Is There a Difference in the Perception of Symptoms Between African Americans and Whites with Osteoarthritis?

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ABSTRACT. ***Objective.*** To determine if there is a difference in the perception of pain and functional disability between African Americans and Whites at any given radiographic severity of osteoarthritis (OA). Ethnic differences in utilization of joint replacement may reflect differences in the perception of symptoms of OA.

Methods. A cross-sectional survey included 596 male veterans (44% African Americans and 56% Whites) with chronic moderate to severe knee and/or hip pain at the General Medicine Clinics. The average age of the total cohort was 65.63 ± 9.5 years. The Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) for pain and function were the primary outcome measures of interest. All knee and or hip radiographs were graded using the Kellgren-Lawrence (K/L) grading system.

Results. African Americans and Whites were comparable with respect to age (65 ± 9.5 vs 66 ± 9, respectively); body mass index ≥ 30 kg/m^2 (53.9% vs 58.8%); Lequesne severity score (11 ± 4 vs 11 ± 4); geriatric depression score (4.5 ± 3.3 vs 5.0 ± 3.8) and Charlson Comorbidity Index (2.3 ± 2 vs 2.5 ± 2). African Americans had lower socioeconomic status with fewer high school graduates (57% vs 71%, p = 0.001), lower employment rate (8.4% vs 14.7%, p = 0.017), and lower total household incomes (41.4% vs 20.4% reported income < \$10,000, p = 0.000). African Americans and Whites were not different in mean scores for WOMAC pain and WOMAC function when stratified by joint space narrowing, osteophyte and Kellgren Lawrence grades. After controlling for important covariates, ethnicity was not a significant predictor of WOMAC pain and function.

Conclusion. In this sample of male veterans, African Americans and Whites perceived the same degree of pain and functional difficulties at any given radiographic severity of OA. Differences in the perception of symptoms cannot explain the observed ethnic disparity in utilization of joint replacement. (J Rheumatol 2003;30:1305–10)

Key Indexing Terms:
OSTEOARTHRITIS   JOINT ARTHROPLASTY   ETHNICITY   HEALTH SERVICE

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Although the benefits of total joint replacement have been well documented, there are marked ethnic differences in the utilization rates of this procedure[1-4]. Previous studies have largely focused on differences in utilization rates. Only recently have we started to explore the reasons for this disparity.

The underlying reasons for ethnic variations in the utilization of joint replacement are likely multifactorial. Possible explanations include ethnic differences in preferences for aggressive treatment, beliefs in the benefits and expectations of outcome following an invasive procedure, supplemental insurance coverage, care-seeking behavior, risk aversion, willingness to undergo surgery, interactions with the health care provider and finally, physician biases[5-13]. An alternative explanation that merits further investigation is that there may be biological differences in clinical severity.

Pain and functional disability are cardinal symptoms of

patients with osteoarthritis (OA). It is considered reasonable that patients having severe symptomatic OA with pain that has failed to respond to medical therapy, and who have progressive limitation in activities of daily living, should be considered for evaluation for joint replacement. Complaints of pain and disability by the patient can be influenced by numerous factors, and differences in symptom reporting can potentially affect the use of joint replacement procedure. A person's experiences, beliefs, and attitudes are derived from growing up within a particular social community and may affect one's reported perception of chronic symptoms, such as pain[14-16]. Although these culturally-acquired patterns may influence the neurophysiological processing of nociceptive information, as well as psychological, functional, and verbal responses to pain, the influence of cultural variables on patient symptom perception has been understudied.

Since the radiographic severity of OA and patients' perception of symptoms are the prime determinants of disease severity and strongly influence surgical decision making for both knee and hip OA[17-19], we hypothesized that ethnic variation in symptom perception (i.e., pain and function) exist between African Americans and Whites at any given level of radiographic severity of OA. Our objective was to determine if there is a difference in the perception of pain and functional disability between African Americans and Whites when stratified by radiographic severity of OA.

