

Variability in Recommendations for Total Knee Arthroplasty Among Rheumatologists and Orthopedic Surgeons

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ABSTRACT. Objective. The most rapidly growing population of patients undergoing total knee arthroplasty (TKA) is under the age of 65. The objective of our study was to gain insight into the factors influencing physicians' recommendations for persons in this age group with moderate osteoarthritis (OA).

Methods. Rheumatologists and orthopedic surgeons attending national meetings were asked to complete a survey including a standardized scenario of a 62-year-old person with knee OA who has moderate knee pain limiting strenuous activity despite medical management. We used an experimental $2 \times 2 \times 2$ design to examine the effects of sex, employment status, and severity of radiographic OA on physicians' recommendations. Each physician was asked to rate a single scenario.

Results. The percentage of physicians recommending TKA varied from 30% to 55% for scenarios describing a patient with mild radiographic OA, and from 39% to 71% for scenarios describing a patient with moderate radiographic OA. Surgeons were less likely to recommend TKA for women compared to men of the same age, employment status, symptom severity, and functional status, and radiographs. Rheumatologists practicing in academic settings were more likely to recommend TKA compared to those practicing in nonacademic settings, and American surgeons were more likely to recommend TKA compared to their European counterparts.

Conclusion. Orthopedic surgeons and rheumatologists vary significantly in their recommendations for patients with moderate knee pain and functional limitations. Both patient and physician characteristics influence physicians' recommendations, and rheumatologists and orthopedic surgeons display different patterns of decision making. (J Rheumatol First Release Dec 1 2013; doi:10.3899/jrheum.130762)

Key Indexing Terms:

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PRACTICE PATTERNS
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Total knee arthroplasty (TKA) is an effective treatment option for patients with knee osteoarthritis (OA) and is currently one of the most commonly performed elective surgical procedures worldwide¹. The number of TKA performed in the United States per year has been rising substantially since 1990^{2,3}. This rise was anticipated given the increasing prevalence of older adults in the population. However, while rates of TKA are increasing among all age groups, the most rapidly growing population of patients undergoing this procedure are those under the age of 65 years³.

Because there is no consensus regarding the indications for TKA, the number of procedures performed varies significantly across geographic regions¹. Whereas rates are expected to vary based on patients' preferences, disease severity, and comorbidity, the number of TKA performed is also influenced by unwarranted sources of variability such as patient ethnicity, sex (with women being less likely to be offered TKA), and motivation to improve function^{4,5,6,7,8}.

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Not surprisingly, physicians' opinions⁹ are also influential. For example, Wright, *et al*¹⁰ found that orthopedic surgeons' enthusiasm for TKA was a strong determinant of geographic variation in TKA rates in Canada. Moreover, the surgeons' opinion was the only statistically significant modifiable predictor identified ($p = 0.0001$)¹⁰.

Given that physicians' opinions explain a significant amount of the variability observed in TKA rates⁹, and the rising rates of TKA in persons under the age of 65, the aim of our study was to identify patient and provider differences driving decisions to recommend TKA in standardized patient scenarios in which there was uncertainty regarding the appropriateness of surgery.

MATERIALS AND METHODS

We composed scenarios to represent patients for whom there was uncertainty regarding the appropriateness criteria for TKA: i.e., patients who had moderate (that is, neither mild nor severe) pain and limitations in function and had exhausted a reasonable number (but not all) medical treatment options. Using an experimental $2 \times 2 \times 2$ design¹¹, we examined the effects of sex, employment status, and severity of radiographic OA on physicians' recommendations.

We examined decision making among 2 groups of physicians: orthopedic surgeons and rheumatologists. We chose to include orthopedic surgeons and rheumatologists to permit a direct comparison between physicians who have a comparable level of expertise in the care of patients with OA. Moreover, because rheumatologists and surgeons generally act as consultants for patients with knee OA, they may approach the tradeoffs between the escalating use of analgesics and TKA differently from primary care providers.

