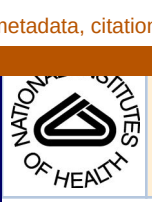

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Occurrence of Radiographic Osteoarthritis of the Knee and Hip Among African Americans and Whites: A Population-Based Prospective Cohort Study

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Abstract

Objective—To compare the incidence and progression of radiographic osteoarthritis (OA) in the knee and hip among African Americans and whites.

Methods—Using the joint as the unit of analysis, we analyzed data from the Johnston County Osteoarthritis Project, a population-based prospective cohort study in rural North Carolina. Baseline and followup assessments were 3–13 years apart. Assessments included standard knee and hip radiographs read for Kellgren/Lawrence (K/L) radiographic grade. Weighted analyses controlled for age, sex, body mass index, level of education, and baseline K/L grade; bootstrap methods adjusted for lack of independence between left and right joints. Time-to-event analysis was used to analyze the data.

Results—For radiographic knee OA, being African American had no association with incidence (adjusted hazard ratio [HR_{adj}] 0.80, 95% confidence interval [95% CI] 0.53–1.22), but had a positive association with progression (HR_{adj} 1.67, 95% CI 1.05–2.67). For radiographic hip OA, African Americans had a significantly lower incidence (HR_{adj} 0.44, 95% CI 0.27–0.71), whereas

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AUTHOR CONTRIBUTIONS

All authors were involved in drafting the article or revising it critically for important intellectual content, and all authors approved the final version to be published. Dr. Kopec had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

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the association with progression was positive but nonsignificant (HR_{adj} 1.46, 95% CI 0.53–4.01). In sensitivity analyses, the association with hip OA incidence was robust to a wide range of assumptions.

Conclusion—African Americans are protected against incident hip OA, but may be more susceptible to progressive knee OA.

INTRODUCTION

Osteoarthritis (OA) is a highly prevalent form of arthritis affecting 10–20% of the adult population in North America (1,2). OA is often found in large weight-bearing joints, such as the knees and hips, and is associated with significant pain and disability (2,3). Being strongly related to age, OA presents an increasing burden as the population ages (4,5). Although a large number of potential risk factors for incident radiographic knee or hip OA have been studied, the role of race or ethnicity has not been well delineated. Most of the published studies are limited by their cross-sectional design, and even then, some results are conflicting (1,2,6,7).

For radiographic knee OA, several studies in the US showed a higher prevalence in African Americans, especially among women (6 –12), but data on the effect of race on incidence and progression are limited. For radiographic hip OA, relatively few studies looked at the prevalence according to race. Earlier studies suggested a relatively low prevalence of radiographic hip OA among blacks in Africa and the Caribbean (13,14); however, these results have not been confirmed in studies directly comparing African Americans and whites in the US (7,11,15).

Other observations suggest that factors related to race may well play a role in facets of OA epidemiology. The prevalence of hip OA (but not knee OA) is very low in Chinese (16). African Americans have lower rates of joint replacement than whites (17,18). The purpose of our study was to compare the incidence and progression of radiographic knee and hip OA in African Americans and whites.

PATIENTS AND METHODS

Data collection

We used population-based prospective cohort data from the Johnston County Osteoarthritis Project (6,7) in rural North Carolina. The probability-based sample was designed to be representative of the civilian, noninstitutionalized, African American or white population of Johnston County. Data were collected on a probability-based sample of participants ages ≥45 years who were residents of 6 townships in North Carolina for at least 1 year, and who were physically and mentally capable of completing the study's protocol. Baseline data were collected between 1991 and 1997, with followup data collected between 1999 and 2003 (3–13 years postbaseline). Weight-bearing anteroposterior knee radiographs with a foot map were obtained on all subjects at baseline and followup; supine anteroposterior pelvis radiographs were obtained on all subjects at baseline and followup except in women ages <50 years. Both knees and both hips were assessed using standard Kellgren/Lawrence (K/L) radiographic grade (range 0 – 4) (2). K/L grades 0 and 1 were treated as no OA. K/L grade

