Racial Disparities in the Receipt of Osteoporosis Related Healthcare Among Community-Dwelling Older Women with Arthritis and Previous Fracture

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ABSTRACT. ***Objective.*** To examine potential racial/ethnic disparities in osteoporosis care among community-dwelling older women with self-reported arthritis and previous fracture.

Methods. We conducted a computer assisted telephone interview using a population based random sample drawn from 6 counties in Alabama, USA. Eligible respondents had self-reported arthritis and were over 50 years of age; 1424 people responded to the survey. Logistic regression was used to examine the association of race/ethnicity with the receipt of dual energy x-ray absorptiometry (DEXA) and prescription osteoporosis treatments (including bisphosphonates, calcitonin, hormone replacement, or selective estrogen receptor modulators) among older women with a history of fracture.

Results. Of eligible African American and Caucasian female respondents, 251 (25%) reported a history of fracture after 45 years of age. Women with a history of self-reported fracture were predominantly Caucasian (n = 178, 71%) and had a mean age of 68 ± 11 years. After multivariable adjustment, African American women with a fracture history were less likely than Caucasian women with a history of fracture to receive a DEXA (OR 0.39, 95% CI 0.19–0.81) or prescription osteoporosis medicines (OR 0.17, 95% CI 0.08–0.37).

Conclusion. In this population of community-dwelling older women, African American respondents at high risk for fracture were far less likely than Caucasians to receive osteoporosis related healthcare. (J Rheumatol 2005;32:870–5)

Key Indexing Terms:
RACE ETHNICITY DISPARITY OSTEOPOROSIS
FRACTURE DUAL ENERGY X-RAY ABSORPTIOMETRY

Although the incidence of osteoporosis is lower in African Americans than in Caucasians[1,2], African Americans may have substantially worse fracture related outcomes. In comparison to their occurrence in Caucasian women, fractures among African American women result in increased disability, longer hospital stays, and higher overall mortality[1,3,4].

Racial disparities in health outcomes, including those related to fracture, may follow an unequal allocation of healthcare resources among racial/ethnic groups[1,3-7]. In a prior study involving beneficiaries of a large healthcare maintenance organization (HMO), postmenopausal African American women were substantially less likely than older Caucasian women to receive bone mineral density (BMD) testing or prescription osteoporosis treatments[8], even after adjusting for known osteoporosis risk factors and multiple predisposing, enabling, and need factors associated with healthcare utilization[9]. However, it is unclear whether these observations extend to the general population. To address this issue, we performed a comprehensive population based survey of urban and rural, Caucasian and African American older adults. We hypothesized that community-dwelling African Americans at high risk for fracture would be less likely than Caucasians to receive BMD testing or prescription osteoporosis treatments.

MATERIALS AND METHODS

Survey administration. The methods of survey design and administration have been reported[10]. After approval by the University of Alabama at Birmingham (UAB) Institutional Review Board, the survey was adminis-

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tered using CATI software (Sawtooth Software, Evanston, IL, USA) and was conducted by 19 trained interviewers in the UAB Survey Research Unit. All interviewers received a minimum of 6 hours of training on this survey before calling prospective respondents. To ensure quality, interviews were supervised at all times and were randomly electronically monitored.

The survey was conducted from January 2001 to December 2001. Respondents were eligible to participate in the interview if they self-reported arthritis and were over 50 years of age. Arthritis was defined as the presence of joint symptoms lasting most days for at least 1 month out of the previous 12 months or by a history of an appropriate physician diagnosis[11]. To minimize responder bias, a potential respondent was chosen by random selection among eligible adults in the household.

Survey instrument design. The survey instrument was compiled from a number of previously validated surveys and studies of chronic health conditions[12-16]. A detailed arthritis history was obtained from each respondent and included self-reported physician diagnoses (osteoarthritis, rheumatoid arthritis, or other), a brief comorbidity inventory, arthritis-specific symptoms (joint swelling and stiffness), and medication use (both prescription and over the counter medicines within the previous 30 days). We asked respondents about their use of osteoporosis treatments including calcium, vitamin D, and approved antiresorptive therapies (bisphosphonates, calcitonin, hormone replacement therapy, or select estrogen receptor modulators). To ensure accurate data ascertainment, the interviewers asked the respondents to bring their active arthritis medications to the telephone during the interview.