A single research assistant approached physicians before or after concurrent oral and plenary sessions held at the American College of Rheumatology Annual Meeting (November 2011) and the American Academy of Orthopedic Surgeons Annual Meeting (February 2012). Physicians who were able to speak English were asked to complete a paper survey including a standardized scenario of a 62-year-old person with knee OA who has moderate knee pain limiting strenuous activity despite medical management (Appendix A). Physicians were not informed of the purpose of the survey and were not offered any incentives. Each physician responded to a single, randomly assigned scenario. Randomization was determined using a computer-generated list of random numbers in blocks of 24. The scenarios were identical (in terms of pain, functional status, and comorbidities) and varied only by patient sex, employment status (business manager vs retired/housewife), and radiographs (mild vs moderate OA). The radiographs used are included in Appendix A.

Each physician was asked to rate their recommendation for TKA on a 6-point scale (1 = very strongly recommend having TKA and 6 = very strongly recommend against having TKA). Recommendation was treated as a dichotomous variable (strongly or very strongly recommend vs other). Subjects were also asked to report their age, sex, number of years in practice, country of residence, and primary practice setting. Surgeons also reported the number of TKA they performed per year (< 15, 15–19, 20–24, or ≥ 25) and rheumatologists reported the number of OA patients they saw per month (< 10, 10–20, ≥ 20). We examined the likelihood of recommending TKA among rheumatologists versus orthopedists. We used chi-square statistics to examine the associations between patient and physician characteristics with recommendations for TKA. Logistic regression models were subsequently used to determine the independent effect of each predictor on rheumatologists' and orthopedic surgeons' recommendations.

Our study was determined by our institution's Human Investigation Committee to be exempt from institutional review board approval.

RESULTS

We surveyed 896 physicians (494 rheumatologists and 406 orthopedic surgeons). Among orthopedic surgeons, 54% performed ≥ 25 TKA per year. About half (52%) reported practicing in a solo or group practice, 23% in a hospital/medical center-based practice, 4% in a Veteran's Administration (VA) hospital, and 0.5% on a prepaid plan or health maintenance organization (HMO) setting. Among rheumatologists surveyed, 54% reported seeing over 20 patients with knee OA per month. About half (51%) practice primarily in a community-based solo or group practice setting, 27% in a hospital/medical center-based practice, and 2% in a VA hospital. Additional characteristics by physician specialty are presented in Table 1. Overall, the same percentage (51%) of surgeons and rheumatologists recommended TKA. However, both groups of physicians' recommendations for TKA varied significantly across scenarios (Figure 1).

Influence of patient characteristics on TKA recommendations (Table 2). As expected, both groups recommended TKA more frequently for scenarios including more severe radiographic OA; however, this feature had a greater influence among rheumatologists (difference = 19%, $\chi^2 = 16.3$, $p < 0.0001$) than orthopedic surgeons (difference = 9%, $\chi^2 = 3.91$, $p = 0.048$). Patient sex did not influence rheumatologists' recommendations. In contrast, orthopedic surgeons were less likely to recommend TKA for female compared to male patients. Male rheumatologists recommended TKA for 49% of the male patients versus 50% of the female patients ($p = 0.8$); whereas male orthopedic surgeons recommended TKA for 59% of the male compared to 43% of the female patients ($p = 0.001$). Sex bias was not observed among female rheumatologists. The number of female orthopedic surgeons was too small ($n = 18$) to examine the influence of patient sex on their recommendations. Patient employment status did not significantly

Table 1. Rheumatologists' and orthopedic surgeons' characteristics.

	Rheumatologists, n = 494	Orthopedic Surgeons, n = 406
Age, mean, yrs (SD)	48.4 (11.4)	48.9 (10.5)
Years in practice, mean (SD)	17.1 (11.1)	17.2 (10.7)
Female, n (%)	218 (44)	18 (4)
Academic practice, n (%)	98 (20)	53 (13)
Practice site, n (%)		
Africa	9 (2)	4 (1)
Asia	50 (10)	24 (6)
Australia	9 (2)	4 (1)
Europe	122 (25)	68 (17)
Central America	5 (1)	6 (1)
Canada	23 (5)	9 (2)
Mexico	6 (1)	4 (1)
United States	211 (43)	265 (65)
South America	40 (8)	19 (5)
Other	15 (3)	2 (0.5)

