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Clinical Appropriateness and Not Race Predicted Referral for Joint Arthroplasty

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Abstract

Objective—To understand the reasons behind racial disparities in the use of total joint arthroplasty (TJA), we sought to examine the predictors of time to referral to orthopedic surgery for consideration of joint replacement.

Method—In this prospective, longitudinal study of 676 primary care clinic patients with at least moderately severe degree of hip or knee osteoarthritis (OA), we examined the effects of race, health beliefs (i.e., perceived benefits and risks of TJA) and clinical appropriateness of TJA on referral to orthopedic surgery.

Results—Sample included 255 (38%) African Americans and 421 (62%) whites; 523 (78%) patients with knee OA and 153 (22%) with hip OA. Subjects were 60% male, with a mean (± SD) age of 64 ± 9 years, a mean body mass index of 33.6 ± 8 kg/m^2, and a mean summary WOMAC score of 56 ± 14, suggesting moderately severe OA. At baseline, African Americans perceived fewer benefits and greater risk from TJA than whites. There were no significant racial group differences in the proportions of those deemed clinically appropriate for TJA. After controlling for potential confounders, clinical appropriateness (hazard ratio (HR) =1.95, 1.15-3.32, p=0.01) predicted referral to orthopedic surgery. Neither race (HR=1.30, 0.94-2.05, p=0.1) nor health beliefs (HR=1.0, p=0.5) were associated with referral status.

Conclusions—In this sample of primary care clinic patients, African Americans and whites were equally likely to be referred by their physicians to orthopedic surgery. Clinical appropriateness predicted future referral to orthopedic surgery and not race or TJA-specific health beliefs.

Introduction

Osteoarthritis (OA), the most common form of arthritis, accounts for as much disability and dependency in lower extremity functioning among the elderly as any disease(1;2). Treatment options are varied, and range from nonpharmacologic approaches (e.g. weight loss), and use of analgesic agents and nonsteroidal anti-inflammatory drugs for relief of symptoms, to total joint arthroplasty (TJA) for end-stage disease. Based on existing research evidence, TJA is a relatively safe and cost-effective treatment for alleviating pain and restoring physical function in patients who do not respond to nonsurgical therapies(3;4).

Despite these benefits, marked ethnic differences in the utilization of TJA are well documented. Over the past 15 years, numerous studies have reported that African Americans (AA) received TJA less often than whites(5-11). The reasons for these reported differences

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in utilization are likely multi-factorial and include patient-level factors (e.g., health beliefs), system-level factors (e.g., access to specialist care) and provider-level factors (e.g., physician biases)(12-14).

Because referral to an orthopedic surgeon is the chief means by which use of TJA is made available to OA patients, it is important to study the mechanisms of racial disparities that may be operating at the patient-primary care physician (PCP) level. As the medical "gatekeeper", PCPs have an important role in deciding when to refer a patient to an orthopedic surgeon for consideration of TJA. Before making such a decision, the PCP must take into consideration two sets of issues: patient preferences (i.e., beliefs regarding the benefits and risks of TJA) and the clinical appropriateness of the procedure. Based from two survey studies of PCP, physicians self-reported that clinically-relevant variables, and not race, were the main determinant in their decision to refer a 'hypothetical' patient to an orthopedic surgeon(15;16). Because a physician response to a hypothetical clinical scenario may differ from his actual practice when confronted with a similar problem in the clinic (17), we deemed it necessary to evaluate how clinically-relevant variables, race and health beliefs may influence referral for TJA. Determining predictors of referral to orthopedic surgeon is an important first step towards eliminating racial differences in the use of TJA.

In this longitudinal cohort study of 676 OA patients, we sought to identify baseline patient characteristics that predicted time to referral to an orthopedic surgeon. Consistent with the known disparities in health care use in different medical and surgical specialties(18), we hypothesized that AA would less likely be referred to orthopedic surgery for knee or hip OA than their white counterparts. Second, because we and others have previously reported that AA were less likely than whites to perceive the benefits of TJA and more likely to recognize barriers to TJA(19-21), we hypothesized that these racial differences in TJA-specific health beliefs would influence referral to orthopedic surgery. Finally, we hypothesized that clinical appropriateness to undergo TJA would be a stronger predictor of referral to orthopedic surgery than race.