MATERIALS AND METHODS

Study setting. Our study was conducted at the Louis Stokes Department of Veterans Affairs Medical Center, Cleveland, Ohio and was approved by the Human Subjects Subcommittee.

Data collection. Potential participants were identified at the General Medicine clinics using a series of questions to determine the presence of knee or hip pain, its severity, and its interference with daily functioning. Trained interviewers asked patients 2 screening questions from the Arthritis Supplement National Health and Nutrition Examination Survey 1 (NHANES I)[20]: Have you ever had pain in and around your knee/hip on most days for at least one month? and Over the past month, have you had pain in your knee/hip when walking or standing on at least half of the days? Patients who responded affirmatively to either of the questions were categorized as having current or past knee/hip pain. Patients were eligible if they identified themselves as either White or African-American, were over 50 years of age, and reported a history of hip or knee pain of at least moderate severity as measured by the Lequesne OA Severity Index[21]. Severity was rated on a scale from 0 to 24 for hip pain and 0 to 22 for knee pain. This validated index includes questions pertaining to night pain, morning stiffness, pain with standing, pain with walking, pain with sitting, walking distance, and 3 knee or 4 hip specific activities of daily living.

Radiographic evaluation of the more symptomatic joint (hip or knee) was obtained to aid in the confirmation of the diagnosis of hip or knee OA. For participants with equally symptomatic bilateral knees/or hips (n = 102), the readings of the joint with more severe evidence of OA were included in the analysis. Patients who had not had a radiograph of the symptomatic hip or knee within the past year underwent a standard radiograph. For patients with symptoms of knee pain, one weight bearing anterior-posterior view of both knees was taken. For patients with symptoms of hip pain, one anterior-posterior view of the pelvis that included both hips was taken.

All knee and hip radiographs were blindly read (DA) and graded using the Kellgren-Lawrence grading system[22]. This grading system has been used extensively in epidemiological research in OA and has good reproducibility[23,24]. It combines the appearance of osteophyte, joint space narrowing, sclerosis, and cysts into a global score from 0 to 4 for each joint[25].

We also utilized the Atlas of Standard Radiographs[26] as the basis of grading the severity of the individual radiographic features of OA to improve reproducibility. Osteophytes were graded from 0 to 3 with 0 = none, 1 = minute or possible osteophytes, 2 = definite, and 3 = large; for joint space narrowing (0-3) they were rated as 0 = none, 1 = mild, 2 = moderate or definite, and 3 = severe or marked. Sclerosis and cyst were both classified as 0 = absent and 1 = present.

Apart from the Kellgren Lawrence grading, the severity of the individual radiographic features was used to classify OA as well.

Major outcome measures. The Western Ontario and McMaster Universities OA Index (WOMAC)[27] is a tridimensional, disease specific, self-administered, health status measure consisting of clinically important, patient relevant symptoms in the areas of pain, stiffness, and physical function designed specifically for patients with OA of the hip or knee. WOMAC-pain and WOMAC-function were used separately as primary outcome measures. The original scores of WOMAC-pain (0 to 20) and function (0 to 68) were transposed to a 0 to 100 range. It has been shown from previous study that a 10-point difference in WOMAC is considered clinically meaningful to patients with hip and knee OA[28].

Covariates. Patient information gathered through an interviewer-administered questionnaire included age, education, total household income, employment, marital status, and body mass index (BMI).

The geriatric depression scale (GDS) was used for screening depression in the elderly. Scores from 0 to 4 are considered normal; 5 to 9 indicate mild depression; and 10 to 15 indicate moderate to severe depression[29-31].

The Charlson comorbidity count[32] was used to assess the presence of 13 other significant medical conditions (based on a review of patients' medical records).