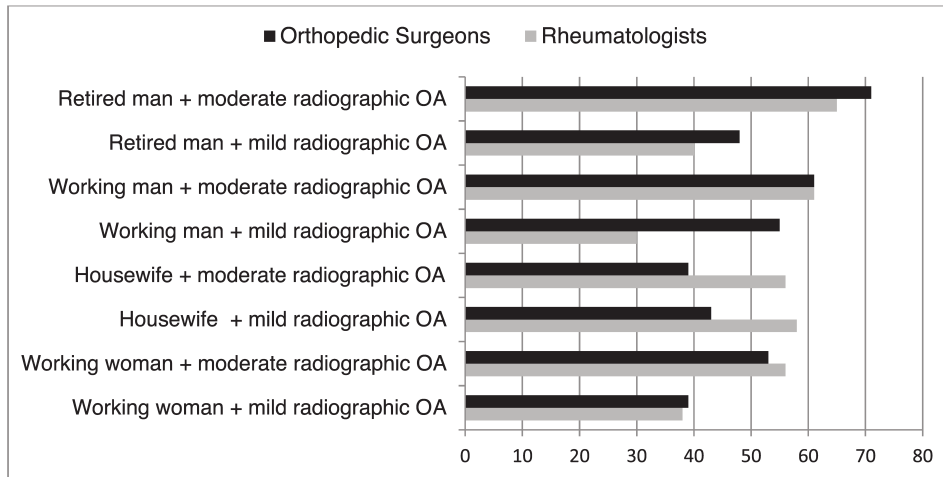


Figure 1. Percent of physicians recommending total knee arthroplasty for each scenario. OA: osteoarthritis.

Table 2. Influence of patient characteristics on physicians' recommendations for total knee arthroplasty (TKA).

Patient Characteristics	Percent of Rheumatologists Recommending TKA	Percent of orthopedic Surgeons Recommending TKA
Moderate vs mild radiographic changes	60 vs 41, $p < 0.0001$	56 vs 47, $p = 0.05$
Male vs female	49 vs 52, $p = 0.5$	59 vs 44, $p = 0.002$
Working outside the home vs retired/housewife	47 vs 55, $p = 0.07$	52 vs 51, $p = 0.8$

influence rheumatologists' or orthopedic surgeons' recommendations.

Influence of physician characteristics on TKA recommendations (Table 3). Physicians' demographic characteristics had variable influence on TKA recommendations. Younger physicians, regardless of specialty, were more likely to recommend TKA (Figure 2). The mean (SD) age of rheumatologists of those who did versus did not recommend TKA was 46.8 (11.6) years and 50.1 (11.0) years, $p = 0.002$, respectively. The mean (SD) age of orthopedic surgeons for and against TKA was 47.8 (11.0) years and 50.1 (9.8) years, $p = 0.026$, respectively. The effect of physician sex could not be definitively examined among orthopedic surgeons because of the small number of female orthopedic surgeons. Nonetheless, we found no effect of physician sex among rheumatologists. Academic rheumatologists were more likely to recommend TKA compared to rheumatologists

working primarily in nonacademic settings; whereas academic orthopedic surgeons were less likely. The latter was not statistically significant. Rheumatologists' recommendations for TKA did not vary by geographic location. In contrast, American surgeons were substantially more likely to recommend TKA compared to their European counterparts. Other countries could not be examined because of the small number of participants (Table 1).

Multivariate analysis. Rheumatologists' recommendations for TKA were independently and significantly associated with younger physician age, academic setting, and greater radiographic severity in a logistic regression model including all 3 variables (Table 4). Among orthopedic surgeons, male patients, greater radiographic severity, and practicing in the United States remained significantly associated with recommendation for TKA in a multivariable model whereas physician age was of borderline significance.

Table 3. Influence of physician characteristics on recommendations for total knee arthroplasty (TKA).

