



Use of Complementary and Alternative Therapy for Knee Osteoarthritis: Race and Gender Variations

Ernest R. Vina,¹  Ada O. Youk,² Cristian Quinones,¹  C. Kent Kwoh,¹ Said A. Ibrahim,³ and Leslie R.M. Hausmann²

Objective. To evaluate race and gender variations in complementary and alternative medicine (CAM) use for knee osteoarthritis (OA) (unadjusted and adjusted for demographic and clinical factors).

Methods. A secondary analysis of cross-sectional data was conducted. The sample included Veterans Affairs patients 50 years of age or older with symptomatic knee OA. Current use of various CAM therapies was assessed at baseline. Logistic regression models were used to compare race and gender differences in the use of specific CAMs.

Results. The sample included 517 participants (52.2% identified as African American [AA]; 27.1% identified as female). After adjusting for demographic and clinical factors, AA participants, compared with white participants, were less likely to use joint supplements (odds ratio [OR]: 0.53; 95% confidence interval [CI], 0.31-0.90); yoga, tai chi, or pilates (OR: 0.39; 95% CI: 0.19-0.77); and chiropractic care (OR: 0.51; 95% CI: 0.26-1.00). However, they were more likely to participate in spiritual activities (OR: 2.02; 95% CI: 1.39-2.94). Women, compared with men, were more likely to use herbs (OR: 2.42; 95% CI: 1.41-4.14); yoga, tai chi, or pilates (OR: 2.09; 95% CI: 1.04-4.19); acupuncture, acupressure, or massage (OR: 2.45; 95% CI: 1.28-4.67); and spiritual activities (OR: 1.68; 95% CI: 1.09-2.60). The interactive effects of race and gender were significant in the use of herbs ($P = 0.008$); yoga, tai chi, or pilates ($P = 0.011$); acupuncture, acupressure or massage ($P = 0.038$); and spiritual activities ($P < 0.001$).

Conclusion. There are race and gender differences in the use of various CAMs for OA. As benefits and limitations of CAM therapies vary, clinicians must be aware of these differences.

INTRODUCTION

Approximately 27 million Americans have symptomatic osteoarthritis (OA) (1). The lifetime risk of symptomatic knee OA is 1 in 2 and is nearly 2 in 3 for individuals with obesity (2). Although there are various nonpharmacologic and pharmacologic therapies that may be used to manage OA, there is no known cure, and many patients with OA have unrelieved pain and chronic disability (3,4). Because of the limited number of effective therapies, more than 40% of patients with OA report the use of a variety of different complementary and alternative medicine (CAM) therapies (5). Despite widespread use of CAM for OA, there is

limited support of efficacy from high-quality randomized controlled clinical trials (3,6).

Certain CAM therapies (eg, yoga, tai chi, and acupuncture) have been shown to be effective for joint pain, function, and mobility and are strongly recommended in the 2019 American College of Rheumatology/Arthritis Foundation (ACR/AF) Guideline for the Management of OA (3). The use of other treatments (eg, glucosamine, chondroitin, manual therapy [eg, mobilization/manipulation used by chiropractors], and massage therapy), however, is strongly or conditionally recommended against by the recent ACR/AF Guideline (3). A recent systematic review and meta-analysis of dietary supplements for OA, for instance, found that the quality

Supported by the Veterans Health Administration Health Services Research and Development Service (IIR13-080; Principal Investigator: Dr. Hausmann). Dr. Vina was supported in part by a K23 Career Development Award from the National Institute of Arthritis and Musculoskeletal and Skin Diseases (K23AR067226). Dr. Ibrahim was supported in part by a K24 Mid-Career Development Award from the National Institute of Arthritis and Musculoskeletal and Skin Diseases (K24AR055259).

