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Self-Reported Osteoarthritis, Ethnicity, BMI and other Associated Risk Factors in Postmenopausal Women---Results from the Women's Health Initiative

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Abstract

The objective of this analysis was to assess risk factors for self-reported osteoarthritis (OA) in an ethnically diverse cohort of women. The participants were postmenopausal women aged 50 to 79 (n=146,494) participating in the clinical trial and observational study of the Women's Health Initiative (WHI). Baseline OA and risk factors were collected from WHI questionnaires. Logistic regression was used to find the association between the risk factors and OA. Risk factor distribution and ethnicity interaction terms were used to assess ethnic differences in OA risk. Forty-four percent of the participants reported OA. Older age (odds ratio (OR)$_{70–79 \text{ vs } 50–59}$=2.69, 95% confidence interval (CI)=2.60–2.78) and higher body mass index (BMI) (OR$_{BMI≥40.0 \text{ vs } \<24.9}$=2.80, 95% CI=2.63–2.99) were found to be the strongest risk factors associated with self-reported OA. The prevalence of obesity (BMI≥30.0) was 57.9% in African Americans, 51.0% in American Indians, 41.9% in Hispanic whites, and 32.9% in non-Hispanic whites. The prevalence of other major OA risk factors was higher in African-American, American-Indian, and Hispanic white women than in non-Hispanic white women. Non-Hispanic white women who were in the extreme obese category (BMI≥40.0λkg/m^2) had a 2.80 times (95% CI=2.63, 2.99) greater odds of self-reported OA. The odds were even higher in American-Indian (OR=4.22, 95% CI=1.82, 9.77) and African-American (OR=3.31, 95% CI=2.79, 3.91) women, indicating a significant interactive effect of BMI and ethnicity on odds of OA. In conclusion, OA is a highly prevalent condition in postmenopausal women, and there are differential effects according to ethnicity.

Keywords

self-reported OA; WHI; ethnicity; risk factors

INTRODUCTION

Arthritis and rheumatic conditions are the leading cause of disability in the United States, affecting approximately 46 million adults, with estimated total medical costs of $128

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billion annually.[1] Osteoarthritis (OA), the most common arthritic condition, is characterized as "a range of disorders that result in structural and functional failure of synovial joints when the dynamic equilibrium between the breakdown and repair of joint tissues is overwhelmed."[2] The prevalence of OA has been estimated to be 12% in people 25 and older [3] and increases to almost 68% in people aged 65 and older.[4] It has been recently reported that, along with osteoporosis, OA is a major health problem in postmenopausal women, and the condition is more debilitating in this population.[5] Strong OA risk factors identified by epidemiological studies include age and high body mass index (BMI). Physical activity has been shown to be a strong protective factor,[6–8] and factors such as race or ethnicity, educational attainment, cigarette smoking, hypertension, fasting blood glucose, and alcohol intake have been inconsistently associated.[7]

Although several studies have investigated OA and its risk factors in postmenopausal women, few have assessed these risk factors in a group of women from multiple racial and ethnic backgrounds. Research has shown that there are ethnic differences in arthritis-related outcomes, such as disability and pain,[9] and African Americans have an overall higher age-adjusted death rate from arthritis and other rheumatic diseases.[10] The Women's Health Initiative (WHI) is one of the largest, most ethnically diverse cohorts of postmenopausal women with abundant health information on variables related to OA. The WHI cohort provides a potential resource to shed new light on ethnic variations in the prevalence of and risk factors for OA in postmenopausal women. The objectives of the current analysis were to assess the prevalence of self-reported OA within the WHI, to investigate the association between established OA risk factors and self-reported OA in this population, and to evaluate ethnic differences in the distribution and effect of risk factors within the WHI.