Physician Characteristics	Percent of Rheumatologists Recommending TKA	Percent of orthopedic Surgeons Recommending TKA
Age (≤ 40 yrs vs > 40)	61 vs 46, $p = 0.002$	60 vs 48, $p = 0.03$
Practice setting (academic vs nonacademic)	63 vs 48, $p = 0.006$	43 vs 53, $p = 0.2$
Site (United States vs Europe)	52 vs 49, $p = 0.6$	52 vs 34, $p = 0.007$

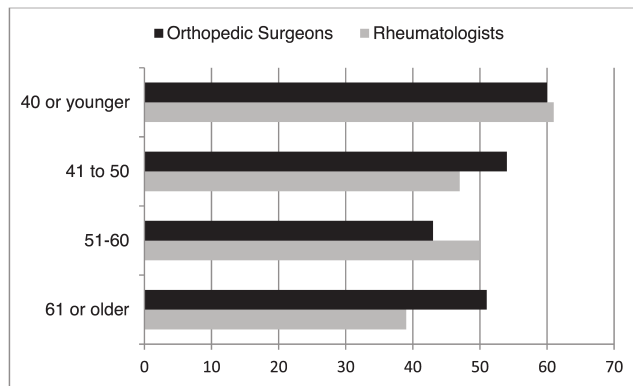


Figure 2. Percent of physicians by age group recommending total knee arthroplasty.

Table 4. Multivariate analyses on the influence of patient and physician characteristics on recommendations for total knee arthroplasty.

	Adjusted OR (95% CI)
Rheumatologists*	
Moderate vs mild radiographic changes	2.15 (1.49–3.11)
Age of surgeon, per year increase	0.98 (0.96–0.99)
Academic vs nonacademic practice	1.75 (1.09–2.82)
Orthopedic surgeons**	
Female vs male patients	0.55 (0.37–0.82)
Moderate vs mild radiographic changes	1.51 (1.01–2.26)
Age of surgeon, per year increase	0.98 (0.96–1.00)
European vs American	0.42 (0.24–0.74)

* Model contains the 3 variables found to be significant in unadjusted analyses: radiographic severity, age of surgeon, practice site. ** Model contains the 4 variables found to be significant in unadjusted analyses: patient sex, radiographic severity, age of surgeon, geographical location.

DISCUSSION

In our study, orthopedic surgeons and rheumatologists varied significantly in their recommendations for patients with mild to moderate radiographic knee OA and moderate pain and functional limitations. Both patient and physician characteristics influenced recommendations, and rheumatologists and orthopedic surgeons displayed different patterns of decision making.

Most of the variability between physician groups occurred for patients with mild radiographic disease. The only significant difference between rheumatologists and orthopedic surgeons for patients with moderate radiographic disease was seen in the scenario describing a housewife, for which fewer orthopedic surgeons recommended TKA compared to rheumatologists. A significant sex bias against female patients was observed among orthopedic surgeons even after controlling for radiographic severity and employment status. For example, orthopedic surgeons recommended TKA for 55% of working men and 39% of working women of the same age and having identical

symptoms, functional limitations, and radiographs. Borkhoff, *et al*⁶ found that Canadian physicians (29 orthopedic surgeons and 38 family physicians) were less likely to recommend TKA when presented with standardized female compared to male patients. In contrast, sex bias in our study was observed only among surgeons. Moreover, we did not detect this bias when we restricted the analyses to male rheumatologists.

Our study does not provide insights as to why rheumatologists did not exhibit the same sex bias as surgeons or as family physicians⁶. Orthopedic surgeons may be more strongly influenced by the results of some studies published in subspecialty surgical journals demonstrating differences in TKA outcomes between men and women. For example, several studies have shown that, while women have similar improvements in pain and function as men following TKA, their postoperative absolute pain and function scores are poorer, because they have worse preoperative scores^{12,13,14}. Some data suggest that women may actually fare better than men after TKA. Liebs, *et al*¹⁵ found that women recover more quickly following TKA, while Singh, *et al*¹⁶ demonstrated higher rates of wound infections, revision rates, and mortality in men compared to women. Whether these findings will alter the sex differences seen in this study should be examined in future research.