Respondents were asked, "Have you ever had a measurement of your bone mineral density with a DEXA machine (a DEXA scan is an x-ray test where a machine is used to measure your bone density and your risk for osteoporosis)?". Sociodemographic and health behavior variables collected included age, sex, race/ethnicity, education status, smoking and alcohol use, marital status, and household income. The survey also included specific questions on healthcare access including the availability and/or types of insurance coverage.

Sampling. A stratified population based random-digit dialing sample (provided by Survey Sampling, Inc., Fairfield, CT, USA), was drawn from 6 preselected counties in Alabama: 5 rural and one urban[10]. In order to examine differences in healthcare receipt based on race/ethnicity, stratified sampling was conducted with a goal of having a one-to-one mix of African American and Caucasian respondents.

Statistical analysis. Descriptive analyses were used to examine demographic and other respondent characteristics, comparing participants by race/ethnicity. Categorical variables were analyzed using the chi-square statistic and continuous variables were compared by Student t test.

Odds ratios (OR) and 95% confidence intervals (CI) were used to describe the association of race/ethnicity with the receipt of DEXA and prescription osteoporosis medications and were calculated using logistic regression. Using the conceptual framework of Aday and Andersen[9], we examined the bivariate association of multiple predisposing, enabling, and need factors with the receipt of osteoporosis related healthcare. Given their limited number (n = 45) and the multiple different racial/ethnic groups involved, respondents reporting a race/ethnicity category other than African American or Caucasian were excluded from all analyses.

To construct valid and predictive multivariable models, the entire dataset (n = 1379 observations) was randomly split into 2 parts. We developed multivariable models using the first half of the data, performing a stepwise logistic regression and examining DEXA and osteoporosis medicine receipt as separate outcomes. The regression algorithm for model-building required a bivariate p value of 0.25 or less to enter the model and a p value of 0.05 or less to remain. The validity of the final multivariable models were then checked using the second half of the data. As part of the validation process, model fit and calibration were assessed for all multivariable models using the deviance goodness-of-fit p value and c statistics, respectively[17,18]. In our primary analyses, we extended these validated models to postmenopausal women with a history of fracture after the age of 45 years (n = 251). All analyses were conducted using SAS (SAS Institute, Cary, NC, USA).

RESULTS

A total of 1379 community-dwelling African Americans and Caucasians with self-reported arthritis responded to the survey, yielding an 85% upper bound response rate [completions/(completions + refusals + surveys terminated in process)]. Among women responding to the survey (n = 988), one-fourth (n = 251) reported a history of fracture after the age of 45 years. Caucasian women were more likely than African American women to report a previous fracture (29% vs 19%; $p < 0.001$). Fracture types were similar among African American and Caucasian women (Table 1) who reported a previous fracture and included the wrist (28%), ribs (18%), spine (14%), hip (11%), and other. The demographic and health characteristics of these women, stratified by race/ethnicity, are shown in Table 1.

Women self-reporting fracture had a mean age of 68 ± 11 years and were predominantly Caucasian (n = 178, 71%). Compared to Caucasian women, African American women with a history of fracture were slightly younger and less likely to be married. Additionally, African American women with fracture reported lower levels of income and education, more comorbidity, and a higher body mass index (BMI), and were less likely than Caucasian women to report a diagnosis of osteoarthritis. There was no difference in urban/rural residence based on race/ethnicity.