MATERIALS AND METHODS

Design and Patient population

This was a 2-year prospective observational study designed to understand the reasons behind ethnic disparities in health care utilization among OA patients. Patients were enrolled from the primary care clinics of the Roudebush Veterans Affairs Medical Center (VAMC) and the Wishard Hospital. The Wishard Hospital is a county hospital with an established primary care network consisting of its primary care centers and 6 community health centers located in the neighborhoods throughout Indianapolis, Indiana. Approximately one-half mile from the county hospital, the Roudebush VAMC serves veterans from Indiana and surrounding states.

Initial identification of potential participants has been detailed elsewhere(19). To be eligible for this study, patients had to be ≥ 50 years of age, have radiographic evidence of osteoarthritis on the symptomatic joint, and have a Western Ontario and McMaster Universities (WOMAC) Osteoarthritis Index summary score ≥ 30. The WOMAC summary score ≥ 30 was chosen based on a previous study that demonstrated that the mean WOMAC summary score for knee OA patients undergoing preoperative evaluation for total knee arthroplasty was 27.6 ± 2.9(22). Notably, subjects were not required to meet specific radiographic criteria (e.g., Kellgren and Lawrence ≥ 3) for osteoarthritis. Patients who already underwent knee/hip TJA or who had already been referred to an orthopedic surgeon for their knee or hip pain were excluded.

Between March 1, 2003 and September 30, 2006, 1,478 consecutive patients with radiographic evidence of osteoarthritis were screened for the study. Seven hundred forty patients met the study eligibility criteria. Sixty-four patients (8.5%) declined to participate and 676 (91.4%) enrolled. After completion of baseline assessments, subjects received follow-up phone calls at month 12 and month 24 study anniversary dates to assess their arthritis-related management since study entry or since the last phone contact. The mean length of follow-up was 1.8 ± 0.6 years.

Study procedures, including written informed consent, were approved by the Indiana University Purdue University Indianapolis and Veteran Administration Institutional Review Boards.

Baseline Measures

Arthritis-related Health Belief Instrument (ASBI)—The arthritis-related health belief instrument is a 16-item tool with four scales(19;23;24):

1. *Perceived severity of arthritis*. This dimension refers to an individual's perception of the medical and social consequences of having arthritis or of not treating such a condition.
2. *Perceived susceptibility for arthritis to progress*. This dimension refers to an individual's subjective perception of the risk or vulnerability for arthritis to progress.
3. *Benefits of arthroplasty*. This dimension includes an individual's beliefs about the likelihood that getting TJA will lead to effective treatment of arthritis.
4. *Barriers/risks of arthroplasty*. Barriers are the potential negative aspects of TJA. These include cost, amount of time required, inconvenience, side effects, and degree of unpleasantness (painful, upsetting, difficult, etc.).

The 16 health belief items were measured on a five-point Likert scale with the following response options: strongly disagree (1), disagree (2), undecided (3), agree (4), and strongly agree (5). For each scale, a higher composite score indicates a heightened perception of the specific latent construct (i.e. *severity*, *susceptibility*, *benefits* and *barriers/risks*) being measured. Ang and colleagues have reported the Cronbach's alpha reliability estimates for each scale range from 0.7 to 0.8 (24;25). Factor analysis indicated that the dimensions of the ASBI are sufficiently distinct to be considered different beliefs (24;26). Establishment of factorial invariance of the ASBI lend further support for the use of the instrument in comparing mean scale scores between African Americans and Whites (24). The appendix lists the survey items for each of the four health belief scales.

Clinical Appropriateness of Total Joint Arthroplasty—At study entry, clinical appropriateness for TJA was obtained for each patient using an algorithm that included 5 variables: adequacy of medical management, WOMAC pain severity, WOMAC functional limitation, age (50 - 70 years or > 70 years), and medical comorbidity. Based on these 5 variables, the appropriateness algorithm classified each patient as appropriate, uncertain or inappropriate for TJA(27-29). *Appropriate* characterizes someone who is severely symptomatic (pain and functional limitation) despite adequate medical management, and is also healthy enough to withstand the stress of surgery. The appropriateness algorithm has been validated in at least 1500 OA patients, and studies have suggested a direct relationship between appropriateness and better health-related quality-of-life outcomes six months after TJA(30).