METHODS

Study Population

The focus of the WHI was to investigate the risk factors and preventive strategies of the major contributors to morbidity and mortality in postmenopausal women: heart disease, breast and colorectal cancer, and osteoporotic fractures.[11] The WHI recruited 161,809 postmenopausal women aged 50 to 79 from 40 centers across the country to participate in the clinical trial or observational study. Details of recruitment strategies and baseline participant information have been previously published.[12]

Outcome

This analysis was conducted using baseline self-reported OA from the WHI observational study (n=92,971) and clinical trial (n=68,838). The participants were asked, "Did your doctor ever tell you that you have arthritis?" with choices including yes or no. Nonresponders (n=1,438) were excluded. The participants answering no were placed in the non-OA reference group (n=83,954). Women responding yes (n=76,417) were then asked "What type of arthritis do you have?" including choices of rheumatoid arthritis and other or don't know. Women reporting rheumatoid arthritis (n=7,862) and women not answering the follow-up arthritis question (n=3,995) were excluded from the analysis. Women selecting other or don't know were placed in the OA case group (n=64,550). Prevalence of other arthritic and rheumatic conditions (such as systemic lupus erythematosus and Crohn's disease) was asked about in separate questions; 793 women reported lupus, of whom 365 (0.57%) were counted as OA cases, and 1,780 women reported Crohn's disease or ulcerative colitis, of whom only 825 (1.3%) were counted as OA cases, indicating that the general arthritis questions are good proxy indicators for OA

Covariates

A literature search was performed to acquire variables that have been strongly or moderately attributed to OA risk or protection. These included factors such as age, ethnicity, BMI, alcohol use, education, income, insurance status, smoking, postmenopausal hormone therapy, history of diabetes mellitus, and measures of physical activity. The WHI collected self-reported information or clinical measurements on most variables. Participant age was reported and categorized into three age ranges (50–59, 60–69, and 70–79). BMI (kg/m^2) was calculated based on height and weight measurements at screening examinations. Women reported ethnicity in one of six groups: American Indian or Alaskan Native, Asian or Pacific Islander, African American, Hispanic or Latino, white (not Hispanic origin), or other. Women reporting other and those not specifying an ethnic group (n=1,813) were excluded from the analysis. Education status was categorized based on the highest grade finished in school. Annual household income was self-reported, and responses were categorized into six categories ranging from less than $20,000 to $100,000 or more. Insurance status was ascertained through questions regarding usual payment of medical care. Alcohol consumption categories included nondrinker, former drinker, and current drinker. Smoking status was classified into never smoker, past smoker, and current smoker. The women were asked about the number of days per week they participated in moderate (e.g., biking outdoors, using exercise machines) or strenuous (e.g., aerobics, swimming laps) exercise. Metabolic equivalent (MET) units were assigned, and continuous and categorical summary variables were created. Participants were asked about history of diabetes mellitus, current use of diabetic treatments, and postmenopausal hormone therapy (HT) use.

Statistical Analysis

Descriptive statistics were performed according to OA status, and chi-square was used to test statistical differences in the frequency of risk factors between the two groups. Continuous age, BMI, and the MET summary variable were also analyzed, but only categorical results are presented. Logistic regression was used to assess the association between the risk factors and the self-report of OA. Marginal analyses were performed using univariate logistic regression models, and the variables found to be significant (*P*<.20) were placed into the multivariate model. Backward elimination regression techniques were used to generate the final model, which included all variables significant at *P*<.05. Ethnic differences in the association between risk factors and OA were tested by examining the ethnic distribution of all variables as well as including an ethnicity and risk factor interaction term in logistic regression models. Ethnicity-specific odds ratios (ORs) were reported if significant interactions were found. All analyses were performed using Stata 10.0 (Statcorp, College Station, TX).

RESULTS

Demographics

At baseline, 63,699 (43.5%) women self-reported OA; 54,122 (83.9%) of those were non-Hispanic white, 5,955 (9.2%) African American, 2,117 (3.3%) Hispanic white, 1,203 (1.9%) Asian or Pacific Islander, and 302 (0.47%) American Indian or Alaskan Native. The OA group was significantly older, heavier, less educated, and less physically active and had a lower total family income than the reference group. Women with OA were significantly (*P*<.001) more likely to rate their overall health as fair or poor (11.5% and 1.1%, respectively) than the reference group (4.7% and 0.3%, respectively). Complete population characteristics can be found in Table 1.

Associations of Arthritis Risk Factors

All variables tested in the marginal analysis were significant at the pre-set alpha level (*P*<. 20) and were included in the full model. A significant linear trend with age was found, with odds of OA the highest in the group aged 70 to 79 (OR=2.69, 95% confidence interval (CI) =2.60–2.78), followed by those aged 60 to 69 (OR=1.81, 95% CI=1.76–1.86), with the group aged 50 to 59 serving as the reference (Table 2). Asian women had significantly lower odds of OA than non-Hispanic white women (OR=0.60, 95% CI=0.55–0.64). The marginal analysis revealed that African-American women had greater odds of OA (1.11, 95% CI=1.07–1.15) than non-Hispanic white women, although this relationship became statistically non-significant in the adjusted model. Native American women had a slightly greater odds of OA than non-Hispanic white women (OR=1.15, 95% CI=0.96–1.38).

