An Exploratory Study of Primary Care Physician Decision Making Regarding Total Joint Arthroplasty

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BACKGROUND: For patients to experience the benefits of total joint arthroplasty (TJA), primary care physicians (PCPs) ought to know when to refer a patient for TJA and/or optimize nonsurgical treatment options for osteoarthritis (OA).

OBJECTIVE: To evaluate the ability of physicians to make clinical treatment decisions.

DESIGN AND PARTICIPANTS: A survey, using ten clinical vignettes, of PCPs in Indiana.

MEASUREMENTS: A test score (range 0 to 10) was computed based on the number of correct answers consistent with published explicit appropriateness criteria for TJA. We also collected demographic characteristics and physicians' perceived success rate of TJA in terms of pain relief and functional improvement.

RESULTS: There were 149 PCPs (response rate=61%) who participated. The mean test score was 6.5±1.5. Only 17% correctly identified the published success rate of TJA (i.e., ≥90%). In multivariate analysis, the only physician-related variables associated with test score were ethnicity, board status, and perceived success rate of TJA. Physicians who were white (P=.001), board-certified (P=.04), and perceived a higher success rate of TJA (P=.004) had higher test scores.

CONCLUSIONS: PCP knowledge with respect to guideline-concordant care for OA could be improved, specifically in deciding when to consider TJA versus optimizing nonsurgical options. Moreover, the perception of the success rate of TJA may influence a clinician's decision making.

KEY WORDS: total joint arthroplasty; primary care physicians; osteoarthritis; decision making.
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INTRODUCTION

Osteoarthritis (OA) is the most common joint disorder in the United States.[1] The prevalence and incidence correlates with age and can be expected to increase as the elderly population grows.[2] Because no curative therapy is available for OA, treatment is aimed primarily at alleviation of symptoms and prevention of functional deterioration.[3] Treatment options are varied and include nonpharmacologic approaches (e.g., weight loss and wedged insoles), use of analgesic agents and nonsteroidal anti-inflammatory drugs for relief of symptoms, and total joint arthroplasty (TJA) for end-stage disease.

TJA is one of the medical miracles of the late 20th century. The procedure has a mortality rate of 1% and leads to 90% improvement in pain and function of patients with knee or hip OA.[4] It is generally agreed that patients with severe symptomatic OA who have failed to respond to medical therapy and who have progressive limitation in their activities of daily living should be referred to an orthopedic surgeon for evaluation for TJA.[5,6]

Unfortunately, the benefits of TJA are not equally spread across geographic, gender and ethnic lines. After controlling for several potential explanatory variables—socioeconomic status (SES), insurance coverage, severity of disease, and type and availability of health care services—significant residual disparities exist in the use of TJA.[7–12] Reasons for these disparities in utilization of TJA are poorly understood and likely multifactorial. Whether a patient with OA undergoes TJA is the consequence of a complex interplay of patient preferences,[13–15] health beliefs,[16] personal resources (e.g., ability to pay for out-of-pocket costs),[16] and the characteristics of the clinicians providing care.[16]

Because referral to an orthopedic surgeon is the chief means by which TJA is made available to patients with OA, potential mechanisms to explain differences in TJA rates may operate at the primary care physician (PCP) level. The observed disparities may stem in part from gaps in PCP knowledge regarding the proper indications (and contraindications) for TJA.[17] As the medical "gatekeeper," PCPs have an important role in deciding when to refer a patient to an orthopedic surgeon and when to optimize medical management. It is important therefore that the physician knows the indications for both surgical and nonsurgical treatment options for OA. For this reason, the first aim of the study was to assess the proficiency of PCP in recognizing the appropriate indications and contraindications (i.e., failure to maximize nonsurgical treatment options) for TJA, through the use of ten clinical vignettes. In contrast to prior studies that used isolated patient characteristics in describing physician practice preferences,[17,18] the use of clinical vignettes has the added advantage of capturing the complexities of real-life clinical decision making.

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The second aim was to identify potential correlates of PCPs' proficiency in the management of OA. In particular, we were interested in whether a physician's estimates of the effectiveness of TJA influenced decision making. In one small survey, only 58% of PCPs indicated that TJA improved quality of life and only 70% believed it relieved pain.[19] These estimates are strikingly pessimistic. We hypothesized that physician perception of the effectiveness of TJA may be a driving force in their referral patterns or treatment approaches.