1. *Adequacy of medical management:* Drugs (acetaminophen, non-steroidal anti-inflammatory drugs, tramadol, and narcotic analgesics) and referrals to allied health specialists (physical therapy, occupational therapy, and nutrition) were abstracted from the electronic medical record (EMR) databases. Previous medical management was considered adequate if any of the following conditions were met within the 24-month period prior to study entry:

    a. Filled prescriptions for at least 3 different drugs (≥ 30 day supply) for hip or knee pain, or

    b. Filled prescriptions for 2 different drugs (≥ 30 day supply) and received a referral to one allied health specialist for hip/knee pain or weight reduction, or

    c. Filled a prescription for 1 drug (≥ 30 day supply) and received referrals to two or more allied health specialists.

If none of the conditions were met, previous medical management was considered inadequate.

2. *WOMAC disease severity:* Lower extremity OA disease severity was assessed using the WOMAC index, which includes 24 items that probe pain (score range 0–20), stiffness (score range 0–8), and functional limitation (score range 0–68). The WOMAC index has been extensively validated and shown to be a reliable and responsive instrument(31). Depending on the WOMAC scores, participants were classified as having mild, moderate or severe level of symptoms. For WOMAC pain, scores of 0-8, g9-14, and 15-20 correspond to mild, moderate and severe pain respectively. For WOMAC functional limitation, the severity levels are 0-22 (mild), 23-45 (moderate) and 46-68 (severe).

3. *Medical Comorbidity:* Medical comorbidity, which is an indicator of surgical risk, was assessed using the modified Deyo-Charlson comorbidity index(32;33). The index assigned nonzero weights to 19 conditions based on their risk of mortality(34;35). The weights can take on values of 1, 2, 3, or 6 and are then summed for each patient. The modified Deyo-Charlson comorbidity index has been shown to predict mortality in a cohort of community-dwelling older adults attending a large primary care practice(36). Depending on the total co morbidity score, participants in the study were classified either in the low (≤ 1) or high (≥ 2) surgical risk category at study entry. The relevant diagnoses were electronically abstracted from the medical record database.

Demographics—Age, gender, educational level, employment status, marital status and adequacy of financial situation (“Considering your regular household members’ income, would you say that you are....comfortable, just able to make ends meet, unable to make ends meet”) were assessed. Patients were asked to self identify their ethnicity. EMR abstractions provided information on height, weight, number and types of insurance coverage

Outcome Measures

The *primary* outcome was the length of time in months from study entry to orthopedic surgery referral by the PCP. The referral date and the reason for referral were abstracted from the EMR. For the purpose of the study, participants were considered ‘referred’ if the PCP filled out a consult specifically for consideration of TJA, or for treatment of hip or knee OA. We did not consider referrals that were made for reasons such as evaluation and treatment of joint instability (n=2), meniscal injury (n=1), fracture (n=4), avascular necrosis (n=0), joint injection (n=2) and arthroscopy (n=2). For this latter group of participants

(n=11), it is important to note that they were not excluded from the cohort, but that they were continued to being followed up until the end of the 2-year study or until they get referred back to orthopedic surgery for the appropriate reasons.

The *secondary* outcome was *self-reported* referral to an orthopedic surgeon as obtained by the research assistant during the month 12 or month 24 follow-up phone call interviews.
Statistical Analysis

Chi-square tests were used for all categorical variables and t-tests for continuous variables. Cox proportional hazard regression was used to model time to referral (in months) as abstracted from the EMR. All participants were captured in the EMR. Participants not referred were censored at the last completed phone interview, the two-year study anniversary date, or date of death, whichever came first. The months to referral time variable was available for all 676 participants, but 16 had missing values for some of the baseline variables. Thus, the Cox models were based upon 660 individuals. Three separate models were estimated in which the African-American indicator for race was entered first, followed by arthritis-related health beliefs and then by the clinical appropriateness indicators. All three models were controlled or adjusted for potential confounders including gender, education, adequacy of income, insurance coverage, recruitment site (county hospital vs. VA), index joint (hip vs. knee) and body mass index (BMI). With this approach, we were able to reduce or eliminate the confounding effects of demographic and health conditions to obtain an adjusted effect of race on time to referral. Additionally, interactions of race with arthritis-related health beliefs and with clinical appropriateness were examined.