Women with a BMI of 40.0λkg/m^2 or greater had a 2.80 (95% CI 2.63–2.99) greater odds of OA than women with a BMI less than 25.0λkg/m^2. Higher levels of education and income were associated with lower odds of OA, and no clear association was seen with alcohol and smoking status. Women in the highest physical activity category had significantly lower odds of OA (OR=0.81, 95% CI=0.78–0.85) than women in the lowest category. The use of diabetic treatments was found to be associated with greater odds of OA (OR=1.23, 95% CI=1.16–1.31), and after adjusting for all variables, current HT usage was associated with greater odds of OA (OR=1.38, 95% CI=1.34–1.41). The adjusted ORs, including 95% CIs, for the total population can be found on Table 2.

Interaction Between Ethnicity and OA

Significant ethnic differences in the distribution of variables were seen, with African-American, American Indian, and Hispanic white women have more OA risk factors and less protective factors. For example, women from these ethnic groups were more likely to be obese than non-Hispanic white women (African American, 57.9%; American Indian, 51.0%; Hispanic, 41.9%; non-Hispanic white, 32.9%). These women also reported the least amount of physical activity (African American, 30.1%; American Indian, 29.5%; Hispanic, 27.9%; non-Hispanic white, 19.5%) and a higher percentage of women using diabetes treatments than non-Hispanic white (African American, 14.2%; American Indian, 15.9%; Hispanic, 8.6%; non-Hispanic white, 4.3%). Although the prevalence of OA increased with age, larger percentages of Hispanic, African American, and American Indian women reporting OA were in the group aged 50 to 59 than non-Hispanic white women (African American, 33.8%; American Indian, 36.4%; Hispanic, 39.3%; non-Hispanic white, 22.6%). The complete distribution of risk factors according to ethnicity can be found in Table 3.

Several significant interaction terms were found, so the analysis was stratified according to ethnicity (Table 2). Slight differences in OA associations were seen according to ethnic group; the most noticeable was BMI. The odds of OA were much higher in American Indian (OR=4.22, 95% CI=1.82–9.77) and African American women (OR=3.31, 95% CI=2.79–3.91) in the highest BMI category than in non-Hispanic white women (OR=2.71, 95% CI=2.52–2.92). Current HT usage was significantly associated with greater odds of OA in all ethnic groups, although the stratified analysis revealed that the association was much higher in American Indian women (OR=2.18, 95% CI=1.47–3.47) than in the other ethnic groups, for example, Asian (OR=1.28, 95% CI=1.09–1.51) and white (OR=1.38, 95% CI=1.35–1.42).

DISCUSSION

OA is a highly prevalent condition in postmenopausal women, with 44% of the WHI participants reporting OA. The WHI self-reported prevalence of OA is similar to what was found in female participants of the Johnston County Osteoarthritis Project,[13] as well as to

national prevalence estimates found previously.[3] The study confirmed several known OA risk factors and found some new and interesting results on the ethnic differences in OA risk factors.

The predominant risk factors confirmed in the analyses were age and BMI, with older age and higher BMI associated with greater odds of OA. Testing the interaction between BMI and ethnicity revealed a differential effect of obesity according to ethnicity on odds of OA. As shown in Table 2, American Indian and African-American women in the extreme obesity category had significantly greater odds of OA than non-Hispanic white women. Asian women had lower odds of OA in each BMI category than the other ethnic groups, although the odds of OA was dramatically greater in Asian women in the highest BMI category.

It is hypothesized that obesity plays a role in OA development and progression through two mechanisms; obesity increases dynamic stress on the joints, which leads to cartilage disruption, and obese people have a higher bone mineral density (BMD), which may increase subchondral bone stiffness and facilitate cartilage breakdown.[14] It has been shown that African Americans have higher BMD than other ethnic groups,[15] so higher BMD coupled with obesity may explain the greater prevalence of OA in the African-American population, as well as the poor joint health found in obese women from other ethnic groups.