Data analysis. Descriptive statistics were calculated for the demographic, clinical, and psychosocial characteristics of the sample. The significance of differences in means between the 2 ethnic groups was assessed using the Student's t test, and the significance of differences in proportions was tested using chi-square statistic. The Spearman correlation was used to assess the correlation between radiographic severity and patients' reported symptoms by ethnic group. The analysis of the ethnic differences in patients' perception of their symptoms (i.e., pain and function) was stratified by Kellgren-Lawrence grade, and by the severity of the individual radiographic features of OA (i.e., osteophyte and joint space narrowing).

To assess effect modification, we ran a stratified analysis of the association of ethnicity and patients' symptoms according to specific demographic and clinical covariates.

To detect a clinically meaningful 10-point difference in both WOMAC-pain and function, 55 participants per ethnic group for each level of severity of radiographic OA (2 tailed alpha = 0.05) were required to achieve 80% power. Sample size was derived using a variance of 4.24 from prior literature[28].

Multiple linear regressions were used to estimate the effect of ethnicity on WOMAC-pain and WOMAC-function scores, adjusting for the following variables: age, education, income, employment, marital status, BMI, Lequesne severity index, GDS, and Charlson comorbidity index. The significance of the interaction of ethnicity and radiographic severity was examined. We also examined issues with collinearity among the socioeconomic variables in our final model.

After the initial assessment of the severity of the individual radiographic features of OA, 60 films were reevaluated 2 weeks later to assess intra-rater reliability. There was good agreement between the 2 readings with kappa statistics of 0.69. A second reader independently reread 60 radiographs and had good inter-rater reliability (kappa statistics = 0.57). Both the intra- and inter-rater Kappa values were similar to previous reports[23,24]. Only the reading of the primary reader (DA) was used in the final analysis

because the second reader evaluated only a small fraction (10%) of the entire collection of joint radiographs. Readings were performed blinded to the other data on the participants.

All p values were 2-tailed and values ≤ 0.05 were considered to indicate statistical significance. Confidence intervals (CI) were calculated at the 95% level.

RESULTS

Study sample. A total of 776 patients met the enrollment criteria, with 737 consenting to participate. The first 596 who completed the structured interview were included in the analysis. Only 558 patients had joint films available for reading. The remaining 38 were either lost, moved to another facility, or were not taken. Patients whose films were unavailable were not significantly different in their demographic and clinical variables from the rest of the study cohort (data not shown).

Demographic and clinical characteristics. The sample was 44% African Americans (n = 262) and 56% Whites (n = 334). The average age of the total cohort was 65.63 ± 9.5 years. Most participants had low incomes, with more than 25% reporting a total household income of less than $10,000, and 78% reported their highest level of education to be high school graduate or less.

As indicated in Table 1, African Americans and Whites were comparable with respect to the following variables: age (65 ± 9.5 vs 66 ± 9, respectively); BMI ≥ 30 (53.9% vs 58.8%); Lequesne severity score (11 ± 4 vs 11 ± 4); bilateral knee or hip pains (15.4% vs 17.0%); GDS (4.5 ± 3.3 vs 5.0 ± 3.8) and Charlson Comorbidity Index (2.3 ± 2 vs 2.5 ± 2). African Americans had lower socioeconomic status, with fewer high school graduates (57% vs 71%, p = 0.001), lower employment rate (8.4% vs 14.7%, p = 0.017), and lower total household incomes (41.4% vs 20.4% reported income < $10,000, p = 0.001).

Ethnicity and radiographic OA severity. As indicated in Tables 2 and 3, there were no significant associations between ethnicity and the radiographic features (i.e., osteophytes, joint space narrowing, or Kellgren Lawrence grade) of OA in either the hip or the knee joint. There was a trend towards a relationship between ethnicity and osteophyte size when we combined the hip and knee OA cohorts, with African Americans having a higher percentage of definite to large size osteophytes compared to Whites (36.1% vs 28.9%; p = 0.08).