As a secondary outcome, *self-reported* referral to orthopedic surgery was also examined using logistic regression. Self-report data were available for 609 participants and 7 of these had missing values at baseline. So, the logistic models were based upon 602 participants. Similar to the Cox regression models, we estimated three separate models and controlled for the potential confounders in each model.

RESULTS

Baseline Characteristics of the sample

The sample of 676 patients consisted of 255 (38%) AA and 421 (62%) whites; 523 (78%) had knee OA and 153 (22%) had hip OA. The mean age for the entire sample was 64.4 ± 9 years; 59% were males, 64% had ≤ high school education, 20% were employed (either full or part time) and 55% reported annual household income < $15,000. The mean summary WOMAC score was 56 ± 14, suggesting at least a moderately severe symptomatic OA. As seen in table 1, the two groups were similar with respect to educational attainment, employment status, insurance coverage, joint type, WOMAC-pain and function and status of clinical appropriateness. Compared with whites, AA were younger (62.6 ± 8.8 vs. 65.7 ± 10), had higher mean BMI (34.4 ± 8.4 vs. 33.1 ± 8.0) and fewer comorbid illnesses, and were more likely to be female (58% vs. 29%), report inadequate income (73.5% vs. 66.0%), and be recruited from county hospital-affiliated clinics (63.9% vs. 29.7%). Interestingly, fewer AA patients met the preset definition of having received ‘adequate’ medical management (22.8% vs. 37.5%). AA perceived less benefit (9.5 ± 2.4 vs. 10.1 ± 2.0) and greater risks (15.1 ± 3.7 vs. 14.1 ± 3.5) from TJA than whites, but did not differ in their perceptions of arthritis severity or susceptibility to progression.

Comparison of Subjects Based on Referral Status

Based on review of the medical records, there were 119 (17.6%) subjects who were referred by their PCP to orthopedic surgery during the follow-up period. The overall mean time from study entry to referral was 20.1 months (SD=7.2). Compared with the non-referred subjects,

referred subjects were more likely to be AA (50.4% vs. 35.0%), female (52.1% vs. 37.3%), younger (62.1 ± 8.7 vs. 65.0 ± 9.8) and recruited from the county hospital-affiliated primary care clinics (60.5% vs. 38.8%). As shown in table 2, of the socioeconomic status (SES) variables, only perceived adequacy of income was associated with referral status. Compared with subjects who were comfortable with their household income, subjects who were uncomfortable (i.e., “just able to make ends meet” or “unable to make ends”) were more likely to be referred (78.2% vs. 66.8%).

Clinically, the referred group had worse WOMAC pain (12.6 ± 3.5 vs. 11.4 ± 3.4) and function (42.2 ± 11.3 vs. 39.7 ± 10.5), higher BMI (35.7 ± 9.2 vs. 33.1 ± 7.9), and fewer comorbid conditions, and was more clinically appropriate for TJA (36.1% vs. 22.8%) at study entry than the non-referred group. Joint type and adequacy of medical management did not influence referral status. Compared with the non-referred subjects, referred subjects considered it more likely their arthritis would progress (18.1 ± 3.8 vs. 17.5 ± 3.5, p=0.08). However, the referred and non-referred group did not differ in terms of their perception of the benefits and risks of TJA or the perceived severity of arthritis.

Multivariate Predictors of Referral

After controlling for potential confounders, race did not predict referral to an orthopedic surgeon (table 3). None of the health beliefs measures predicted referral. As we expected, clinical appropriateness was an important predictor of referral. Compared to subjects who were ‘inappropriate’ for TJA at study entry, subjects who were ‘appropriate’ were (almost) twice as likely to be referred to orthopedic surgery. The only other variable that was associated with time to referral was recruitment site. Subjects recruited from the county hospital-affiliated clinics were more likely (HR= 2.7, 1.4-5.1, p=0.0026) than VA participants to be referred to orthopedic surgery. Gender (HR=0.6, 0.3-1.2), education (HR=1.2, 0.8-1.8), adequacy of income (HR=1.3, 0.8-2.1), insurance coverage (HR=0.9, 0.6-1.3), joint type (HR=0.9, 0.6-1.5) and body mass index (HR=1.0, 0.9-1.1) were not associated with future referral status. Moreover, the interactions of race with recruitment site (HR=0.8, 0.4-1.8, p=0.7), arthritis-related health beliefs (p= 0.11-0.82), and clinical appropriateness (HR=0.7, 0.2-1.9, p= 0.5) were not significant.