Research has shown that African-American and Hispanic populations experience more-disabling effects of arthritis.[9] National population-based studies indicate substantially more disease activity and functional limitations in these groups than in non-Hispanic white Americans.[16] One study assessed ethnic differences in disease activity and found that African-American women had more pain and were considered more disabled than non-Hispanic white women.[17] This provides strong evidence that body weight and BMI may be a large contributing factor to the number and severity of OA symptoms, further elaborating the importance of postmenopausal women, especially African-American, Hispanic, and American Indian women, maintaining a healthy weight.

One unanticipated finding from this study was the greater odds of OA associated with HT use. OA has been linked to estrogen deficiency, and studies on postmenopausal hormone use and its relationship to OA have produced conflicting results. One study found that, in postmenopausal Italian women, users of estrogen replacement therapy had a 27% lower odds of physician-diagnosed OA than those who did not use estrogen replacements.[18] Several other studies have found HT use to be a protective factor,[19,20] although another study found that, after controlling for several risk factors (age, BMI, smoking, and exercise), women using postmenopausal estrogen had a five times greater risk of clinical hip OA, 30% higher knee OA risk, and 50% greater risk of hand OA.[4] Similarly, other studies have found HT to be a risk factor for OA.[21,22] The study found that past and current HT use was associated with 29% and 38% greater odds of OA. The methods used in the Italian study[18] are fairly similar to those used in the current study, although the characteristics of the Italian women were not comparable with those of the WHI population. Although results were similar, the women of one of the studies were all non-Hispanic white women from an upper class community and on average older than the women in the WHI.[4] The current study used self-reported OA and was not site specific. Further investigation of the quantity or duration of HT may provide clearer estimates of the effect of hormones on OA in this population, especially in the American Indian population.

American Indian women who reported current HT use at baseline had more than twice odds of OA than the population as a whole. A literature search was performed on American Indian women and postmenopausal hormone use, and only seven articles were found. The articles showed that HT use may contribute to greater risk of developing diabetes mellitus,[23] as well

as higher levels of inflammatory factors,[24] which both have been shown to play a role in OA. The WHI Native American sample size is not as large as other groups (n=619), but several significant associations and interesting trends were found, signifying the need of further study of OA in this ethnic group.

Strengths and Limitations

The use of general arthritis data as a proxy for OA status is the most noticeable limitation of the study. The WHI arthritis question did not differentiate between arthritic conditions other than rheumatoid arthritis, and with more than 100 conditions considered in the broad category of arthritis, the associations found in this analysis could be weakened because the outcome may represent more than one condition. Nevertheless, OA remains the most common arthritic condition, especially in this age range. Conditions that are generally thought of as arthritic conditions other than OA are fairly rare in the general population. For example, rheumatoid arthritis has a prevalence of 1% in the general population, the prevalence of systemic lupus erythematosus (SLE) is estimated to be 40 to 50 cases per 100,000 persons, and the prevalence of spondylarthropathy (including ankylosing spondylitis, psoriatic arthritis, and inflammatory bowel disease) is estimated to be 2.1 cases per 1,000.[3] The WHI asked about rheumatic conditions such as SLE, Crohn's disease, and ulcerative colitis in separate questions on the medical history questionnaire and specified OA in the medical history follow-up questionnaires, providing firm evidence that the initial arthritis questions were trying to assess the prevalence of OA and that the associations presented in this paper are indeed that of OA.

Using self-reported cases of the outcome is another limitation of this study. Although widely used, validation of this data collection method in OA has not been readily investigated. One study found that a rheumatologist could confirm 81% of self-reported OA cases.[25] The use of a cross-sectional study design limits the results of the analysis because a true temporal relationship between OA and the variables cannot be established. For example, does the lack of physical activity cause OA, or does the development of OA cause reduction in physical activity? The cross-sectional design of this study could also attribute to the discrepancy in HT results. The WHI is not representative of the entire U.S. population, and selection bias may cause under- or overestimation of the prevalence of OA as well as of the associations found. Although a major strength, the size of the WHI allows a statistical association to be found that may not necessarily be meaningful. As with any study, not controlling for all potential confounders and measurement error in data collection could bias the study results.