was considered missing in joints with joint replacement and in persons with radiographic evidence of inflammatory arthritis. In a sensitivity analysis, we recoded joints with replacement as K/L grade 4. Baseline and followup radiographs were read paired and blinded to time sequence. Covariates known to be associated with OA were measured, including age (45–54, 55– 64, 65–74, and ≥75 years), sex, educational level (less than high school, high school, and greater than high school), and measured body mass index (BMI; <25, 25–29.9, and ≥30 kg/m^2). Details of the sampling and data collection procedures have been published previously (6,7). All subjects provided informed consent, and the study was approved by the Institutional Review Boards at the University of North Carolina and the Centers for Disease Control and Prevention.

Statistical analysis

The unit of analysis was the joint (knee or hip), rather than the person, since K/L grade was assessed independently in each joint. Incident radiographic OA of the knee or hip was defined as an increase from no OA (K/L grade 0/1) at baseline to OA (K/L grade 2, 3, or 4) at followup. Progressive radiographic OA of the knee or hip was defined as an increase in K/L grade at followup in a joint with OA (K/L grade 2 or 3) at baseline.

To model the effects of the exposure variable (being African American versus white) on radiographic knee and hip OA incidence and progression during the followup period, we fit both the exponential and the more flexible Weibull parametric time-to-event regression models (19). The exponential model fit was tested against the Weibull model. The hypothesis that the exponential distribution did not fit as well as the Weibull model (i.e., that the Weibull shape parameter was not equal to 1) was tested with bootstrap methods. If the Weibull shape parameter was significantly different from 1, we used the Weibull model; otherwise, we used the exponential model. Event time was interval censored between baseline and followup if incidence or progression was observed at followup, and right censored at followup if incidence or progression was not observed at followup.

For each of the 4 analyses, we include the results from 2 adjusted models. Model 1 included, in addition to race, baseline values for age, sex, educational level, and BMI. Model 2 was additionally adjusted for baseline K/L grade. Two-way interactions between sex, race, and education were allowed in all models based on the literature (8 –12,20); however, nonsignificant interactions were removed from the final models. The effects are shown as crude and adjusted hazard ratios (HRs) with 95% confidence intervals (95% CIs). To account for the lack of independence between the left and right joints, bootstrap methods were used for variance estimation (21). All analyses have been weighted to account for the differing selection probabilities in the selection of the cohort and, consequently, to make the results generalizable to the Johnston County population. The methodology for obtaining the sampling weights has been reported previously (7). All statistical analyses were performed using SAS, version 9.2.

We performed a sensitivity analysis to assess the effect of potential selection bias among persons lost to followup. To this end, we fit a range of unadjusted and adjusted models on the full data set, randomly generating the rate of events among persons lost to followup in each racial group as 0.5, 0.75, 1, 1.5, or 2 times the rate observed in persons with followup.

In these analyses, we used the exponential regression model adjusted for age, sex, BMI, and education, with bootstrap-based variance and appropriate weights reflecting the full sample.

RESULTS

There were 3,068 persons in the Johnston County Osteoarthritis Project cohort at baseline; of those, 1,590 provided followup data. Of the remainder who were lost to followup, 387 persons died, 216 were mentally or physically unable to participate, 237 had moved out of the study area, 409 declined participation, 149 completed the questionnaire but not the clinical examination, and 80 were lost to followup for other reasons (Figure 1). Persons who were lost to followup tended to be older, less educated, more likely to be male and African American, and more likely to have radiographic knee or hip OA (K/L grade ≥2) (Table 1).

In the 1,590 persons with followup data, hip radiographs were not available for 113 women (age <50 years), 70 knees and 34 hips were excluded due to joint replacement, and radiographic data were missing for 62 knees and 77 hips, leaving 3,048 knees and 2,843 hips available for analysis (Figure 1). African Americans accounted for 22% of this weighted sample (Table 2), and were younger and less educated than whites. Approximately 84% of African Americans were overweight or obese, compared with ~74% of whites. The mean duration of followup was 6.6 years in African Americans (median 6.8 years, interquartile range 5.3–7.4 years) and 5.8 years in whites (median 5.4 years, interquartile range 4.8 – 6.9 years).