When self-reported referral was used as the outcome (table 4), the findings were similar to the primary analyses except that recruitment site was no longer significant (OR=1.2, 0.6-2.5, p=0.5). Being appropriate for TJA at study entry was still a significant predictor. Additionally, subjects who were classified as ‘uncertain’ were more likely than those who were ‘inappropriate’ to report that they had been referred to orthopedic surgery for their hip or knee OA.

DISCUSSION

In our sample of 676 primary care patients with moderately severe OA, race was not a predictor of the time to consult orthopedic surgery. Surprisingly, although African Americans perceived fewer benefits and recognized more barriers to TJA than whites, TJA health beliefs did not influence referral to orthopedic surgery. Moreover, clinical appropriateness of TJA at study entry was as an independent predictor of referral to surgery. Specifically, subjects who were clinically appropriate to undergo TJA were more likely to be referred to orthopedic surgery than subjects who were considered inappropriate for the procedure.

Contrary to our first hypothesis, we found no difference in rates of referral to orthopedic surgeon between AA and whites. There are several potential explanations for our null finding. First, the presence of racial differences (or lack thereof) in health care use depends

significantly on the state and the type of conditions being studied. For example, Skinner et al reported significantly lower rates of TJA among AA than whites in Atlanta, Georgia but not in Bronx, New York(37). While racial disparities exist in invasive cardiac care, others have found no difference in cancer screening procedures and diabetes care between AA and whites(18). Second, the lack of racial difference in referral rates could be because our study subjects were in equally accessible health care systems. Other authors have suggested that the provision of insurance coverage is a key pathway toward equalizing access to the health care system(38-41). Third, an increased PCP density in central Indiana may also explain our findings. Basu et al have reported that an increased PCP supply was associated with reductions in racial disparities in referral patterns for certain high cost surgical procedures for AA(42).

Similar to previous studies, AA patients in our sample perceived fewer benefits and greater risks from TJA than whites. Despite this, TJA-specific health beliefs were not shown to predict referral to orthopedic surgery. We postulate 3 potential reasons. First, the lack of association between health beliefs and referral status could be a reflection of poor communication between PCP and their AA patients. For instance, AA may not be adequately expressing their health beliefs regarding TJA during the clinic encounter, or the PCP may not be eliciting or listening to the concerns of their AA patients. Street et al have reported that miscommunication between providers' and patients' concerns about TJA were greater when patients were AA than whites(43). Second, although TJA-specific health belief did not influence referral to orthopedic surgeon, it may very well predict receipt of TJA. The role of health beliefs in the *actual* use of TJA deserves further scrutiny. Lastly, the Health Belief Model (HBM) - the theoretical basis of the arthritis-related health belief instrument- has been challenged by other experts in the field(44). Historically, the HBM is based upon the assumption that direct health concerns are the reasons for change. However, other studies have documented the importance of social or other motivating factors rather than health concerns as driving behavior change(45). Moreover, the HBM further assumes a rational basis of human behavior, which may not reflect the human experience in the real world where social, political and environmental factors can influence behavior(46).

Our study is the first longitudinal study to investigate TJA-specific health beliefs as potential predictor of referral to orthopedic surgeon. In a population-based cohort from Canada, Hawker et al have found that the strongest predictor of the time to first TJA was person's willingness to consider TJA (47). Although willingness has been linked to one's perceived risks and benefits of TJA (48), the lack of association between TJA-related health beliefs and surgical referral in the current study suggests that other factors that could affect willingness (e.g., knowing someone else who underwent a TJA and had a good or bad outcome and mistrust with health care provider) may explain why some individuals get surgery and others do not. Further study is needed to better understand the factors that impact willingness.