There are several noteworthy strengths of this study. This is the first study focusing on the prevalence of OA and its risk factors in a large multi-ethnic postmenopausal population. Approximately 20% of the WHI women are from ethnic minority backgrounds, and the women were recruited from 40 centers located across the United States. Because of the focus of the WHI, information on a variety of health information was collected, including almost all of the risk factors associated with OA. The large sample size provided sufficient power to observe important associations and trends in groups with smaller sample sizes. The large sample size also increased the ability to use multiple statistical methods to examine the relationship between the risk factors and OA. With the significant findings found in this study, further analyses using the high-quality data of the WHI is possible.

In conclusion, OA is a prevalent condition in postmenopausal women. This analysis revealed several differences in OA risk according to race or ethnicity in a group of highly motivated, healthy postmenopausal women. It is possible that there are greater ethnic differences in the general population, warranting further study of ethnic variation in frequencies and determining factors.

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Table 1

Characteristics of Study Participants by Baseline Self-Reported Osteoarthritis

	Osteoarthritis	
	No	Yes
	N (%)	N (%)
Total	82,795 (56.5)	63,699 (43.5)
Study Group*		
CT	36,747 (43.8)	28,184 (41.5)
OS	47,211 (56.2)	39,725 (58.5)
Age (years)		
50–59	34,082 (40.6)	16,784 (24.7)
60–69	35,719 (42.5)	32,280 (47.5)
70–79	14,153 (16.9)	18,845 (27.8)
Ethnicity		
Non-Hispanic White	69,256 (83.6)	56,878 (84.9)
Hispanic White	3,626 (4.4)	2,321 (3.5)
African American	6,862 (8.3)	6,279 (9.4)
Asian	2,734 (3.3)	1,231 (1.8)
Native American	317 (0.4)	315 (0.5)
BMI (kg/m^2)		
<24.9	33,011 (39.7)	20,338 (30.2)
25.0–29.9	39,397 (35.2)	23,047 (34.2)
30.0–34.9	13,851 (16.7	13,845 (20.6)
35.0–39.9	4,847 (5.8)	6,391 (9.5)
≥40	2,181 (2.6)	3,698 (5.5)
Education		
Less than high school	3,560 (4.3)	4,133 (6.1)
High School Diploma or GED	13,486 (16.2)	12,353 (18.3)
Some college/vocational/training school	30,807 (37.0)	26,187 (38.8)
College graduate or higher	35,480 (42.6)	24,737 (36.7)
Income		
<$20,000	10,683 (13.6)	12,454 (19.7)
$20,000–$34,999	17,602 (22.4)	16,646 (26.3)
$35,000–$49,999	16,091 (20.5)	13,039 (20.6)
$50,000–$74,999	16,902 (21.6)	11,521 (18.2)
$75,000–$99,999	8,127 (10.4)	4,862 (7.7)
$100,000+	9,026 (11.5)	4,778 (7.5)
Insurance Status		
Yes	78,678 (94.6)	64,856 (96.4)
No	4,478 (5.4)	2,388 (3.6)
Alcohol Consumption		
Non Drinker	8,855 (10.6)	7,503 (11.1)

	Osteoarthritis	
	No	**Yes**
	N (%)	**N (%)**
Past Drinker	13,701 (16.4)	14,009 (20.8)
Current Drinker	60,862 (73.0)	45,932 (68.1)
Smoking Status		
Never Smoked	42,878 (51.6)	33,731 (50.3)
Past Smoker	24,088 (41.0)	29,017 (43.3)
Current Smoker	6,101 (7.3)	4,263 (6.4)
Total Energy Expended in Physical Activity (METs*)		
<1.25	13,993 (17.5)	13,403 (20.8)
1.25–5.49	15,733 (19.7)	13,722 (21.3)
5.50–11.66	16,144 (20.2)	13,338 (20.7)
11.67–20.9	16,012 (20.0)	12,074 (18.8)
≥21.0	18,134 (22.7)	11,836 (18.4)
Diabetes Treatments (pills/shots)		
No	81,091 (96.7)	60,962 (94.5)
Yes	2,798 (3.3)	3,520 (5.5)
Postmenopausal Hormone Therapy		
Never Used	37,697 (44.9)	28,728 (42.3)
Past User	12,303 (14.7)	11,868 (17.4)
Current User	33,890 (40.4)	27,253 (40.2)