In the weighted joint-based analysis (excluding persons with an undetermined K/L grade), any radiographic knee OA (K/L grade ≥2) at baseline was found in 14.0% of the knees in African Americans and 9.0% in whites, whereas moderate or advanced OA (K/L grade ≥3) was found in 6.3% of the knees in African Americans and 2.8% in whites (Table 3). Any radiographic hip OA (K/L grade ≥2) at baseline was present in 25.3% of the hips in African Americans and 22.3% in whites, whereas moderate or advanced hip OA (K/L grade ≥3) was present in 2.4% of the hips in African Americans and 1.4% in whites (Table 3).

During the followup, radiographic OA developed in 12.1% of the knees with no OA at baseline and 45.7% of the knees with mild or moderate OA (K/L grade 2 or 3) progressed (Table 4). Radiographic OA developed in 7.4% of the hips with no OA at baseline, but only 3.6% of the hips with mild or moderate OA progressed over the followup period (Table 4). In Table 5, the results of regression modeling of the effect of race unadjusted for covariates; adjusted for age, sex, BMI, and education (model 1); and additionally adjusted for baseline K/L grade (model 2) are shown. The results from model 1 and model 2 were similar, and only those from model 2 are described.

Being African American was not significantly associated with radiographic knee OA incidence (adjusted HR 0.80, 95% CI 0.53–1.22). However, progression of knee OA was higher in African Americans and statistically significant (adjusted HR 1.67, 95% CI 1.05–2.67). African Americans had a significantly lower incidence of radiographic hip OA than whites (adjusted HR 0.44, 95% CI 0.27– 0.71). In contrast, hip OA progression appeared higher in African Americans, but was not statistically significant (adjusted HR 1.46, 95% CI

0.53– 4.01). The HRs were not significantly different between men and women for any of the models (data not shown).

Sensitivity analyses

Joint replacement—There were 54 knee replacements and 17 hip replacements between the baseline and followup assessments (Figure 1). In the analysis in which all joint replacements during the followup period were recoded as K/L grade 4, the unadjusted and adjusted HRs for knee OA incidence were virtually unchanged, and those for hip OA incidence and progression remained unchanged (data not shown). The HR for knee OA progression was reduced and became nonsignificant (adjusted HR 1.27, 95% CI 0.84 –1.92).

Losses to followup—The results of the sensitivity analysis of the effects of incomplete followup are shown in Table 6. For knee OA incidence, differences in event rates between those with and without followup (followup bias) that were nondifferential with respect to race did not change the conclusion. Differential bias that was in the same direction in African Americans and whites did not change the conclusion either, except when the event rate was doubled in whites and increased by 50% in African Americans. Differential bias in opposite directions could result in the HR being significantly different from 1 in either direction. For knee OA progression, our conclusion would remain the same under all scenarios in which followup bias was nondifferential with respect to race or differential, but in the same direction in both groups. In scenarios in which bias was in opposite directions, the HR could be nonsignificant or even reversed (and significant). For incidence of hip OA, the results remained essentially unchanged under all of the scenarios studied. Finally, for progression of hip OA, none of the scenarios resulted in the reversal of the HR. The HR was statistically significant in approximately half of the scenarios.

DISCUSSION

To our knowledge, this is the first longitudinal study to compare the incidence and progression of radiographic OA in African Americans and whites in both knees and hips using the joint as the unit of analysis. The results depended on the joint and whether the outcome was defined as incidence or progression of disease. In the knee, OA incidence was similar in the 2 groups. We could find no directly comparable studies of incidence by race, but indirect comparisons with previous studies can be made using prevalence estimates. In a recent analysis of the Johnston County Osteoarthritis Project baseline data, Jordan et al (6) reported a slightly higher prevalence of radiographic knee OA in African American men and women. Other studies have also demonstrated a higher prevalence of radiographic knee OA in African Americans, especially in women (8 –12).