Of women self-reporting fracture, Caucasians were substantially more likely than African Americans to have received a DEXA examination (46% vs 19%; $p < 0.001$), prescription osteoporosis medicines (57% vs 21%; $p < 0.001$), or calcium and/or vitamin D supplementation (64% vs 37%; $p < 0.001$; Figure 1). Hormone replacement therapy represented the majority of prescription osteoporosis treatments received. Among African American women with fracture, only 15 received prescription osteoporosis therapies and 13 of these were hormone replacement. The receipt of prescription osteoporosis medicines, stratified by race/ethnicity, is summarized in Table 2.

Our multivariable regression models had good discrimination and calibration. C statistic results from both the development models and validation models consistently exceeded 0.7 and varied by less than 10% between the split data set. Goodness-of-fit p values were consistently > 0.05 for all models.

Results from our primary analyses are summarized in Table 3. After adjusting for potential confounding predisposing, need, and enabling factors, race/ethnicity remained a significant determinant of receiving a DEXA examination and prescription osteoporosis therapies for those at highest risk for osteoporosis (women with a history of fracture). African American women with a fracture history were 3 to 6 times less likely than Caucasian women with a history of

Table 1. Demographic and health characteristics among women with self-reported fracture after the age of 45 years (n = 251).

Patient Characteristic	Number (%) or Mean ± SD Caucasians, n = 178	African Americans, n = 73	p
Age, yrs	68.7 ± 10.2	65.9 ± 11.0	0.06
Body mass index, kg/m^2	27.4 ± 6.4	31.4 ± 8.0	< 0.001
Urban residence	90 (51)	36 (49)	0.86
Married	86 (48)	22 (30)	0.008
Total household income, < $25 thousand/yr	91 (58)	50 (78)	0.004
≥ High school education	137 (77)	37 (51)	< 0.001
Ever smoker	78 (44)	32 (44)	0.99
Comorbidity*	143 (80)	66 (90)	0.05
Arthritis diagnoses			
Osteoarthritis	90 (51)	18 (25)	< 0.001
Rheumatoid arthritis	20 (11)	13 (18)	0.16
Regular source of primary care	169 (96)	68 (93)	0.45
Any healthcare coverage	168 (94)	65 (89)	0.14
Medicare coverage	100 (56)	36 (49)	0.32
Prescription drug benefit	93 (52)	41 (59)	0.37
Site of past fracture			
Wrist	52 (29)	18 (25)	0.46
Ribs	31 (17)	13 (18)	0.94
Spine	26 (15)	10 (14)	0.63
Hip	17 (10)	10 (14)	0.34

* Includes history of one or more of the following: high blood pressure, stroke or neurological condition, diabetes, lung disease, cancer, kidney disease, or heart disease.

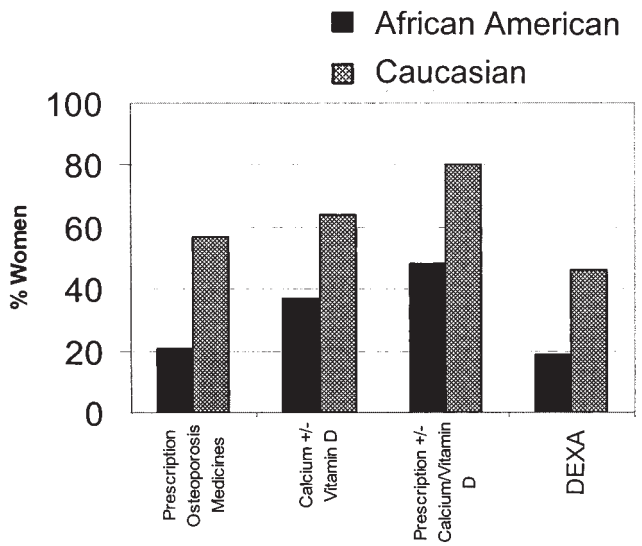

Figure 1. Healthcare utilization among women at high risk for osteoporosis leading to fracture (n = 251). Unadjusted p values < 0.001 for differences between African American and Caucasian women for all measures shown.

fracture to receive a DEXA examination (OR 0.39, 95% CI 0.19–0.81) or prescription osteoporosis medicines (OR 0.17, 95% CI 0.08–0.37). These results were unchanged when calcium and/or vitamin were included, along with prescription medicines, as osteoporosis treatments (Table 3).