¹Ernest R. Vina, MD, MS, Cristian Quinones, BS, C. Kent Kwoh, MD: College of Medicine and University of Arizona Arthritis Center, University of Arizona, Tucson; ²Ada O. Youk, PhD, Leslie R.M. Hausmann, PhD: Veterans Affairs Pittsburgh Healthcare System and University of Pittsburgh, Pittsburgh, Pennsylvania; ³Said A. Ibrahim, MD, MPH, MBA: Weill Cornell Medicine, New York, New York.

Dr. Kwoh reports grants from Abbvie, EMD Serono, Lilly, Pfizer, GlaxoSmithKline, and Cumberland Pharmaceuticals and reports personal fees from Amzell, Thusane, EMD Serono, Express Scripts, Regeneron, Taiwan Liposome Company, LG Chem, Focus Communications, PRIME Education, Kolon Tissue Gene, and Sanofi outside the submitted work. Dr. Kwoh also participated on an advisory board for Kolon Tissue Gene and Sanofi. Dr. Vina reports personal fees from Sanofi outside the submitted work. No other disclosures relevant to this article were reported.

Address correspondence to Ernest R. Vina, MD, MS, University of Arizona Arthritis Center, 1501 North Campbell Avenue, PO Box 245093, Tucson, AZ 85724-5093. Email: evina@arizona.edu.

Submitted for publication June 17, 2021; accepted June 21, 2021.

of evidence for efficacy was low (7). “Strong recommendations” were made when there was compelling evidence of efficacy and that benefits clearly outweighed harms and burdens (3). On the other hand, “conditional recommendations” were made when the quality of the evidence proved to be low or very low and/or the balance of benefits versus harms and burdens was sufficiently close that shared decision-making between the patient and the clinician would be particularly important.

Compared with non-Hispanic white individuals, African American (AA) individuals are more likely to develop symptomatic knee and hip OA (8). AA individuals are also more likely than white individuals to report greater knee pain, stiffness, and disability due to lower extremity OA (9,10). In addition, there are known racial differences in radiographic knee OA features (11–13). In a recent longitudinal study, AA men had higher risk of development of medial joint space narrowing of the knee, a sign of structural progression, compared with AA women and white individuals (13). Although AA individuals have a higher burden of lower extremity OA than white individuals, studies suggest that they are less likely to be on an anti-inflammatory medicine or an opioid analgesic for OA (14,15). Most studies done in the United States also report that AA individuals are less likely than white individuals to use CAM therapies (16–22). Very few studies, however, have examined racial and ethnic differences in CAM use for knee OA management (16,17,23,24).

Similarly, compared with men, women are more likely to develop hand, foot, and knee OA (25). Women also report higher pain and lower quality of life due to knee and other types of OA (26,27). Studies suggest that women are more likely than men to receive a prescription for a nonsteroidal anti-inflammatory drug for OA (28). As oral NSAIDs are strongly recommended for patients with knee, hip, and/or hand OA by the ACR/AF Guideline (3), underutilization of these medications is likely to be perceived negatively by most. Regardless, actions to mitigate the risks of their use (eg, monitoring for the development of gastrointestinal and renal side effects) should be done by prescribing providers. CAM use, in general, is more common among women than among men (22,29–32). However, it is not clear whether there are gender differences in CAM use for knee OA or whether gender differences in the use of CAMs for OA may vary by CAM type.

Although it is important to examine the effects of race and gender on CAM treatment use independently, it is also important to examine the effects of race and gender simultaneously. Race and gender are interlocking categories of experiences that affect all aspects of human life (33,34). They simultaneously influence and structure the lives, issues, identities, and experiences of people. Although race or gender may feel more salient or meaningful in a person’s life at times, they are “overlapping and cumulative” in their effect on people’s experience (33). Although OA causes more pain and disability among AA individuals and women than among white individuals and men, respectively, rarely are race and gender considered simultaneously in OA (9,10,26,27). Because of

historical mistreatment of and experimentation on AA individuals, particularly AA women, there may also be different levels of trust in the modern medical establishment and of openness to CAM as an alternative to traditional pharmacologic treatment for pain across race and gender subgroups (35).