Being African American was associated with an increase in progression of radiographic knee OA. However, this result needs to be interpreted with caution because it was sensitive to the coding of knee replacement surgery and potential selection bias due to losses to followup. Nonetheless, this finding is consistent with progression of radiographic knee OA seen in a small longitudinal study reported by Mazzuca et al (22), who found a significant odds ratio of 4 for joint space narrowing in African Americans compared with whites; the odds ratio for osteophytosis was not significant in the final model. Our findings are also

consistent with our cross-sectional data showing a greater prevalence ratio for moderate/advanced OA compared with all OA among African Americans and with previous studies by Jordan et al (6) in Johnston County (person-based analysis) and Ang et al (11) among veterans with knee pain that have found a higher prevalence of severe radiographic knee OA among African Americans. It may also explain the higher prevalence of OA in African American women in the First National Health and Nutrition Examination Survey (NHANES-I) reported by Anderson and Felson (9), where the radiographic criteria may have been relatively conservative, leading to the diagnosis of OA being restricted to more severe cases (6).

For radiographic hip OA, the risk of incident disease among African Americans was less than half the risk among whites and statistically significant. The result was not affected by the coding of hip replacements or potential selection bias due to incomplete followup. In contrast, the rate of radiographic hip OA progression appeared higher in African Americans, but the difference was not statistically significant. We could find no directly comparable studies of progression by race. Indirect evidence from the literature for an association between race and radiographic hip OA is limited to cross-sectional studies, most of which show a similar prevalence in African Americans and whites (7,11,14,15). In a recent analysis of baseline data from the Johnston County Osteoarthritis Project cohort, Jordan et al (7) found a slightly higher prevalence of radiographic hip OA among African Americans. Earlier indirect comparisons suggested a relatively low prevalence of hip OA among blacks in Africa and the Caribbean (13,14).

The most important difference between our study and previous research on the relationship between race and OA is the longitudinal design. A comparison of prevalence rates in other studies with incidence rates in our study shows notable differences. It should be noted that prevalence rates depend on historical trends in incidence, progression, and duration of disease. Therefore, associations between race and prevalence of OA may not reflect contemporary causal relationships in a dynamic population and may not correspond to differences in incidence rates. From the perspective of disease risk factors, incidence studies are preferable.

In contrast to previous studies, including reports from the Johnston County Osteoarthritis Project cohort by Jordan et al (6,7), the unit of analysis in our study was the joint rather than the individual, which provided a much larger sample size. Although this approach may lead to different results if the frequency of bilateral disease differs across the groups compared, prevalence comparisons of our data with previously published person-based analyses show similar results.

The overall prevalence of radiographic knee OA in our study was somewhat higher than that found in the Framingham OA Study and the prevalence of hip OA was much higher than in NHANES-I (1). It was also higher than the prevalence rate reported by Lane et al among elderly white women in 4 metropolitan areas in the US (23). This could relate to the lack of comparability of radiographic OA across studies because the radiograph techniques and interpretation of radiographs may vary, or could relate to differences in population characteristics. The Johnston County Osteoarthritis Project population comes from a

relatively rural area with a large proportion of African Americans, relatively low levels of education, and moderate levels of obesity.

Although the baseline prevalence of hip OA in our study was high, the rate of hip OA progression was lower than the rate of knee OA progression. Our hip OA progression rate was also lower than that reported by Lane et al (3.6% versus 21%) (23). However, the population studied by Lane et al was older and female and white only, and came from metropolitan areas. Their mean followup period was longer (8.3 versus 6.0 years) and their data were person based rather than joint based. Finally, they used a different definition of radiographic hip OA and a different definition of progression. Differences in the interpretation of hip radiographs with regard to the presence of OA may also lead to different hip OA progression rates between the studies. Comparisons with other published studies are limited because most were conducted in clinical samples.