METHODS

Participants

From July 2002 to June 2005, we approached PCPs attending any one of six continuing medical education (CME) programs for primary care in Indianapolis. Physicians were told that the study objective was to assess their practice patterns in the care of patients with OA. Resident physicians, nurse practitioners, and physician assistants were excluded from the study. Approval was obtained from the Institutional Review Board. The requirement for written informed consent was waived.

Survey Development

Before the distribution of the test questionnaire, the authors developed 10 clinical vignettes that reflected scenarios commonly presenting in primary care practice. To determine face validity (i.e., subjective judgment of whether the vignettes provide a measure of clinicians' ability in the recognition of the appropriateness or inappropriateness of surgical referral for TJA), we invited a panel of ten specialists (5 orthopedic surgeons and 5 rheumatologists) and five Internists to review each item. For each item, the interrater agreement was at least 93%. The

Table 1. Description of Each Clinical Vignette and Percentages of Physicians Responses

Clinical vignettes	Appropriate treatment recommendation	Participants' responses (*N*=149)
1. 55-year-old woman, well-controlled hypertension, not obese, persistent left knee pain that occasionally interferes with sleep, previously tried acetaminophen and naproxen, worked with a physical therapist 4 months ago, takes regular doses of oxycodone, recently started using a cane	Consider surgical consultation	Surgical: 96% Nonsurgical: 4%
2. 49-year-old white man, poorly controlled hypertension, on amlodipine and hydrochlorothiazide, with progressive knee pain that interferes with recreational activity, moderate degree of radiographic knee OA*, positive knee crepitus, takes 500 mg of acetaminophen once or twice daily	Maximize nonsurgical treatment options (increase acetaminophen dose, add NSAIDs†)	Nonsurgical: 95% Surgical: 5%
3. 48-year-old white man, no significant medical problems, with intermittent right knee pain, moderately severe radiographic knee OA, takes acetaminophen	Maximize nonsurgical treatment options, despite radiographic evidence of severe knee OA	Nonsurgical: 90% Surgical: 10%
4. 67-year-old African-American man, mild COPD‡, diabetes on oral medication, left hip pain with most daily activities, takes tramadol, naproxen and oxycodone, height and weight proportional, limited hip range of motion, severe radiographic hip OA, lives alone, on Medicare with no supplemental insurance	Consider surgical consultation because patient continues to be quite symptomatic despite triple analgesics	Surgical: 86% Nonsurgical: 14%
5. 75-year-old African-American man, diabetes on glipizide XL 5 mg once daily, with worsening knee pain, interferes with sleep and *active* lifestyle, severe radiographic knee OA, regularly does leg exercises, currently uses oxycodone and tramadol, previously failed 3 different NSAIDs	Consider surgical consultation (despite age)	Surgical: 82% Nonsurgical: 18%
6. 55-year-old white woman, body mass index 30 (mildly obese), with left hip pain, on acetaminophen 4 g/d, had 4 lb weight loss in 2 mo, positive leg length discrepancy and with moderate grade radiographic hip OA	Maximize nonsurgical treatment options (NSAIDs, shoe insert, weight loss)	Nonsurgical: 73% Surgical: 27%
7. 62-year-old African-American man, with stable angina and diet-controlled diabetes, severe radiographic hip OA, symptomatic hip pain despite multiple NSAIDs, 14 lb intentional weight loss, recently started using a walker	Consider surgical consultation (despite comorbidity)	Surgical: 71% Nonsurgical: 29%
8. 70-year-old white woman, diabetes on glyburide 5 mg once daily, with progressive knee pain requiring a cane, on ibuprofen 400 mg every 6 h and glucosamine, height=5 ft 6 in., weight=115 lb, positive knee crepitus and tenderness of the anserine bursae, with moderately severe radiographic knee OA	Maximize nonsurgical treatment options (local glucocorticoid injection, physical therapy)	Nonsurgical: 67% Surgical: 33%
9. 60-year-old African-American woman, overweight, with hypertension, leg length inequality, symptomatic hip OA despite naproxen; previously tried acetaminophen and over-the-counter ibuprofen	Maximize nonsurgical treatment options (physical therapy, orthotics, weight loss)	Nonsurgical: 61% Surgical: 39%
10. 50-year-old African-American man, well-controlled diabetes and hypertension, with severe left knee pain partially responsive to combination of celecoxib, tramadol, and oxycodone, severe radiographic knee OA, completed a course of physical therapy, height and and weight proportion, with severe knee crepitus	Consider surgical consultation, despite relatively young age	Surgical: 60% Nonsurgical: 40%

*OA: Osteoarthritis.
†NSAIDs: Nonsteroidal anti-inflammatory drugs.
‡COPD: Chronic obstructive pulmonary disease.

panel was also asked to rate the clarity or readability of each vignette from a scale of 1 to 10 (with 10 being optimum). The median rating score for all the 10 items was 9.0. The 10 clinical vignettes and aggregate PCP responses are summarized in Table 1.