Both rheumatologists' and orthopedic surgeons' recommendations were influenced by radiographic changes; however, the difference between the radiographs used in this study had greater influence on rheumatologists' than orthopedic surgeons' recommendations. While the approaches used are different, these results are consistent with a recent survey in which 68% of orthopedic surgeons reported that their decision to perform TKA, and 77% of rheumatologists and family physicians reported that their decision to refer for TKA, was influenced by radiographic severity⁹. These findings suggest that referring rheumatologists may place a higher emphasis on radiographic findings compared to surgeons, perhaps because of a perceived need to ensure that surgeons will view referred patients as appropriate candidates for surgery.

The literature examining variability in physicians' recommendations for TKA has focused primarily on patient factors^{6,7,8,9}; however in our study, we found that physicians' characteristics were also important. Younger rheumatologists and orthopedic surgeons were more likely to recommend TKA compared to their older counterparts. Whether this difference reflects a generally more conservative attitude among older physicians, or specific differences in the way older and younger physicians weigh the risks and benefits related to TKA deserves further study.

Academic rheumatologists were significantly more likely than their community-based counterparts to recommend TKA. Potential explanations include the possibility that academic rheumatologists have a more favorable view of

the outcomes associated with TKA or, alternatively, a less favorable view of the medical treatment options available for knee OA. There were no differences in recommendations among rheumatologists by geographic location; however, European surgeons were much less likely to recommend TKA compared to American surgeons, suggesting that site-related factors such as practice norms, reimbursement, and/or insurance coverage may influence surgeons' TKA recommendations.

Our study has several important strengths. We were able to survey a large group of physicians. The use of a $2 \times 2 \times 2$ design allowed us to isolate the effect of both patient and physician factors on TKA recommendations. Each subject answered a single scenario; thus our findings were not influenced by clustering or ordering effects.

Several limitations should be noted. The use of standardized scenarios, while enabling us to systematically vary patient characteristics, cannot replicate the complexity of decision making in clinical practice. Although we surveyed a large number of physicians, most of whom spend the majority of their time in clinical practice, the study population represents a convenience sample of consecutively approached volunteers, which limits generalizability. Our classification of volume did not allow us to discriminate between surgeons with high volumes and those with more moderate-sized practices. We chose to compare "housewife" to "retired man" to represent typical sex roles. These terms, as well as choice of employment (business manager) may be associated with specific socioeconomic stereotypes. This bias, however, would not have affected the sex bias seen for



APPENDIX 1. A 62-year-old woman, who works fulltime as a manager of a small business, is referred to you for consideration of a total knee arthroplasty (TKA) by her primary care physician. She has had worsening right medial and lateral knee pain over the past 2 years and complains of moderate right knee pain on most days of the month. Her left knee is fine. Although she did have some relief with nonsteroidal antiinflammatory drugs (NSAID) when her symptoms began, she has not responded to recent trials of physical therapy, acetaminophen, NSAID, or intraarticular injections with cortisone or hyaluronic acid. She denies any swelling, buckling, catching, or locking of her knee. She has found it increasingly difficult to travel for business. She has a moderate amount of difficulty going up and down stairs and a lot of difficulty doing heavy household chores. Her body mass index is 26 (overweight but not obese). She has well-controlled hypertension and diabetes and no known coronary artery disease. She does not smoke. She lives with her husband who is healthy. Her physical examination is normal except for a positive patello-femoral crunch sign and some medial joint line tenderness of her right knee.

Above are her recent radiographs (taken within the past month).

What would your recommendation be for this patient?

1. Very strongly recommend TKA
2. Strongly recommend TKA
3. Recommend TKA
4. Recommend against having a TKA
5. Strongly recommend against having a TKA
6. Very strongly recommend against having a TKA

working male and female patients. Lastly, our results can only be generalized to the specific patient characteristics represented in the specified scenario. Whether the variability found in our study would be replicated in patients with other characteristics (i.e., younger than the age of 60) requires further research.

Our study adds to the literature demonstrating the influence of physicians' opinions on recommendations for TKA and improves our understanding of the physician factors underlying the unwarranted variability associated with its use. Without explicit appropriateness criteria for TKA, the recommendations that patients receive are likely to remain inconsistent.

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