*METs = Metabolic Equivalent Unit

Table 2

Odds of Osteoarthritis for the Total Population and by Ethnicity

	White	Hispanic	African American	Asian	American Indian	Total Population*
	OR (95%CI)	**OR (95%CI)**	**OR (95%CI)**	**OR (95%CI)**	**OR (95%CI)**	**OR (95%CI)**
Age						
50–59	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
60–69	1.81 (1.76, 1.87)	1.96 (1.72, 2.25)	1.77 (1.62, 1.94)	1.52 (1.26, 1.82)	1.50 (0.98, 2.26)	1.81 (1.76, 1.86)
70–79	2.82 (2.27, 3.50)	2.80 (2.25, 3.48)	2.60 (2.28, 2.96)	2.49 (2.00, 3.10)	1.91 (1.10, 3.32)	2.69 (2.60, 2.78)
BMI (kg/m^2)						
<24.9	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
25.0–29.9	1.24 (1.20, 1.28)	1.18 (1.00, 1.39)	1.23 (1.09, 1.39)	1.27 (1.08, 1.49)	1.21 (0.74, 1.99)	1.23 (1.20, 1.27)
30.0–34.9	1.55 (1.50, 1.61)	1.47 (1.23, 1.75)	1.69 (1.49, 1.92)	1.16 (0.88, 1.55)	1.59 (0.92, 2.73)	1.55 (1.50, 1.60)
35.0–39.9	2.12 (2.01, 2.24)	1.83 (1.44, 2.33)	2.26 (1.95, 2.62)	1.66 (1.04, 2.67)	2.71 (1.31, 5.58)	2.11 (2.01, 2.22)
≥40	2.71 (2.52, 2.92)	2.47 (1.80, 3.41)	3.31 (2.79, 3.91)	3.22 (1.52, 6.84)	4.22 (1.82, 9.77)	2.80 (2.63, 2.99)
Education						
Less than high school	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
High School Diploma or GED	0.88 (0.81, 0.95)	0.92 (0.75, 1.13)	0.92 (0.78, 1.09)	0.93 (0.65, 1.34)	0.94 (0.48, 1.86)	0.88 (0.82, 0.93)
Some college/training school	0.88 (0.82, 0.94)	0.98 (0.82, 1.17)	0.83 (0.71, 0.96)	0.86 (0.61, 1.21)	0.91 (0.50, 1.63)	0.87 (0.82, 0.92)
College graduate or higher	0.84 (0.78, 0.91)	0.85 (0.69, 1.04)	0.83 (0.71, 0.98)	0.89 (0.62, 1.26)	0.62 (0.32, 1.19)	0.84 (0.79, 0.89)
Income						
<$20,000	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
$20,000-$34,999	0.86 (0.83, 0.90)	0.79 (0.67, 0.94)	0.70 (0.63, 0.79)	1.09 (0.84, 1.42)	0.63 (0.38, 1.06)	0.84 (0.81, 0.87)
$35,000-$49,999	0.81 (0.77, 0.84)	0.76 (0.62, 0.92)	0.67 (0.59, 0.76)	1.10 (0.84, 1.44)	0.56 (0.31, 1.01)	0.79 (0.76, 0.82)
$50,000-$74,999	0.75 (0.71, 0.78)	0.76 (0.61, 0.95)	0.63 (0.55, 0.73)	0.81 (0.62, 1.07)	0.82 (0.44, 1.50)	0.73 (0.70, 0.76)

