dissatisfied	9 (9.3)	5 (21.7)	2 (1.7)	

* Fisher's exact test; [†]significant.

Decision to Undergo Surgery

Willingness to undergo surgery and concern about surgery being an inconvenience to daily life were independent predictors of the decision to undergo surgery after multivariate analysis (Table 6). Willingness to undergo surgery predicted a positive decision to undergo surgery (adjusted

OR, 4.56; $p = 0.042$). Concern about surgery being an inconvenience to daily life predicted a negative decision to undergo surgery (adjusted OR, 0.12; $p = 0.017$). Univariate analysis also found that the decision to undergo surgery was negatively associated with concern about the potential risks and complications ($p = 0.038$), whether the patients considered themselves good surgical candidates ($p = 0.029$),

concern about the competency of the surgeon ($p = 0.001$), and concern about the communication skills of the surgeon ($p = 0.025$), although these variables were not independent predictors after accounting for confounders (Table 3). Of the 23 patients who had decided against surgery or were unsure, 18 (78.3%) expressed willingness before the consultation. The reasons given for the change in decision were variable and included the symptoms not being severe enough and expecting improvement with time; the risks of

surgery being too great; concerns about the level of post-operative pain; surgery currently would be an inconvenience; would prefer to have surgery for another joint first; and would prefer to await the outcome of additional investigations before making a final decision. Furthermore, most patients were satisfied ($n = 104$ [86.7%]) with their involvement in the decision-making process.

Discussion

Knowledge of the factors affecting the willingness and decision to undergo surgery for patients considering elective surgical procedures is essential for enhancement and provision of patient-centered care and shared decision-making. Previous studies have identified that sex, ethnicity, socioeconomic status, and level of disability influence this process in patients considering hip or knee arthroplasties [3, 4, 6, 7, 10–16]. Although, to our knowledge, there are no previous studies of patients with shoulder and elbow disorders for comparison, studies in patients undergoing hip or knee arthroplasties suggest that physicians are less than effective in assessing the impact of symptoms on function and the resultant levels of disability, with shared decision-making not occurring often enough [7, 8, 20]. The aim of our study, therefore, was to investigate the factors that affect the willingness and decision to proceed with surgery in a cohort of patients with shoulder and elbow disorders.

This study has several limitations. First, our cohort consisted of a heterogeneous group of patients with shoulder and elbow conditions that may have had a variable impact on the patient and potentially their choices regarding surgery. Further stratification of the results may have identified such differences, although our study was not adequately powered to detect this. Furthermore, the patient cohort came from one

Fig. 1 The flow of patients through the study including the subset of patients offered surgery is shown.

Table 4. Clinical diagnoses by decision to undergo surgery

Diagnosis	Decided to have surgery (n = 97)	Decided against surgery/unsure (n = 23)	Overall (n = 120)	p value
Osteoarthritis of shoulder	30 (30.9)	7 (30.4)	37 (30.8)	0.963
Inflammatory–shoulder	4 (4.1)	2 (8.7)	6 (5.0)	0.324
Rotator cuff (impingement/partial/full tear)	38 (39.2)	7 (30.4)	45 (37.5)	0.590
Labral/instability	9 (9.3)	2 (8.7)	11 (9.2)	1.000
Adhesive capsulitis	1 (1.0)	0 (0)	1 (0.8)	1.000
Biceps–shoulder	4 (4.1)	0 (0)	4 (3.3)	1.000
Osteoarthritis of elbow	3 (3.1)	3 (13.0)	6 (5.0)	0.084
Inflammatory–elbow	5 (5.2)	0 (0)	5 (2.5)	0.582
Lateral epicondylitis	3 (3.1)	0 (0)	3 (2.5)	1.000
Biceps–elbow	0 (0)	2 (8.7)	2 (1.7)	0.035 [†]

* Values denote number followed by percentage in parentheses; [†]significant.