In our analysis, radiographs in persons with knee or hip replacement during the followup period were coded as missing data because the K/L grade at followup was undetermined. A sensitivity analysis in which all joint replacements were coded as advanced OA (K/L grade 4) showed little or no change for knee OA incidence and hip OA incidence or progression, but indicated a reduction of the HR for knee OA progression.

There are several limitations to this study. First, such resource-intensive longitudinal studies are necessarily restricted in geographic reach and may not be generalizable to the US population. Second, current longitudinal analyses were necessarily limited to those who provided followup data. There was considerable loss to followup, which occurs in many longitudinal studies. Our sensitivity analyses suggested that the results for knee OA were somewhat more sensitive than those for hip OA to the assumption of no selection bias in followup. However, even for the knee data, large differences in event rates between those lost to followup and the remainder of the cohort, differential across the racial groups, would be needed to change the conclusions significantly. For example, in the knee incidence model, the effect of race would remain nonsignificant even if we increased the event rate by 50% among African Americans lost to followup, without changing the rate among whites. In the hip incidence model, the lower rate among African Americans would remain statistically significant even in the presence of large and differential followup bias. Racial differences in radiographic hip OA progression were more difficult to assess because of a small number of events.

Confounding by unknown or unmeasured risk factors related to exposure is a possible source of bias in all observational studies. In addition, when interpreting the results pertaining to disease progression, one must consider the limitations associated with studies of risk factors for progressive disease. As demonstrated by Zhang et al (24), such studies are subject to confounding by unmeasured variables that cause both incidence and progression but are not related to exposure, such as genetic factors.

There are several strengths to this study as well. Most importantly, we used data from a large, population-based prospective cohort study. The study population included a large proportion of African Americans and therefore allowed us to compare the incidence and

progression of OA according to race. Although it is uncertain whether our study population is representative of the general US population, the percentage of overweight or obesity, an important risk factor for OA incidence and progression, was 75% and similar to current figures for the rest of the country (25). We analyzed both the incidence and progression of radiographic knee and hip OA in the same cohort and examined by the same radiologist. Finally, we performed extensive sensitivity analyses to assess the effects of missing data on the results.

An improved understanding of the factors that influence incidence and progression of OA in different joints is important from a clinical perspective, since it may help identify more effective interventions aimed at preventing OA or slowing its progression (26). Our study suggests that the relationship between radiographic OA and race or ethnicity may vary according to joint and stage of disease. Potential differences in joint anatomy and biomechanics, physical activity, muscle strength, bone density, and other factors that might explain these differences across racial and ethnic groups require further research. Longitudinal studies with a longer followup period will be needed to better understand the different roles some of these factors may play at different stages in the natural history of OA.

Acknowledgments

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

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Significance & Innovations

- This is the first study to compare the incidence and progression of radiographic knee and hip osteoarthritis (OA) in African Americans and whites using the joint (not the person) as the unit of analysis. Previous cross-sectional studies compared OA prevalence across different racial and ethnic groups.
- After adjusting for age, sex, body mass index, education, and radiographic stage at baseline, African Americans had a lower risk of incident hip OA than whites, but a higher risk of progressive knee OA.
- The results suggest that factors related to race may play different roles at different stages in the natural history of OA and underscore the importance of large, population-based longitudinal studies in this disease.