Procedure

Published in 2000, the explicit appropriateness criteria for TJA using the RAND appropriateness method were applied in determining the correct response to the clinical vignettes.[20] The RAND appropriateness method combines available scientific evidence with expert opinion. Development of the method was motivated by the concern that the increasing complexity of medical care was resulting in some patients not undergoing procedures that they needed, and others undergoing procedures that they did not need. The TJA appropriateness algorithm included the following variables: age, surgical risk, previous nonsurgical managements, degree of pain and functional limitation, and radiographic findings. In contrast to the NIH consensus guidelines,[5,6] the TJA appropriateness algorithm provides guidance in dealing with more than a hundred possible clinical scenarios that a physician may encounter in the clinic. A subsequent validation study has supported the use of the TJA appropriateness algorithm for clinical guideline or evaluation purposes.[21] In fact, the results from this prospective observational study of more than 1,500 patients suggested a direct relationship between the TJA appropriateness algorithm and better health-related quality-of-life outcomes 6 months after TJA.

For each physician, we computed a test score (range 0 to 10) based on the number of correct answers consistent with the appropriateness criteria.[20] From a list of four possible answers, physicians were to choose one treatment recommendation for each vignette. Consideration of TJA was the correct response for five of the 10 vignettes. For the remaining five, any one of the nonsurgical treatment options was appropriate. In addition to the vignettes, we asked physicians to estimate the success rate of TJA in terms of pain relief and functional improvement. The response choices were 40–60%, 61–75%, 76–89%, and ≥90%. The test survey took an estimated 20 minutes to complete.

We also collected information on physicians' demographics including: age, gender, ethnicity (whites or nonwhites), years in practice (≤5 years, 6–10, and ≥11), specialty (Internal Medicine and family practice), board status (board-certified or board-eligible), practice setting (academic or nonacademic) and location (rural, urban, or suburban), type of practice (solo or group or others), and the number of half-day clinic per week (≤5 or ≥6 half-days).

Statistical Methods

The primary dependent variable was the test score, which is a continuous variable. Differences in means were tested using Student's *t* test and analysis of variance. Factors independently associated with test score were determined using multiple linear regression analyses. The perceived success rate of TJA was treated as an ordinal independent variable. To assess appropriateness of the linear model, we plotted residuals with predicted values or responses. All analyses were performed using the SPSS 11.0 statistical analysis program. In all cases, a *P* value of less than 0.05 was considered statistically significant.

RESULTS

Physicians' Characteristics

From the 245 CME attendees who received the study questionnaire, 149 physicians (60.9%) returned the completed forms. We do not have the demographic characteristics of the nonresponders; therefore, selection bias could not be assessed. As shown in Table 2, the majority of the 149 physicians were white, male, and belonged to a group practice. The three age groups, ≤40 years, 41–50, and ≥51 were equally represented. Similarly, there was an even distribution of family practice (*n*=77) and Internal Medicine (*n*=72) practitioners. A slight majority (54%) of physicians practiced in a suburban/rural setting. A greater number of physicians were board-certified, worked ≥6 half-day clinics a week, and practiced in a nonacademic environment. Almost 60% of physicians had been in practice for more than a decade.

Table 2. Physicians' Characteristics

Variables	Percentage or mean±SD (%)
Age	
≤40	52 (35)
41–50	51 (34)
≥51	45 (31)
Gender	
Male	94 (63)
Female	55 (37)
Ethnicity	
Whites	110 (74)
Nonwhites	39 (26)
Specialty	
Family practice	77 (52)
Internal Medicine	72 (48)
Place of practice	
Urban	69 (46)
Suburban	40 (27)
Rural	40 (27)
Type of practice	
Solo	32 (22)
Group	90 (60)
Others	27 (18)
Board status	
Board eligible	15 (11)
Board certified	126 (89)
Practice setting	
Academic	39 (26)
Nonacademic	110 (74)
Years in practice	
≤5	31 (21)
6–10	30 (20)
≥11	88 (59)
Number of half-day clinic per week	
≤5	41 (33)
≥6	100 (67)
Estimated success rate (%) of arthroplasty	
40–60%	24 (16)
61–75%	36 (24)
76–89%	63 (43)
≥90%	25 (17)
Test score*	6.5±1.5

**Test score ranged from 0 (no correct answer) to 10 (perfect score).*

Interestingly, 83% of the participants underestimated the success rate of TJA; only 17% correctly identified the published success rate of TJA, which is ≥90%. The mean test score for the ten clinical vignettes was 6.5 (±1.5). The average proportions of physicians who correctly answered the surgical and nonsurgical cases were 79% and 77%, respectively.