Furthermore, this is the first study to introduce the concept of clinical appropriateness in relation to the use of TJA. An appropriate procedure is one in which "the expected health benefit exceeds the expected negative consequences by a sufficiently wide margin that the procedure is worth doing, exclusive of cost"(49). In contrast to two previous prospective studies that showed symptom severity as predictor of later use of TJA (50;51), clinical appropriateness considers several clinically-related factors concurrently; thereby, capturing the complexities of 'real' life clinical situations. Clinical appropriateness has been effectively applied in other fields of health care including coronary revascularization, carotid endarterectomy, and renal transplantation amongst other procedures(52-54). In the context of disparity in the use of TJA, it was reassuring to note that clinical appropriateness and not sociodemographic factors predicted referral for surgery.

Surprisingly, the only other predictor we found to be significant was recruitment site. Subjects recruited from the Indianapolis VA had longer time to referral to orthopedic surgery than those recruited from the county-affiliated primary care clinics. Based on our personal communication with the local VA physicians, there was a 6-month waiting list to see an orthopedic surgeon that happened on multiple occasions during the study period. We speculate that the prolonged waiting time might have resulted in outsourcing of TJA to surgeons outside the VA health care system. If so, such referral would have not been captured by the VA electronic medical record, but only via self-report. Importantly, when we used self-report referral as the outcome measure, VA and non-VA patients were equally likely to have been referred to orthopedic surgery. Recruitment site was no longer associated with referral status.

Several limitations must be taken into account when interpreting the results of our study. First, the study took place in a narrow geographic distribution which can decrease the generalizability. Second, although we did not observe any differences in referral rates, racial disparities in the receipt of joint arthroplasty may still exist. Clearly, orthopedic surgery referral does not always result in joint replacement (e.g., for whatever reason, the patient did not show up for his/her orthopedic surgery appointment). However, because referral to orthopedic surgeon is the principal means by which use of TJA is made available to OA patients, we felt it necessary to determine predictors of referral as the first step towards identifying the reasons behind the racial disparities in TJA use. Third, we have no follow-up data on the actual receipt of TJA. Future studies should determine whether patient's health beliefs impact the use of TJA. Fourth, in our study, patients were considered to have been referred if the reason for consult was for joint arthroplasty, or for the treatment of knee or hip OA. For the latter reason, we assumed that evaluation for joint arthroplasty was the intended end point, which may not be entirely accurate. In an attempt to decrease the likelihood of including patients referred for reasons other than arthroplasty, we did not consider those referred for other indications. Finally, we have no data on dual users (i.e., someone who uses health services within and outside of the VA health care system), which could be a potential source of bias. The bias resulting from lack of data on dual users was likely minimal considering that our findings were similar whether we used referral data from the medical record or self-report from the participants.

In summary, in this cohort of primary care clinic patients with at least moderately severe knee or hip OA, AA and whites were equally likely to be referred to orthopedic surgeon for consideration of TJA. Health beliefs specific to the risks and benefits of TJA did not influence referral status. Importantly, clinical appropriateness was an independent predictor of referral. In the context of racial disparity in TJA use, future explanatory studies should prospectively follow OA patients from the time referrals are made to orthopedic surgeons. In particular, determining the reasons why patients would accept or decline TJA offered by the orthopedic surgeon, or why patients show up or not in the orthopedic clinic could potentially unravel the underlying mechanisms of the reported disparity in TJA use. Moreover, future studies should also examine the role of patient's trust, physician-patient connectedness and knowledge of someone who had undergone surgery as potential predictors of referral or use of TJA.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Appendix

Appendix

Arthritis-related Health Belief Scales

Perceived *benefits* of arthroplasty:
1. Joint replacement surgery would get rid of my joint pain.
2. Joint replacement surgery would allow me to do things that I like to do.
3. Joint replacement surgery will make me feel better.

Perceived *barriers* of arthroplasty:
1.The joint replacement surgery I am aware of is too risky and too time consuming.
2.I would have to change too many daily activities to undergo joint replacement surgery for my arthritis.
3.It is too inconvenient for me to get joint replacement surgery.
4.I would experience too much pain several weeks after joint replacement surgery.
5.To get joint replacement surgery would cause too much inconvenience to my immediate family members.

Perceived *severity* of arthritis:
1. My arthritis keeps me from doing things I want to do.
2. My arthritis limits my daily activities.
3. My arthritis interferes with my going to work or school.