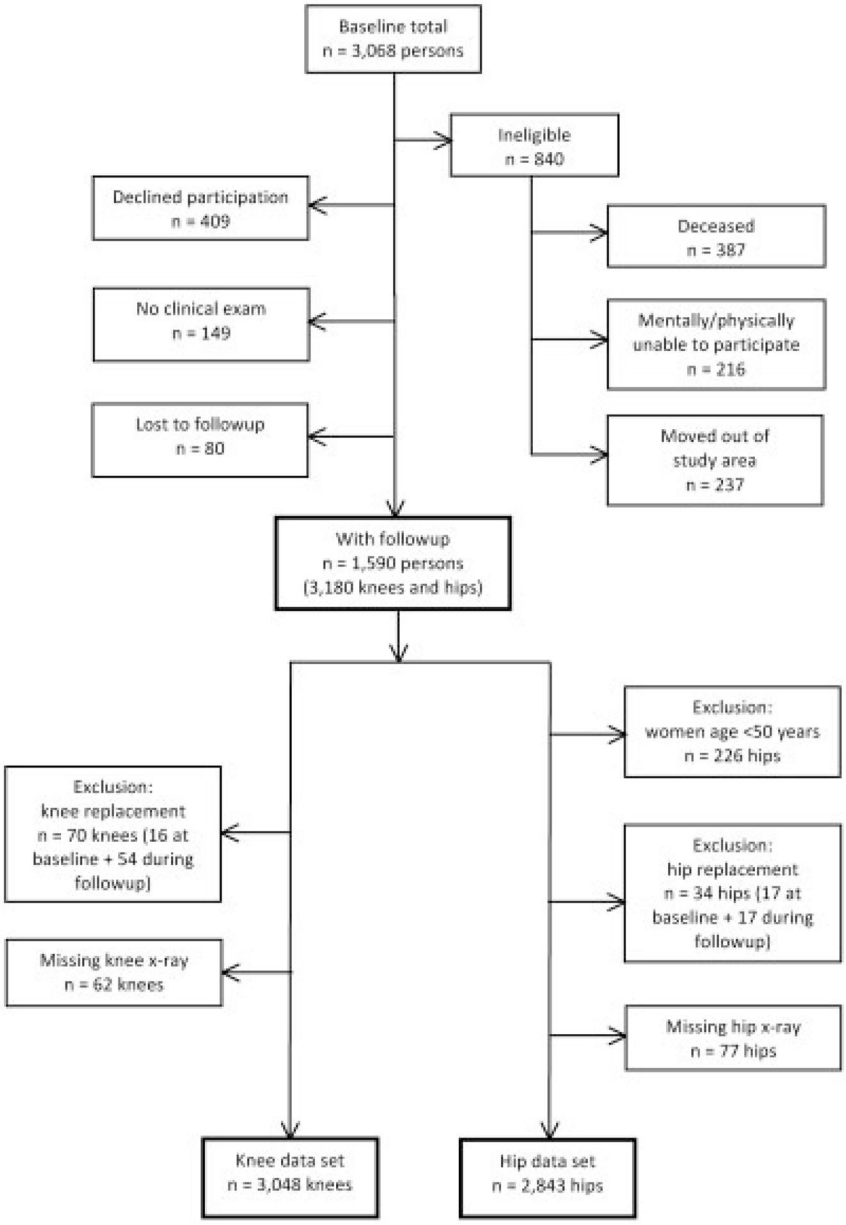

Figure 1.
Flow chart of persons and their subsequent joints analyzed for knee and hip osteoarthritis incidence and progression, by joint.

Table 1

Unweighted demographic and clinical characteristics of persons in the full study sample at baseline according to followup status (n =3,068)*

	With followup (n = 1,590 [51.8%])	Without followup (n = 1,478 [48.2%])
Age, years		
45–54	35.5	29.5
55–64	32.5	24.8
65–74	24.2	27.9
≥75	7.9	17.9
Race		
African American	28.4	37.1
White	71.6	62.9
Sex		
Men	34.8	41.1
Women	65.2	58.9
Educational level		
Less than high school	33.0	49.6
High school	37.8	28.6
Greater than high school	29.1	21.6
Missing	0.2	0.3
Body mass index, kg/m^2		
<25.0	24.2	27.0
25–29.9	40.1	35.3
≥30	35.5	37.1
Missing	0.2	0.6
Maximum K/L grade, knees		
0	44.4	40.7
1	26.8	23.7
2	19.4	21.9
3	5.6	6.7
4	1.6	3.9
Missing	2.2	3.2
Maximum K/L grade, hips		
0	22.7	20.6
1	40.2	38.2
2	21.6	24.3
3	1.7	7.8
4	0.3	1.2
Missing	13.5	13.9
Maximum K/L grade >1, knees		
No	71.2	64.3
Unilateral	14.2	15.2

	With followup (n = 1,590 [51.8%])	Without followup (n = 1,478 [48.2%])
Bilateral	13.1	18.1
Missing	1.5	2.4
Maximum K/L grade >1, hips		
No	62.9	58.9
Unilateral	14.8	15.4
Bilateral	9.8	12.3
Missing	12.5	13.4

* Values are the percentage. Differences between the groups are statistically significant for all variables listed. Percentages may not sum to 100% due to rounding.