Table 5. Independent correlates of willingness to consider surgery

Independent variable	Dependent variable = willingness to consider surgery (n = 351; 91.4%)		
	Adjusted odds ratio	95% CI	p value
Annual household income			0.003
< \$30,000 (reference is < \$100,000)	0.08	0.02–0.30	< 0.001
\$30,000–\$44,999 (reference is > \$100,000)	0.18	0.05–0.71	0.014
Living status (reference is living with family/other)	0.25	0.08–0.77	0.015
English language fluency (reference is not fluent)	28.39	3.49–230.88	0.002
SF-36 mental component score	1.19	1.01–1.18	0.023
Perceived success of surgery			< 0.001
High (reference is unsure)	41.84	5.24–333.82	< 0.001
Moderate (reference is unsure)	8.65	1.87–40.07	0.006
Low (reference is unsure)	0.54	0.01–0.46	0.007

Hosmer and Lemeshow statistic = 6.35; p = 0.609.

Table 6. Independent correlates of decision to undergo surgery after multivariate analysis

Independent variable	Dependent variable = decision to undergo surgery (n = 120; 100%)		
	Adjusted odds ratio	95% CI	p value
Willingness to undergo surgery (reference is unwilling/unsure)	4.56	1.05–19.76	0.042
Inconvenience to daily life (reference is not inconvenient)	0.12	0.02–0.68	0.017

Hosmer and Lemeshow statistic = 4.39; p = 0.821.

center often with tertiary referrals that may not be representative of the general population seeking surgical consultation and may limit the generalizability of our findings. Our cohort also included a greater proportion of high-income earners (33% > \$100,000), who predominantly were white (78%), mostly living with family (79%), and had a high level of fluency in English (97%). A larger multicenter study including university and community hospitals would be required to address this issue. In addition, we were able to include only 84% of the patients presenting to our office after accounting for ineligibility (7.5%) and refusal to participate (8.1%), and this may have resulted in selection bias. Additional selection bias may have occurred as the questionnaires used in the study were available only in English although research coordinators assisted patients in completing the questionnaires, with the help of translators when necessary.

Finally, we dichotomized willingness to either being definitely willing or unwilling/unsure to allow quantitative analysis, which is an oversimplification because this is more likely to be a spectrum with different patients at different levels, which require either a visual scale or qualitative study design to account for this. Overall, the proportion of patients reporting willingness to consider surgery for shoulder and elbow conditions and a definite decision to proceed with surgery after consultation was high at 80%. This is in contrast to studies involving patients who require hip or knee arthroplasties in which only approximately $\frac{1}{3}$ reported willingness [12, 14]. This difference is likely the result of the highly selective nature of our referrals.

Our study showed that a patient's willingness to consider elective shoulder and elbow surgery is predicted by household income, living status, fluency in English, SF-36 mental score, and the perceived likelihood of success of the surgery. Although, to our knowledge, there are no previous studies involving patients with shoulder and elbow conditions for comparison, other studies with patients considering hip and knee arthroplasties have reported similar findings. Ethnic minorities have been found to be less willing to consider and proceed with total joint arthroplasties [5, 9, 18, 19, 21–23] as a result of differences in expectations of the postoperative length of stay, amount of pain, and recoverable function [5, 6, 9, 18]. Although lower levels of income and education have been associated with poorer rates of agreement to undergo invasive cardiac procedures [1], Hawker et al. [15] found that income and education are not independent determinants of willingness to proceed with hip and knee arthroplasties, although patients with lower levels of income and education had a greater unmet need for total joint arthroplasties. Lower socioeconomic status also was associated with increased perceived risks and decreased perceived success of surgery and therefore less likelihood to proceed with surgery [12]. Increasing age and female sex also have been shown to be associated with less willingness to proceed with hip and knee arthroplasties [12, 19], although Hawker et al. [13] reported that females were as willing as males to have surgery but were less likely to consult with a physician. The level of general physical health of the patient does not appear to significantly influence their willingness to consider surgery. This is in contrast to studies of patients considering hip and knee arthroplasties that have shown that an increased level of physical disability is associated with greater willingness and likelihood to proceed with surgery [11, 12]. This contrast is most likely explained by the different effects of lower limb arthritis on the quality of life and pain levels for individual patients compared with a broad range of shoulder and elbow conditions, like in our cohort.

Willingness to consider surgery was found to be an independent predictor of the decision to proceed after consultation. This is in keeping with the study by Hawker et al. [11]

that reported willingness as the strongest predictor of patients agreeing to surgery for hip or knee arthroplasties. Concern stated by the patient regarding surgery being an inconvenience to daily life was found to be an independent negative predictor of the decision to undergo surgery. Other studies in patients having hip and knee arthroplasties have identified similar concerns and highlighted the importance for the surgeon to display good communication skills and identify and address such concerns to enable the patients to make informed decisions [10, 17].