Ethnicity and WOMAC-pain and function. African Americans and Whites had similar mean scores for WOMAC-pain (46.75 ± 18.49 vs 45.87 ± 18.13) and WOMAC-function (49.23 ± 19.23 vs 47.82 ± 19.98) on univariate analysis. Similarly, there were no ethnic differ-

Table 1. Demographic and clinical characteristics by ethnicity. Scores represent means ± standard deviations.

Variable (n = 596)	African American (44%)	White (56%)
Age	65 ± 9.5	66 ± 9
Education* (%)		
< High school (HS)	42.6	29.0
HS graduate or above	57.4	71.0
Total household income* (%)		
< $ 10,000	41.4	20.4
$ 10,000–$ 14,999	28.5	30.6
$ 15,000–$ 29,999	20.1	36.3
$ 30,000 and above	10.0	12.7
Employed* (%)	8.4	14.7
Married* (%)	39.2	55.6
Body Mass Index, kg/m^2 (%)		
< 25	13.5	9.7
25 to < 30	32.7	31.5
30 to < 40	42.7	46.1
≥ 40	11.2	12.7
Lequesne osteoarthritis severity score	11 ± 4	11 ± 4
Bilateral hip or knee pain (%)	15.4	17.0
Geriatric Depression Score	4.5 ± 3.3	5.0 ± 3.8
Charlson Comorbidity Index	2.3 ± 2	2.5 ± 2

* Comparison between African American and Whites, p < 0.01

Table 2. Radiographic severity (hip) by ethnicity.

Radiographic Grading	African American, % (n)	White, % (n)
Kellgren Lawrence		
K/L = 0 (normal)	16.3 (14)	20.0 (23)
K/L = 1 (questionable)	12.8 (11)	20.9 (24)
K/L = 2 (moderate)	51.2 (44)	45.2 (52)
K/L = 3/4 (severe)*	19.8 (17)	13.9 (16)
Osteophytes		
None to small	44.2 (38)	50.4 (58)
Definite to large	55.8 (48)	49.6 (57)
Joint space narrowing		
None	53.5 (46)	61.7 (71)
Mild	33.7 (29)	32.2 (37)
Moderate-severe	12.8 (11)	6.1 (7)

* Original Kellgren Lawrence grades 3 and 4 were combined due to small numbers for these groups.

Table 3. Radiographic severity (knee) by ethnicity.

Radiographic Grading	African American, % (n)	White, % (n)
Kellgren Lawrence		
K/L = 0 (normal)	23.1 (34)	21.5 (40)
K/L = 1 (questionable)	37.4 (55)	39.8 (74)
K/L = 2 (moderate)	16.3 (24)	16.7 (31)
K/L = 3/4 (severe)*	23.1 (34)	22.0 (41)
Osteophytes		
None to small	75.5 (111)	83.9 (156)
Definite to large	24.5 (36)	16.1 (30)
Joint space narrowing		
None	26.5 (39)	23.7 (44)
Mild	40.1 (59)	34.4 (64)
Moderate-severe	33.3 (49)	41.9 (78)

* Original Kellgren Lawrence grades 3 and 4 were combined due to small numbers for these groups.

ences in mean WOMAC-pain and WOMAC-function scores when either the hip or knee OA was analyzed separately. Variables found to be associated with higher WOMAC-pain scores were: age 50-55, < high school graduate, and higher depression score (p < 0.05). Higher depression score and BMI were related to poor WOMAC-function (p < 0.05). As expected, Lequesne score ≥ 11 was associated with higher WOMAC-pain and function scores (p = 0.0005).

To assess for effect modification, the relationship of ethnicity and WOMAC-pain/function were stratified according to specific demographic and clinical variables. We found no clinically meaningful (10 points) difference in the mean WOMAC scores of African Americans and Whites within the subcategory of each covariate (i.e., age, education, BMI, Lequesne severity index, and GDS) (data not shown).