K/L = Kellgren/Lawrence.

Table 2

Weighted baseline distributions of demographic variables and body mass index in African Americans and whites with followup*

Study participants (n = 1,590)	African American (22.3%)	White (77.7%)
Age, years		
45–54	63.8	54.5
55–64	16.2	24.1
65–74	15.1	16.4
≥75	5.0	5.0
Sex		
Men	36.2	42.4
Women	63.8	57.6
Educational level		
Less than high school	42.9	24.0
High school	32.3	40.1
Greater than high school	24.7	35.7
Missing	0.1	0.2
Body mass index, kg/m^2		
<25.0	15.4	26.4
25–29.9	36.6	41.2
≥30	47.8	32.3
Missing	0.1	0.1
Maximum K/L grade >1, knees		
No	77.2	85.0
Unilateral	10.9	8.3
Bilateral	8.3	5.0
Missing	3.6	1.7
Maximum K/L grade >1, hips		
No	50.1	59.0
Unilateral	11.8	13.4
Bilateral	13.6	12.4
Missing	24.5	15.2

* Values are the percentage. Weighted analyses account for the differing selection probabilities in the selection of the cohort. Differences between the groups are statistically significant for all variables listed. Percentages may not sum to 100% due to rounding.

K/L = Kellgren/Lawrence.

Table 3

Weighted baseline distributions of K/L grades for the study joints in African Americans and whites with followup*

	African American	White
Knee (unweighted n = 3,102)		
K/L grade 0	51.4	66.6
K/L grade 1	34.6	24.4
K/L grade 2	7.7	6.2
K/L grade 3	4.8	2.2
K/L grade 4	1.5	0.6
Hip (unweighted n = 2,860)		
K/L grade 0	11.0	19.1
K/L grade 1	63.8	58.7
K/L grade 2	22.9	20.9
K/L grade 3	1.8	1.3
K/L grade 4	0.6	0.1

*Values are the percentage. Weighted analyses account for the differing selection probabilities in the selection of the cohort. Joints with a missing Kellgren/Lawrence (K/L) grade or joint replacement are excluded. Differences in the distribution of K/L grades between the groups are statistically significant for both joints. Percentages may not sum to 100% due to rounding.

Table 4

Weighted frequencies and percentages of cumulative radiographic knee and hip OA incidence and progression*

	Denominator†	New cases	%
Knee OA incidence	2,755	333	12.1
Knee OA progression	259	118	45.7
Hip OA incidence	1,976	147	7.4
Hip OA progression	571	20	3.6

*All values pertain to joints, not persons. The weighted counts are rounded. Weights are rescaled to reflect the sample size. OA = osteoarthritis.

†Denominator is defined as joints without OA (Kellgren/Lawrence [K/L] grade 0/1) at baseline for incidence and joints with mild OA (K/L grade 2) or moderate OA (K/L grade 3) at baseline for progression.

Table 5

HRs for the incidence and progression of radiographic knee and hip OA in African Americans compared with whites[*]

	Unadjusted, HR (95% CI)	Adjusted model 1, HR (95% CI)[†]	Adjusted model 2, HR (95% CI)[‡]
Knee OA incidence	0.96 (0.63–1.46)[§]	0.97 (0.64–1.46)[§]	0.80 (0.53–1.22)[§]
Knee OA progression	1.83 (1.20–2.79)	1.52 (0.97–2.37)	1.67 (1.05–2.67)
Hip OA incidence	0.42 (0.27–0.68)	0.45 (0.28–0.73)	0.44 (0.27–0.71)
Hip OA progression	2.06 (0.73–5.81)[§]	1.76 (0.63–4.89)[§]	1.46 (0.53–4.01)[§]

[*] HR = hazard ratio; OA = osteoarthritis; 95% CI = 95% confidence interval.