This is the first study, to our knowledge, that has investigated the possible factors that influence the willingness and decision to undergo surgery for patients with shoulder and elbow conditions. We have identified that, before a consultation, household income, living status, fluency in English, and the perceived likelihood of success of the surgery are strong independent predictors of willingness to undergo surgery. Willingness to consider surgery a possible treatment option before the consultation was an important predictor of patients' ultimate decision to undergo surgery. Concern about surgery being an inconvenience to daily life, however, predicts the decision to not undergo surgery. Although many of our findings are similar to those reported for patients requiring hip and knee arthroplasties [6, 10, 13–18], unlike some studies in that population [11, 12], the level of physical disability was not a determining factor of willingness to consider surgery for shoulder and elbow conditions.

Many of the factors that we have identified in our study may act as barriers to potentially beneficial surgical interventions for this group of patients. Although most of the factors are not modifiable, an awareness by the surgeon of the influence of individual demographics and possible perceptions on patients' choices may identify that more in-depth questioning and provisions for cultural differences may be required during the consultation to enable patients to make fully informed decisions. Future studies using qualitative methods would provide a greater in-depth understanding of patients' perceptions regarding surgery and their decision to proceed. Furthermore, studies with larger cohorts of patients with homogeneous conditions also would enable further identification of these factors in patients with different shoulder and elbow conditions.

Appendix 1. Factors that influence the choice to undergo surgery: summary of preconsultation questionnaire*

What is the highest level of education you have completed?
 What is the total annual household income (before taxes)?
 What is your ethnicity?

Appendix 1. continued

How would you describe your ability to speak English?
 What is your current living arrangement?
 How willing are you to choose surgery as a treatment option?
 How successful would surgery be for your condition?
 How risky would surgery be for your condition?

* Categorical options were provided for each question.

Appendix 2. Factors that influence the choice to undergo surgery: postconsultation questionnaire*

Do you have a good understanding of what happens to someone when they undergo surgery similar to what has been recommended for your condition?

How painful do you think the operative site would be after the specific surgery recommended for you?

For a person who has fully recovered from the specific surgery recommended for you, how limited do you expect she/he to be in their usual activities afterward?

I am concerned about / I have concerns about (please check all that apply):

Having surgery, going “under the knife”
 Pain of surgery
 Interference of surgery with my social activities
 Inconvenience of surgery to my day-to-day life
 Postoperative restrictions on mobility
 About the risks of surgery
 About whether I am a good candidate or not (considering my age, other health problems)
 How much surgery will actually improve my condition
 The timing of surgery
 The place where either the surgery or rehabilitation will take place
 My ability to cope with surgery and the recovery period because of my obligations to others (either family members, my employers, etc)
 The competency of my surgeon (his or her experience with this procedure, etc)
 The communication skills of my surgeon

Are you satisfied with the amount of say that you have had in making the decision to accept or deny surgery?

Please choose ONE of the 4 options below that you feel best reflects your thinking:

Yes, I'm ready to have surgery
 I will/may consider having surgery at some time in the future but not now
 I'm not sure about having this surgery
 No I don't want to have surgery (either now or in the future)

* Categorical options were provided for each question.