Stratified analysis based on the severity of radiographic OA. As indicated in Table 4, African Americans and Whites were not different in mean scores for WOMAC-pain and WOMAC-function when stratified by joint space

narrowing, osteophytes, or Kellgren Lawrence grades. There was a trend toward higher pain perception among African Americans compared to Whites (50.88 ± 17.70 vs 46.14 ± 17.20) within Kellgren Lawrence 2, but this did not reach statistical significance (p = 0.09).

Multivariate analysis. After controlling for important covariates (i.e., age, education, income, employment, marital status, BMI, Lequesne severity index, GDS, Charlson comorbidity index, and radiographic variables), ethnicity was not a significant predictor of WOMAC-pain or function. The interactions of ethnicity with the 3 radiographic variables were non-significant. Education (standardized beta: –0.107, p = 0.018) and depression (standardized beta: 0.188, p < 0.0005) remained important predictors of pain after backward elimination; while depression (standardized beta: 0.298, p < 0.0005) and BMI (standardized beta: 0.104, p = 0.025) emerged as important predictors for function. The final model without the interaction terms revealed no problem with collinearity.

DISCUSSION

In this cross-sectional survey of elderly male veterans with chronic knee or hip complaints, African Americans and Whites perceived the same degree of pain and functional difficulties at each strata of radiographic severity of OA. Similarly, there was no ethnic difference in the perception of symptoms regardless of clinical OA severity as defined by Lequesne index. After controlling for other covariates, depression was an important co-factor associated with increased pain and worse function. Finally, higher BMI translated to poor daily function in the multivariate analysis.

Previous studies have reported similar findings. In the Johnston County Osteoarthritis Project, Jordan and colleagues noted no significant difference in proportions of African Americans and Whites reporting difficulty performing tasks of basic and instrumental activities of daily living[16]. Coulton and others reported that pain and overall physical disability as measured by the Arthritis Impact Measurement Scales (AIMS) were the same for African Americans, Whites, and Hispanics in a study of patients with self-reported joint symptoms[33]. Lopez-Mendez and co-workers also reported similar levels of disability among African Americans and Whites with rheumatoid arthritis with the use of Health Assessment Questionnaire (HAQ) disability or pain scores[34].

The major difference between our study and prior works is the examination of a stratified analysis, comparing pain and function between the 2 ethnic groups within each level of severity of OA as defined by radiographs. Since patients' perception of pain and function strongly influences decision making for joint replacement in both knee and hip OA, the presence of ethnic difference in symptom reporting at any given level of radiographic severity could potentially lead to ethnic disparity in procedure rates. Our null finding argues

Table 4. Ethnicity with WOMAC-pain and function stratified by the severity of radiographic osteoarthritis. WOMAC-pain and function standardized from from 0 to 100.

	WOMAC-Pain Mean ± SD	WOMAC-Function Mean ± SD
Kellgren Lawrence (K/L) grades		
K/L = 3		
AA	45.70 ± 18.18	50.83 ± 18.68
W	49.01 ± 21.07	53.40 ± 18.47
K/L = 2		
AA	50.88 ± 17.70*	51.87 ± 18.66
W	46.14 ± 17.20	48.64 ± 18.91
K/L = 1		
AA	46.46 ± 19.07	49.48 ± 18.86
W	44.53 ± 18.45	46.69 ± 19.91
K/L = 0		
AA	43.93 ± 17.99	43.91 ± 21.22
W	45.48 ± 16.41	43.30 ± 20.55
Osteophytes		
Definite to large		
AA	48.79 ± 18.27	52.77 ± 17.18
W	48.66 ± 20.22	52.81 ± 19.56
None to small		
AA	46.12 ± 18.35	47.38 ± 20.31
W	44.95 ± 17.26	45.75 ± 19.41
Joint space narrowing (JSN)		
Moderate-severe		
AA	47.37 ± 18.57	53.26 ± 19.55
W	46.66 ± 20.62	50.12 ± 19.16
Mild		
AA	47.35 ± 18.67	48.17 ± 18.57
W	44.80 ± 16.88	47.32 ± 18.70
None		
AA	46.60 ± 18.00	47.84 ± 19.89
W	46.65 ± 17.54	46.50 ± 20.90

AA: African Americans; W: Whites. * p = 0.09.

against differences in eligibility for surgery as a factor to explain ethnic differences in health care utilization, however.