Relationship Between Physician-related Variables and Test Scores

On bivariate analysis, the demographic variables that were significantly associated with a higher test score were ethnicity (white vs nonwhite, 6.8±1.5 vs 5.7±1.5, respectively, *P*=.0001), gender (female vs male, 6.9±1.3 vs 6.3±1.6, respectively, *P*=.02), and number of clinic sessions per week (≥6 half-day clinics per week vs ≤5, 6.7±1.5 vs 6.1±1.6, respectively, *P*=.05). There was a trend toward significance for board status (certified vs eligible, 6.6±1.5 vs 5.9±1.8, *P*=.07).

On multivariate analysis, the only physician-related variables found to be independently associated with test scores were ethnicity, board status, and the estimated success rate of TJA. PCPs who were white, board-certified, and estimated higher success rate for TJA had higher test scores (Table 3). Having more clinic sessions per week almost reached statistical significance (standardized beta 0.15, *P*=.07). Age, gender, years in practice, specialty, and practice setting and location were not significantly associated with test scores. Similarly, the interaction between physician's ethnicity and board certification status was not significant. Plotting of residuals versus predicted responses suggested that the linear model was appropriate for the analysis.

DISCUSSION

The mean test score achieved by PCPs in this study was 6.5, meaning that on average they provided guideline-concordant care for two thirds of the cases. Given that musculoskeletal complaints (of which OA is the most common) account for one fifth to one third of all primary care visits [22] and that the case vignettes were representative of clinical practice, our findings suggest a potential area for CME and quality improvement.

On careful scrutiny of physicians' responses to case vignettes 3, 6, 8, and 9 (Table 1, column 3), we speculate that the mean test score was lowered in part because of PCPs' failure to optimize nonsurgical treatment options (e.g., physical therapy) before orthopedic consultation. In addition, factors such as age (50 or 75 years old) and the presence of comorbidity might also have influenced the PCPs' responses to case vignettes 4, 5, 7, and 10. Despite previous failure of medications and nonpharmacologic modalities, greater than 10% of the respondents chose the nonsurgical option. The reluctance of some physicians to refer patients for TJA because of patient's age (young and old) or the presence of comorbidity has also been reported by other authors.[17,23]

Table 3. Regression Model of Factors Associated with Higher Test Score

Variables	Standardized beta	*P* value
Whites (vs nonwhites)	0.28	0.001
Estimated success rate of TJA*	0.24	0.004
Board-certified (vs eligible)	0.18	0.04

The model explained 23.2% of total variance of the test score.
**Estimated success rate of total joint arthroplasty (TJA) (response choices: 40–60%, 61–75%, 76–89%, and ≥90%).*

Three physician factors—board certification, race, and higher estimates of TJA effectiveness—were associated with higher test scores. While the relative weight that should be attributed to board testing in physician credentialing has been debated, it is generally accepted as one indicator of physician competence and an important factor in quality improvement efforts.[24] Studies correlating board status with positive clinical outcomes have been encouraging in diverse areas of specialties.[25–28] The relationship between the test score and board certification status supports the construct validity of our case vignettes as one measure of physicians' proficiency in treating OA.

In addition, this finding may have a wider application in the observed ethnic disparity in TJA use. Bach et al.[29] found that PCPs treating African-American patients were less well clinically trained, and more likely to report difficulty in providing high-quality care to their patients (e.g., access to specialists) when compared to physicians providing care to white patients. If physicians' clinical competence is indeed associated with patients' ethnic affiliation, which in turn is linked to disparities in TJA use, one could hypothesize that competence in the appropriate use of nonsurgical and surgical treatment options for OA may partly account for ethnic differences in the utilization of TJA. Further research is needed to address the extent to which differences in proficiency in clinical OA care may be responsible for disparities in the use of TJA.