References

1. Alter DA, Naylor CD, Austin P, Tu JV. Effects of socioeconomic status on access to invasive cardiac procedures and on mortality after acute myocardial infarction. *N Engl J Med*. 1999;341:1359–1367.
2. Andersen RM. Revisiting the behavioral model and access to medical care: does it matter? *J Health Soc Behav*. 1995;36:1–10.
3. Ballantyne PJ, Gignac MA, Hawker GA. A patient-centered perspective on surgery avoidance for hip or knee arthritis: lessons for the future. *Arthritis Rheum*. 2007;57:27–34.
4. Clark JP, Hudak PL, Hawker GA, Coyte PC, Mahomed NN, Kreder HJ, Wright JG. The moving target: a qualitative study of elderly patients' decision-making regarding total joint replacement surgery. *J Bone Joint Surg Am*. 2004;86:1366–1374.
5. Emejuiwe N, Jones AC, Ibrahim SA, Kwok CK. Disparities in joint replacement utilization: a quality of care issue. *Clin Exp Rheumatol*. 2007;25(6 suppl 47):44–49.
6. Figaro MK, Russo PW, Allegrante JP. Preferences for arthritis care among urban African-Americans: 'I don't want to be cut.' *Health Psychol*. 2004;23:324–329.
7. Frankel L, Sanmartin C, Conner-Spady B, Marshall DA, Freeman-Collins L, Wall A, Hawker GA. Osteoarthritis patients' perceptions of "appropriateness" for total joint replacement surgery. *Osteoarthritis Cartilage*. 2012;20:967–973.
8. Gooberman-Hill R, Sansom A, Sanders CM, Dieppe PA, Horwood J, Learmonth ID, Williams S, Donovan JL. Unstated factors in orthopaedic decision-making: a qualitative study. *BMC Musculoskelet Disord*. 2010;11:213.
9. Groeneveld PW, Kwok CK, Mor MK, Appelt CJ, Geng M, Gutierrez JC, Wessel DS, Ibrahim SA. Racial differences in expectations of joint replacement surgery outcomes. *Arthritis Rheum*. 2008;59:730–737.
10. Hawker GA. Who, when, and why total joint replacement surgery? The patient's perspective. *Curr Opin Rheumatol*. 2006;18:526–530.
11. Hawker GA, Guan J, Coxford R, Coyte PC, Glazier RH, Harvey BJ, Wright JG, Williams JI, Badley EM. A prospective population-based study of the predictors of undergoing total joint arthroplasty. *Arthritis Rheum*. 2006;54:3212–3220.
12. Hawker GA, Wright JG, Badley EM, Coyte PC. Perceptions of, and willingness to consider, total joint arthroplasty in a population-based cohort of individuals with disabling hip and knee arthritis. *Arthritis Rheum*. 2004;51:635–641.
13. Hawker GA, Wright JG, Coyte PC, Williams JI, Harvey B, Glazier R, Badley EM. Differences between men and women in the rate of use of hip and knee arthroplasty. *N Engl J Med*. 2000;342:1016–1022.
14. Hawker GA, Wright JG, Coyte PC, Williams JI, Harvey B, Glazier R, Wilkins A, Badley EM. Determining the need for hip and knee arthroplasty: the role of clinical severity and patient's preferences. *Med Care*. 2001;39:206–216.
15. Hawker GA, Wright JG, Glazier RH, Coyte PC, Harvey B, Williams JI, Badley EM. The effect of education and income on need and willingness to undergo total joint arthroplasty. *Arthritis Rheum*. 2002;46:3331–3339.
16. Hudak PL, Armstrong K, Braddock C 3rd, Frankel RM, Levinson W. Older patients' unexpressed concerns about orthopaedic surgery. *J Bone Joint Surg Am*. 2008;90:1427–1435.
17. Hudak PL, Clark JP, Hawker GA, Coyte PC, Mahomed NN, Kreder HJ, Wright JG. 'You're perfect for the procedure! Why don't you want it?' Elderly arthritis patients' unwillingness to consider total joint arthroplasty surgery: a qualitative study. *Med Decis Making*. 2002;22:272–278.
18. Ibrahim SA, Siminoff LA, Burant CJ, Kwok CK. Differences in expectations of outcome mediate African American/white patient differences in 'willingness' to consider joint replacement. *Arthritis Rheum*. 2002; 46:2429–2435.
19. Lavernia CJ, Contreras JS, Parvizi J, Sharkey PF, Barrack R, Rossi MD. Do patient expectations about arthroplasty at initial presentation for hip or knee pain differ by sex and ethnicity? *Clin Orthop Relat Res*. 2012;470:2843–2853.
20. Murray E, Pollack L, White M, Lo B. Clinical decision-making: patients' preferences and experiences. *Patient Educ Couns*. 2007;65:189–196.
21. Suarez-Almazor ME, Soucek J, Kelly PA, O'Malley K, Byrne M, Richardson M, Pak C. Ethnic variation in knee replacement: patient preferences or uninformed disparity? *Arch Intern Med*. 2005;165:1117–1124.
22. Ware JE Jr, Sherbourne CD. The MOS 36-item Short-Form health survey (SF-36): I. Conceptual framework and item selection. *Med Care*. 1992;30:473–483.
23. Wilson MG, May DS, Kelly JJ. Racial differences in the use of total knee arthroplasty for osteoarthritis among older Americans. *Ethn Dis*. 1994;4:57–67.