We also found an association of depression with pain and disability similar to previous reports in the OA literature. Both cognitive and behavioral mechanisms have been proposed to account for these associations[35,36].

Our study is important because it provides evidence that African Americans have the same indications to undergo joint replacement as Whites on the basis of perceived symptoms at any given radiographic severity of OA. Whether or not a patient receives joint replacement is an interplay of their values and cultural beliefs in addition to their interaction with the health care system. Difference in clinical disease severity as defined by patient's perception of symptoms seems less likely to play a role in the observed ethnic disparity in the use of joint replacement.

Our research has some limitations, and our results should be interpreted within the context of these limitations. Given the complexities in the classification of ethnicity, we are not able to capture more specific ethnic/cultural characteristics that may influence the perception of pain and function.

There is striking evidence in OA that the amount of joint destruction, as measured by radiology, correlates very poorly with the amount of pain and functional impairment reported by the patient[37-40]. Not surprisingly, we found no significant difference in the perception of symptoms, regardless of ethnicity, at any given radiographic severity of OA.

Although the Kellgren Lawrence system has provided the basis for much of our current understanding about the epidemiology of OA, several limitations of the grading system are worth mentioning. These include inconsistencies in the descriptions of radiographic features of OA, the relatively high degree of between observer variation, the prominence assigned to the osteophyte at all sites, and the unproven assumption that the grades correspond to stages in the development of disease[39,41]. In our study, the use of the Kellgren Lawrence grading system to classify OA may not be sufficiently sensitive or discriminant to detect ethnic disparity in the perception of symptoms. Previous works have suggested that the individual radiographic features of OA correlate better with patient's symptoms[23,24,42]. As a consequence, we also utilized joint space narrowing and osteophyte severity to classify knee or hip OA in this study.

Another bias inherent in our study design was the exclusion of patients with mildly symptomatic OA. It is possible that ethnic differences in symptom perception exist in this subgroup of patients. We excluded the mildly symptomatic OA at screening since they are unlikely to be referred or even be considered for joint replacement surgery.

Radiographs for some of the participants were not originally intended for this research and, therefore, the degree of adherence to precise guidelines on patient positioning and radiographic technique may not be optimum. Since all the radiographs were done in a single radiology department following one standard operating procedure for doing hip/knee films, we expect this type of bias to be at a minimum, however.

Confounding may also explain the null results. Ethnic differences in level of anxiety and life stresses may distort the true relationship between ethnicity and WOMAC scores. Unfortunately, we did not assess either of these 2 important psychological determinants of pain and function. Since participants were required to choose the most symptomatic knee or hip, we do not have data pertaining to the presence of combined hip and knee OA. In addition, since there was not a specific question on concomitant patello-femoral disease, we were not able to determine the effect of this component on the perception of symptoms.

Further, our results include patients from only one VA hospital and only male participants with chronic hip or knee pain of at least moderate severity. Prior studies have demonstrated gender differences in the reporting of physical symptoms[43,44]. To improve the validity and generalizability of our conclusion, this study needs to be replicated in other primary care settings that include both genders.

Since the prevalence of OA of the knee and hip are at least as great in African-Americans as in Whites[45-47], other considerations, such as differing physicians' perception on the value and indication for joint replacement, systematic variation in the way providers communicate treatment options, negative patient experiences elsewhere in the health care system, and physician personal biases all need to be evaluated as possible explanations for the ethnic disparity in the utilization of joint replacement.

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