Perceived *susceptibility* of arthritis to get worse:
1. Due to the condition of my physical health, my arthritis is likely to get worse.
2. My chances that my arthritis will get worse are great.
3. Within the next year my arthritis will get worse.
4. I worry a lot about my arthritis getting worse.
5. It worries me to think about the effect my arthritis will have on my health.

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Table 1

Baseline Characteristics Comparing African Americans and Whites

Variables	African Americans (n=255)	Whites (n=421)	P-value
Demographics			
Age, yrs *(M±SD)*	62.6 (8.8)	65.7 (10.0)	<0.0001
Gender (% female)	58.0	29.0	<0.0001
Education (% ≤ 12 yrs)	63.5	64.6	0.7
Adequacy of income (% uncomfortable)	73.5	66.0	0.04
Employment status (% employed)	19.6	20.0	0.9
Insurance coverage (% ≥ 2 sources)	50.6	49.8	0.8
Recruitment site (% county hospital)	63.9	29.7	<0.0001
Clinical Factors			
Body mass index, kg/m^2 *(M±SD)*	34.4 (8.4)	33.1 (8.0)	0.03
Index joint (% knee)	80.0	75.8	0.2
Comorbidity index (%)			0.04
≥2	25	33	
≤1	75	67	
Knee/hip pain* *(M±SD)*	11.8 (3.4)	11.5 (3.5)	0.2
Lower extremity function* *(M±SD)*	40.0 (11.1)	40.3 (10.4)	0.7
Medical management adequate (%)	22.8	37.5	<0.0001
TJA appropriateness (%)			0.4
Appropriate	25.2	25.2	
Uncertain	46.8	42.7	
Inappropriate	28.0	32.1	
Health Beliefs			
Benefits of TJA† *(M±SD)*	9.5 (2.4)	10.1 (2.0)	0.001
Barriers/risks from TJA† *(M±SD)*	15.1 (3.7)	14.1 (3.5)	0.0006
Perceived severity of OA† *(M±SD)*	10.9 (2.6)	10.9 (2.6)	0.9
Perceived susceptibility to OA progression† *(M±SD)*	17.7 (3.8)	17.6 (3.4)	0.5

Abbreviations: OA = osteoarthritis; TJA = total joint arthroplasty; VA = Veterans Administration

*From the Western Ontario and McMaster Universities Osteoarthritis Index, ranges for the scales are 0-20 for pain and 0-68 for function; greater scores indicate more severe pain/dysfunction

†From the Arthritis-Related Health Belief Instrument; greater scores indicating heightened perception of the target construct.

Table 2

Relationship between Baseline Variables and Referral Status (medical record)

Variables	Referred to Orthopedic Surgery (n=119)	Not referred to Orthopedic Surgery (n=557)	P-value
Demographics			
Race (%)			0.001
African Americans	50.4	35.0	
White	49.6	65.0	
Age, yrs *(M±SD)*	62.1 (8.7)	65.0 (9.8)	0.002
Gender (%)			0.002
Female	52.1	37.3	
Male	47.9	62.7	
Education (%)			0.8
≤ 12 yrs	64.7	64.1	
> 12 yrs	35.3	35.9	
Adequacy of income (%)			0.01
Uncomfortable	78.2	66.8	
Comfortable	21.9	33.2	
Employment status (%)			0.7
Employed	21.0	19.6	
Not employed	79.0	80.4	
Insurance coverage (%)			0.4
≥2 sources	47	51	
≤1 sources	53	49	
Recruitment site (%)			<0.0001
County hospital-affiliated	60.5	38.8	
VA	39.5	61.2	
Clinical Factors			
Body mass index, kg/m^2 *(M±SD)*	35.7 (9.2)	33.1 (7.9)	0.006
Index joint (% knee)	80.7	76.7	0.3
Comorbidity index (%)†			<0.0003
≥2	16	33	
≤1	84	67	
Knee/hip pain* *(M±SD)*	12.6 (3.5)	11.4 (3.4)	0.0006
Lower extremity function* *(M±SD)*	42.2 (11.3)	39.7 (10.5)	0.02
Medical management adequate (%)	34.5	31.4	0.5
TJA appropriateness (%)			0.003
Appropriate	36.1	22.8	
Uncertain	42.9	44.5	
Inappropriate	21.0	32.7	
Health Beliefs			
Benefits of TJA† *(M±SD)*	10.0 (2.4)	9.8 (2.2)	0.3