[†] Adjusted for age, sex, body mass index (BMI), and education.

[‡] Adjusted for age, sex, BMI, education, and baseline Kellgren/Lawrence grade.

[§] From a Weibull model.

Table 6

Sensitivity analysis of the effect of losses to followup on the adjusted association between race and radiographic knee or hip osteoarthritis [*]

Scenario (multiplier)[†]		Knee OA incidence		Knee OA progression		Hip OA incidence		Hip OA progression	
African Americans	Whites	HR_{adj}	*P*	HR_{adj}	*P*	HR_{adj}	*P*	HR_{adj}	*P*
0.5	0.5	0.95	0.663	1.79	< 0.001	0.55	< 0.001	1.85	0.101
0.5	0.75	0.82	0.083	1.40	0.005	0.51	< 0.001	1.60	0.190
0.5	1	0.74	0.009	1.13	0.308	0.47	< 0.001	1.55	0.216
0.5	1.5	0.59	< 0.001	0.78	0.029	0.42	< 0.001	1.41	0.310
0.5	2	0.49	< 0.001	0.54	< 0.001	0.37	< 0.001	1.12	0.714
0.75	0.5	1.08	0.479	2.55	< 0.001	0.57	< 0.001	2.16	0.033
0.75	0.75	0.93	0.526	1.99	< 0.001	0.53	< 0.001	1.87	0.069
0.75	1	0.85	0.124	1.60	< 0.001	0.49	< 0.001	1.81	0.080
0.75	1.5	0.68	< 0.001	1.11	0.343	0.43	< 0.001	1.65	0.123
0.75	2	0.56	< 0.001	0.77	0.013	0.38	< 0.001	1.31	0.366
1	0.5	1.23	0.047	3.33	< 0.001	0.61	< 0.001	2.52	0.008
1	0.75	1.07	0.540	2.59	< 0.001	0.57	< 0.001	2.18	0.017
1	1	0.97	0.741	2.08	< 0.001	0.52	< 0.001	2.11	0.020
1	1.5	0.77	0.010	1.45	< 0.001	0.47	< 0.001	1.93	0.033
1	2	0.64	< 0.001	1.00	0.975	0.41	< 0.001	1.54	0.128
1.5	0.5	1.53	< 0.001	4.85	< 0.001	0.67	0.001	3.21	< 0.001
1.5	0.75	1.32	0.004	3.79	< 0.001	0.63	< 0.001	2.79	0.001
1.5	1	1.20	0.055	3.05	< 0.001	0.58	< 0.001	2.70	0.001
1.5	1.5	0.96	0.638	2.14	< 0.001	0.51	< 0.001	2.46	0.002
1.5	2	0.79	0.009	1.48	< 0.001	0.45	< 0.001	1.96	0.011
2	0.5	1.81	< 0.001	6.03	< 0.001	0.76	0.017	3.74	< 0.001
2	0.75	1.56	< 0.001	4.70	< 0.001	0.70	0.002	3.24	< 0.001
2	1	1.42	< 0.001	3.79	< 0.001	0.65	< 0.001	3.14	< 0.001
2	1.5	1.14	0.156	2.66	< 0.001	0.58	< 0.001	2.85	< 0.001
2	2	0.94	0.464	1.84	< 0.001	0.51	< 0.001	2.26	0.002

[*] HR_{adj} = adjusted hazard ratio.

† The numbers (multipliers) represent the ratio of the assumed incidence or progression rate among persons lost to followup to the rate among those actually observed. For example, the first row is a scenario in which we assume that the rates in both African Americans and whites who were lost to followup would have been 0.5 times the rates in those with followup.