In contrast, our finding regarding physician race should be interpreted cautiously. First, only about a quarter of physicians in our study were nonwhite, and the sample size in this group was too small to explore minority subgroups. Second, there are a number of unmeasured variables, including prior training, characteristics of patients in the PCP practices, referral networks, and other factors that could serve as important confounders. Third, this finding has not been previously reported and thus would need to be explored in studies involving larger number of PCPs controlling for other potential confounders including local geographic experience on TJA outcomes. It is reasonable to assume that local geographic experience dictates physicians' practice patterns or decision making. As previously reported, nonwhite physicians tend to serve a larger proportion of nonwhite patients.[29] If nonwhite patients indeed have higher postoperative complication rates,[30] then nonwhite physicians with a large nonwhite patient population may appropriately alter their practice patterns. In such a situation, local geographic experience may serve as an important confounder in the relationship between physicians' ethnicity and clinical decision making.

The third factor associated with test score was physicians' estimated success rate of TJA. PCPs who perceived a higher degree of TJA effectiveness were more likely to select the optimal management options in the case vignettes. Although, a clinician's response in a hypothetical clinical scenario may differ from his (or her) actual decisions in clinical practice, the effect of "perception" on physicians' practice patterns has previously been documented in other areas of medicine, including renal transplantation,[31] use of anticoagulation,[32] and the manage-

ment of irritable bowel syndrome and chronic fatigue.[33] Wright et al.[34] reported that physicians (in this case, orthopedic surgeons) who have a more favorable impression of the outcome of TJA had a higher propensity to operate, thus offering a partial explanation for the variation in services. If true, differences in perceptions among physicians may be amenable to educational interventions aimed at reducing disparities in service use. However, because of the cross-sectional nature of our study design, we cannot infer a causal relationship (or the direction of the relationship) between physicians' perceived effectiveness of TJA and their clinical decision making.

The study results should be considered in the context of several limitations. The distribution of test scores may reflect variations in clinical opinions or preferences among physicians, rather than differences in clinical proficiency per se. A survey of family practitioners from Ontario, Canada revealed that referring physicians disagreed on the indications of referral for knee arthroplasty and on the treatments for knee OA at least 80% of the time.[17] Clinical disagreement may persist, despite consensus within the scientific literature, because recommendations have not been adequately disseminated.

Second, a physician response to a hypothetical clinical scenario may differ from his actual response when confronted with a similar problem in the clinic. However, the use of clinical vignettes has been validated as a method for measuring the competence of physicians and the quality of their actual practice.[35,36] As compared to medical chart abstraction, measuring quality of care using clinical vignettes consistently approximates the gold standard of using standardized patients (i.e., trained actors) who present unannounced to physicians' clinics.

Third, because the physician participants were a convenience sample recruited from a CME conference, our findings may not be representative of the wider general medical community. Compared to other community physicians, physicians who attend CME are likely to be motivated to stay current in their medical knowledge. Had physicians been recruited directly from their community practices, particularly as a random sample, the findings may have been different. Lastly, selection bias may have affected our study results. Thirty-nine percent of the physicians who received the questionnaire did not return the completed form, and we were not able to compare the characteristics of the nonrespondents versus the respondents. However, the 61% response rate was significantly higher than the two previous PCP survey studies.[17,18]

Despite the above limitations, our study has several important strengths. To assess the proficiency of PCP in recognizing the appropriate indications and contraindications of TJA, we used clinical scenarios (vignettes) that captured the complexities of clinical decision making. Previous studies[17,18] only used isolated patient characteristics, which do not capture the richer complexities of "real-life" clinical cases. Second, the use of a validated TJA appropriateness algorithm in evaluating PCPs' clinical decision making revealed physicians' lack of familiarity with the published TJA literature. This deficiency may be amenable to specific educational interventions. Finally, in the context of health care disparities, our study is the first to suggest an association between perceived effectiveness of TJA and clinical decision making (albeit in vignette format) in OA. This relationship may inform future research directed at unraveling the specific role of physician-related factors in the observed ethnic disparity in TJA use. Qualitative interviews with practitioners might also reveal factors affecting decision-making.

In conclusion, the results of our study suggest that PCPs are not fully aware of the published literature in managing OA, *specifically* in deciding when to consider TJA versus optimizing nonsurgical options. Future studies should determine the best way to disseminate scientific findings to physicians' clinic practices. Also, the relative roles of PCP as gatekeeper in specialty referrals versus direct patient access and improved patient education regarding management of their disease should be considered. Finally, whether variation in clinical proficiency is one explanatory factor in the observed disparity in the utilization of TJA should be further explored.

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