DISCUSSION

We examined the receipt of osteoporosis related healthcare among community-dwelling older adults with self-reported arthritis. In this population, African American women with a history of fracture were far less likely than Caucasian women reporting fracture to receive either BMD testing or medications used for the treatment of osteoporosis. The association of African American race/ethnicity with lower receipt of DEXA examination and osteoporosis medicine use remained after adjusting for other determinants of healthcare receipt and known osteoporosis risk factors.

These findings are consistent with 2 other recent reports. In an investigation of HMO beneficiaries, Mudano, *et al* found that African Americans were only 50% as likely as Caucasians to receive BMD testing or antiosteoporosis medications, even after adjusting for multiple confounding factors[8]. In a small study involving female beneficiaries of the Veterans Administration Health System, investigators found that among women with documented BMD reductions (t score ≤ –1 SD), Caucasian women were more than 3 times as likely as African Americans to receive antiresorptive medications[19]. This association remained even after adjusting for the severity of BMD decline. Although these previous surveys had only modest response rates (30%–68%) and were limited to members of single healthcare systems, findings from our population based survey (with an 85% upper bound response rate) strongly support the conclusion of these previous reports. Namely, African Americans at high

Table 2. The receipt of prescription osteoporosis medicines among women reporting a history of fracture after the age of 45 years (n = 251).

Healthcare Service or Treatment	Number (%) Caucasians, n = 178	African Americans, n = 73	p*
Hormone replacement therapy	77 (43)	13 (18)	< 0.001
Alendronate	21 (12)	0 (0)	0.002
Raloxifene	8 (5)	0 (0)	0.11
Calcitonin	5 (3)	1 (1)	0.68
Pamidronate	2 (1)	1 (1)	1.00
Resedronate	1 (1)	0 (0)	1.00

* Chi-square test (or Fisher exact test with small cell size).

Table 3. Multivariate associations of respondent factors with the receipt of osteoporosis medications or DEXA measurement among older women with self-reported fracture after the age of 45 years (n = 251).

	Prescription Osteoporosis Medicines		Prescription + Calcium/ Vitamin D		DEXA Measurement	
	OR	95% CI	OR	95% CI	OR	95% CI
Predisposing factors						
African American race (vs Caucasian)	0.17	0.08–0.37	0.25	0.12–0.51	0.39	0.19–0.81
Age, yrs	0.94	0.91–0.97	0.94	0.91–0.97	—	—
Body mass index, kg/m^2	0.96	0.92–1.01	0.93	0.89–0.98	0.96	0.91–1.00
Need factors						
Osteoarthritis	1.33	0.72–2.43	1.52	0.75–3.06	2.05	1.15–3.64
Rheumatoid arthritis	—	—	1.45	0.53–3.97	—	—
Kyphosis or stooped posture	1.50	0.78–2.86	—	—	—	—
COPD	—	—	3.75	1.36–10.35	—	—
Past prednisone use	—	—	—	—	1.17	0.15–9.20
Enabling factors						
Healthcare coverage	13.42	2.41–74.8	—	—	—	—
Arthritis care from						
Rheumatologist	3.34	1.52–7.38	—	—	—	—
Internist	1.18	0.62–2.25	2.79	1.25–6.25	1.99	1.08–3.66

* Nonsignificant factors in all multivariable analyses include education, care from an orthopedist or general practitioner, urban or rural residence, cigarette smoking, Medicare coverage, prescription drug benefit, hypertension, cancer, stroke, renal disease, diabetes mellitus, joint swelling, and joint tenderness. COPD: chronic obstructive pulmonary disease. OR and 95% CI not shown for factors with p value > 0.05 in model-building phase.

risk for fracture appear to be far less likely than Caucasians to receive appropriate healthcare interventions.