	White	Hispanic	African American	Asian	American Indian	Total Population*
	OR (95%CI)	OR (95%CI)	OR (95%CI)	OR (95%CI)	OR (95%CI)	OR (95%CI)
$75,000-$99,999	0.72 (0.68, 0.76)	0.55 (0.39, 0.76)	0.49 (0.40, 0.59)	0.96 (0.70, 1.31)	0.52 (0.20, 1.36)	0.69 (0.66, 0.73)
$100,000+	0.68 (0.64, 0.72)	0.73 (0.51, 1.05)	0.56 (0.44, 0.69)	0.96 (0.69, 1.34)	0.64 (0.22, 1.88)	0.67 (0.63, 0.70)
Insurance Status						
Yes	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
No	0.62 (0.58, 0.67)	0.58 (0.48, 0.69)	0.73 (0.62, 0.85)	0.83 (0.48, 1.42)	1.58 (0.76, 3.29)	0.64 (0.61, 0.69)
Alcohol Consumption						
Non Drinker	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Past Drinker	1.17 (1.11, 1.23)	0.96 (0.78, 1.17)	1.24 (1.10, 1.41)	1.04 (0.84, 1.27)	0.87 (0.46, 1.65)	1.16 (1.11, 1.21)
Current Drinker	0.99 (0.94, 1.04)	0.86 (0.72, 1.03)	1.11 (0.98, 1.25)	0.96 (0.81, 1.14)	1.17 (0.64, 2.14)	1.00 (0.96, 1.04)
Smoking Status						
Never Smoked	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Past Smoker	1.08 (1.05, 1.11)	1.13 (0.98, 1.30)	1.17 (1.07, 1.28)	1.02 (0.85, 1.21)	1.12 (0.74, 1.68)	1.09 (1.06, 1.11)
Current Smoker	0.96 (0.91, 1.02)	1.33 (1.05, 1.69)	1.22 (1.07, 1.40)	0.93 (0.62, 1.40)	1.25 (0.64, 2.44)	1.01 (0.96, 1.06)
Total Energy Expended from Physical Activity (METS)						
<1.25	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
1.25–5.49	0.95 (0.91, 0.99)	0.93 (0.78, 1.11)	1.03 (0.92, 1.15)	0.96 (0.76, 1.22)	0.61 (0.35, 1.07)	0.96 (0.92, 0.99)
5.50–11.66	0.95 (0.91, 0.99)	0.87 (0.72, 1.05)	0.95 (0.84, 1.07)	0.90 (0.71, 1.14)	0.87 (0.49, 1.56)	0.94 (0.91, 0.98)
11.67–20.9	0.91 (0.87, 0.95)	0.85 (0.69, 1.04)	0.86 (0.75, 0.98)	0.98 (0.77, 1.24)	0.69 (0.37, 1.30)	0.91 (0.87, 0.94)
≥21.0	0.82 (0.79, 0.86)	0.74 (0.61, 0.91)	0.71 (0.62, 0.81)	0.90 (0.71, 1.14)	0.68 (0.37, 1.22)	0.81 (0.78, 0.85)
Diabetes Treatments (pills/shots)						
No	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Yes	1.25 (1.16, 1.34)	1.28 (1.00, 1.64)	1.15 (1.01, 1.30)	1.26 (0.93, 1.70)	1.35 (0.74, 2.47)	1.23 (1.16, 1.31)

	White	Hispanic	African American	Asian	American Indian	Total Population*
	OR (95%CI)	**OR (95%CI)**	**OR (95%CI)**	**OR (95%CI)**	**OR (95%CI)**	**OR (95%CI)**
Postmenopausal Hormone Therapy						
Never Used	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Past User	1.30 (1.25, 1.34)	1.14 (0.94, 1.37)	1.35 (1.20, 1.51)	1.31 (1.04, 1.64)	1.20 (0.70, 2.06)	1.29 (1.25, 1.34)
Current User	1.38 (1.35, 1.42)	1.31 (1.14, 1.51)	1.32 (1.20, 1.45)	1.28 (1.09, 1.51)	2.18 (1.41, 3.37)	1.38 (1.34, 1.41)