Variables	Referred to Orthopedic Surgery (n=119)	Not referred to Orthopedic Surgery (n=557)	P-value
Barriers/risks from TJA† *(M±SD)*	14.3 (4.1)	14.5 (3.5)	0.6
Perceived severity of OA† *(M±SD)*	11.2 (2.6)	10.8 (2.6)	0.1
Perceived susceptibility to OA progression† *(M±SD)*	18.1 (3.8)	17.5 (3.5)	0.08

Abbreviations: OA = osteoarthritis; TJA = total joint arthroplasty; VA = Veterans Administration

* From the Western Ontario and McMaster Universities Osteoarthritis Index, ranges for the scales are 0-20 for pain and 0-68 for function; greater scores indicate more severe pain/dysfunction

† From the Arthritis-Related Health Belief Instrument; greater scores indicating heightened perception of the target construct.

Table 3

Predictors of Referral (medical record) to Orthopedic Surgeon

	Referral status (Hazard ratios/HR)	P values
Model 1 †		
African Americans§	1.36 (0.93,2.00)	0.11
Model 2 †		
African Americans§	1.41 (0.96,2.07)	0.08
Arthritis-specific health beliefs		
Perceived benefits of arthroplasty	1.05 (0.97,1.15)	0.2
Perceived risks of arthroplasty	0.98 (0.93,1.04)	0.5
Perceived severity of arthritis	1.03 (0.94,1.12)	0.5
Perceived susceptibility of arthritis to get worse	1.01 (0.95,1.08)	0.6
Model 3 †		
African Americans§	1.39 (0.94,2.05)	0.1
Arthritis-specific health beliefs		
Perceived benefits of arthroplasty	1.05 (0.96,1.15)	0.2
Perceived risks of arthroplasty	0.99 (0.94,1.05)	0.6
Perceived severity of arthritis	1.01 (0.93,1.10)	0.7
Perceived susceptibility of arthritis to get worse	1.00 (0.94,1.07)	0.9
Clinical appropriateness		
Appropriate‡	1.95 (1.15,3.32)	0.01*
Uncertain‡	1.28 (0.78,2.09)	0.3

† Controlled for potential confounders including gender, education, adequacy of income, insurance coverage, recruitment site (county hospital-affiliated vs. VA-affiliated clinics), symptomatic joint (hip vs. knee) and body mass index

§ Reference group: Whites

‡ Reference group: inappropriate

Table 4

Predictors of Referral (self-report) to Orthopedic Surgeon

	Referral status (Odds ratios/OR)	P values
Model 1 †		
African Americans§	1.30 (0.89,1.91)	0.16
Model 2 †		
African Americans§	1.35 (0.92,1.99)	0.12
Arthritis-specific health beliefs		
Perceived benefits of arthroplasty	1.03 (0.94,1.13)	0.4
Perceived risks of arthroplasty	0.97 (0.92,1.03)	0.3
Perceived severity of arthritis	0.99 (0.91,1.07)	0.7
Perceived susceptibility of arthritis to get worse	1.04 (0.98,1.10)	0.2
Model 3 †		
African Americans§	1.35 (0.92,1.98)	0.12
Arthritis-specific health beliefs		
Perceived benefits of arthroplasty	1.03 (0.94,1.12)	0.5
Perceived risks of arthroplasty	0.98 (0.93,1.03)	0.4
Perceived severity of arthritis	0.98 (0.90,1.06)	0.5
Perceived susceptibility of arthritis to get worse	1.03 (0.97,1.09)	0.3
Clinical appropriateness		
Appropriate‡	1.96 (1.17,3.28)	0.01*
Uncertain‡	1.57 (1.01,2.46)	0.04*

†Controlled for potential confounders including gender, education, adequacy of income, insurance coverage, recruitment sites (county hospital-affiliated vs. VA-affiliated clinics), symptomatic joint (hip vs. knee) and body mass index

§Reference group: Whites

‡Reference group: inappropriate