This study provides insight into other potential determinants of healthcare receipt among those at high risk for osteoporosis. Our results are consistent with those of other investigations showing that rheumatologists are more likely than generalists and other types of specialists to prescribe prescription treatments for osteoporosis care[20-22]. However, we found no association between rheumatology visits with calcium and/or vitamin D or DEXA receipt even though visits with internists (but not generalists or orthopedists) were associated with greater odds of undergoing a formal BMD measurement. Notably, patients self-reporting a diagnosis of osteoarthritis were more than twice as likely as those reporting other or "undefined" arthritis diagnoses to have received a DEXA examination. This association is somewhat counterintuitive since osteoarthritis has been associated with higher BMD[23]. However, the presence of a confirmed musculoskeletal diagnosis may simply be a surrogate for more frequent or perhaps more efficient healthcare utilization.

Although we analytically controlled for measures of healthcare access and arthritis specialist interactions, we did not collect comprehensive information pertaining to the frequency, duration, or perceived quality of physician-patient interactions. Attitudes and perceptions regarding diagnostic and treatment modalities may play an integral role in healthcare utilization. Reports suggest that African Americans may have lower concern and familiarity with osteoporosis and risk factors for its development[24,25]. We also did not assess other possible barriers to healthcare receipt including distance traveled or the accessibility of DEXA and/or subspecialty physicians in the areas surveyed. However, it is

unlikely that such factors played important confounding roles since our analyses controlled for closely related factors including urban/rural residence, education, income, and marital status.

Although several studies have shown a high degree of accuracy for self-reported fracture (with positive predictive values ranging from 82% to 95%)[26-29], defining our at-risk population in this manner may have limitations. While our analyses adjusted for socioeconomic and education factors that might confound an association between race and a higher predilection for fracture, we did not collect comprehensive data regarding the association of excessive trauma with reported fractures. This may be relevant, since fractures are more commonly attributable to osteoporosis in Caucasians than in African Americans[30]. However, it is important to recognize that most fractures result directly from some traumatic event[31], and for any given fracture it is impossible to know whether its etiology relates primarily to insufficient bone strength or excessive skeletal loading[30]. This "uncertainty" with regard to etiology only emphasizes the importance of obtaining DEXA examinations in the context of self-reported fracture.

Other limitations to this study include the possibility of recall bias and the potential for racial and other types of misclassification. Self-reported arthritis diagnoses used as covariates in this analysis, particularly rheumatoid arthritis, may be inaccurate[32]. To limit recall bias, we assessed prescription arthritis drug use within the previous 30 days. Our survey sample also involved respondents with self-reported arthritis from a restricted geographical area and included almost exclusively African American and Caucasian respondents. Our results, therefore, may not be generalizable to other regional populations or racial/ethnic groups. An additional limitation is that we were not able to assess sociodemographic or other characteristics of our nonrespondents. However, given our excellent response rate, we do not believe that our results were substantially affected by a responder bias.

It is unknown whether these apparent racial disparities in the receipt of osteoporosis healthcare result in true differences in fracture related outcomes. However, studies have shown that lower rates of osteoporosis related healthcare use (including lower intensity rehabilitation and a lower frequency of estrogen replacement therapy) are associated with increased fracture related disability, longer hospital stays, and higher mortality among African Americans[1,3,4,6,7]. Thus, it is conceivable that the disparities observed in our study may lead to important racial differences in longterm outcomes.

It has been estimated that available antiresorptive therapies reduce fracture risk by as much as 40%–50% in high-risk patients[33,34]. Moreover, certain agents, such as alendronate, have been shown to be cost-effective in fracture prevention[35] and efficacious in African American populations[36]. Based on the magnitude of possible risk reduction, the elimination of disparities in osteoporosis care would substantially reduce the burden of osteoporosis and fracture in high-risk African Americans. To successfully develop and implement programs aimed at eliminating racial health disparities in osteoporosis, efforts are needed to identify patient and provider factors leading to lower rates of healthcare utilization in African American populations.

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