*Adjusted for ethnicity

Table 3

Distribution of Risk Factors by Ethnicity in Women with OA

	White	Hispanic	African American	Asian	American Indian
Total n (%)	54,122 (85.0)	2,117 (3.3)	5,955 (9.4)	1,203 (1.9)	302 (0.5)
Study Group					
OS	33,248 (61.4)	1,207 (57.0)	3,182 (53.4)	785 (65.3)	183 (60.6)
CT	20,874 (38.6)	910 (43.0)	2,773 (46.6)	418 (34.8)	119 (39.4)
Age (years)					
50–59	12,247 (22.6)	831 (39.3)	2,011 (33.8)	310 (25.8)	110 (36.4)
60–69	26,041 (48.1)	968 (45.7)	2,774 (46.6)	502 (41.7)	131 (43.4)
70–79	15,834 (29.3)	318 (15.0)	1,170 (19.6)	391 (32.5)	61 (20.2)
BMI (kg/m^2)					
<24.9	17,373 (32.4)	455 (21.8)	761 (12.9)	664 (55.5)	62 (20.8)
25.0–29.9	18,682 (34.7)	760 (36.3)	1,719 (29.1)	391 (32.7)	84 (28.2)
30.0–34.9	10,519 (19.6)	539 (25.8)	1,629 (27.6)	91 (7.6)	78 (26.2)
35.0–39.9	4,617 (8.6)	213 (10.2)	993 (16.8)	32 (2.7)	40 (13.4)
≥40	2,513 (4.7)	124 (5.9)	797 (13.5)	18 (1.5)	34 (11.4)
Education					
Less than high school	2,187 (4.1)	562 (27.0)	855 (14.5)	89 (7.4)	56 (18.7)
High School Diploma or GED	10,035 (18.7)	347 (16.7)	906 (15.4)	217 (18.1)	51 (17.1)
Some college/vocational/training	20,922 (38.9)	757 (36.4)	2,262 (38.5)	413 (34.5)	138 (46.2)
school	20,622 (38.4)	414 (19.9)	1,857 (31.6)	477 (39.9)	54 (18.1)
College graduate or higher					
Income					
<$20,000	8,444 (16.7)	775 (40.8)	1,962 (36.1)	157 (14.1)	110 (38.7)
$20,000–$34,999	13,476 (26.6)	461 (24.3)	1,319 (24.3)	252 (22.6)	68 (23.9)
$35,000–$49,999	10,751 (21.2)	301 (15.9)	926 (17.0)	235 (21.0)	44 (15.5)
$50,000–$74,999	9,594 (19.0)	230 (12.1)	798 (14.7)	227 (20.3)	41 (14.4)
$75,000–$99,999	4,148 (8.2)	72 (3.8)	249 (4.6)	129 (11.5)	12 (4.2)
$100,000+	4,205 (8.3)	60 (3.2)	183 (3.4)	117 (10.5)	9 (3.2)
Insurance Status					

	White	Hispanic	African American	Asian	American Indian
Yes	52,403 (97.5)	1,719 (84.3)	5,347 (92.2)	1,171 (98.2)	265 (89.5)
No	1,339 (2.5)	319 (15.7)	455 (7.8)	21 (1.8)	31 (10.5)
Alcohol Consumption					
Non Drinker	5,000 (9.3)	413 (19.8)	995 (16.9)	477 (39.8)	45 (15.0)
Past Drinker	10,098 (18.8)	522 (25.0)	2,163 (36.8)	261 (21.8)	86 (28.7)
Current Drinker	38,743 (72.0)	1,151 (55.2)	2,714 (46.2)	460 (38.4)	169 (56.3)
Smoking Status					
Never Smoked	26,516 (49.6)	1,258 (60.5)	2,792 (47.9)	874 (73.0)	139 (46.8)
Past Smoker	23,587 (44.6)	663 (31.9)	2,389 (41.0)	281 (23.5)	127 (42.8)
Current Smoker	3,101 (5.8)	159 (7.6)	643 (11.0)	42 (3.5)	31 (10.4)
Energy Expended from Physical Activity (Mets)					
<1.25	10,530 (19.5)	584 (27.9)	1,784 (30.1)	228 (19.0)	89 (29.5)
1.25–5.49	11,250 (20.8)	503 (24.0)	1,497 (25.2)	237 (19.7)	57 (18.9)
5.50–11.66	11,273 (20.9)	406 (19.4)	1,175 (19.8)	242 (20.1)	67 (22.2)
11.67–20.9	10,587 (19.6)	292 (13.9)	776 (13.1)	244 (20.3)	40 (13.3)
≥21.0	10,355 (19.2)	312 (14.9)	698 (11.8)	252 (20.9)	49 (16.2)
Diabetes Treatment (pills or shots)					
No	51,773 (95.7)	1,934 (91.4)	5,103 (85.8)	1,109 (92.3)	248 (84.1)
Yes	2,303 (4.3)	182 (8.6)	844 (14.2)	93 (7.7)	47 (15.9)
Postmenopausal Hormone Therapy					
Never Used	21,691 (40.1)	1,061 (50.2)	3,514 (59.1)	431 (35.9)	138 (45.7)
Past User	9,457 (17.5)	299 (14.1)	984 (16.6)	201 (16.7)	44 (14.6)
Current User	22,932 (42.4)	755 (35.7)	1,446 (24.3)	570 (47.4)	120 (39.7)