The primary objective of this analysis is to evaluate race and gender variations in the use of various CAMs for knee OA management. The secondary objective is to determine whether race and gender differences in the use of different CAMs persist after adjustment for potential demographic and clinical confounders.

METHODS

Study design and setting. This study is a cross-sectional analysis of data from a sample of patients who participated in a clinical trial that investigated the effects of a positive psychological intervention on chronic knee OA pain (36). Study participants were recruited from two large, urban, academic Veterans Affairs (VA) medical centers, and the details of the study were previously described (36). Patients who screened positive for chronic pain consistent with knee OA were randomized to a 6-week program consisting of either positive psychological skill-building activities or neutral control activities. Patients who met the study criteria were invited to complete an in-person baseline questionnaire administered by trained research staff; all data used for the current analysis were from the baseline questionnaire. The study was approved by the VA Central Institutional Review Board.

Participants. The study sample included primary care patients with symptomatic knee OA. Based on the requirements of the parent study, only those who self-identified as non-Hispanic white or non-Hispanic AA were included (36). Patients who met the initial screening criteria on the basis of a review of the VA medical records were mailed an invitation to be screened for the study (36). Patients who expressed interest or did not respond within 2 weeks were telephoned by trained research staff to determine study eligibility prior to enrollment. Individuals were included in the study if they were 50 years of age or older; self-reported as non-Hispanic AA or white; received primary care at a participating site; reported frequent pain characteristic of symptomatic knee OA identified using questions from the Osteoarthritis Initiative Study (37); rated their pain as 4 or more on a 0 to 10 numeric rating scale; and could speak, read, and write in English. Exclusion criteria included self-reported serious problems with eyesight, hearing, or memory; past diagnosis with any type of arthritis other than OA; treatment for cancer in the last 3 years; plan to have a knee replacement surgery in the next 6 months; steroid injection or knee replacement in the last 3 months; inability to complete the study procedures; and lack of a reliable telephone number. Patients who answered two or more items incorrectly on a six-item screening test for cognitive impairment were also excluded (38).

Study variables. *Outcome.* The primary outcome of analysis was self-reported use of CAMs categorized by the National Center for Complementary and Alternative Medicine (39) (natural products, mind and body practices, and others) at the time of the baseline visit. A list of commonly used CAM treatments for OA was adapted from the CAM treatments assessed in the Osteoarthritis Initiative Study (37). Specifically, participants were asked the following: “Are you currently using any of the following specifically for joint pain or arthritis?” Patients responded yes or no for each of the following types of CAM: 1) herbs (echinacea, ginger, or garlic); 2) vitamins/minerals; 3) joint health supplements (glucosamine, chondroitin, S-adenosylmethionine, or methylsulfonylmethane); 4) yoga, tai chi, chi gong, or pilates; 5) acupuncture, acupressure, or massage therapy; 6) chiropractic care; 7) relaxation/mind–body activities; 8) homeopathy/naturopathy; 9) copper bracelets/magnets; and 10) spiritual activities. Current use of each specific CAM was assessed at baseline. Treatment use was assessed on the basis of self-report with dichotomous variables indicating current use or no use of each of the CAM treatments for OA.

Exposure variables and study covariates. The main exposure variables were patient race (non-Hispanic AA or non-Hispanic white) and gender (male or female), both of which were self-reported by participants during the telephone screening for the parent study. Other self-reported demographic characteristics included age, employment, and annual income. An interviewer-administered Charlson Comorbidity Index was also used to evaluate physical comorbid conditions (40). Mental comorbidities were assessed using parts of the 2010 Behavioral Risk Factor Surveillance System Questionnaire (41). Specifically, patients were asked to respond yes or no to the following questions: 1) “Has a doctor or other healthcare provider ever told you that you have an anxiety disorder (including acute stress disorder, anxiety, generalized anxiety disorder, obsessive-compulsive disorder, panic disorder, phobia, posttraumatic stress disorder, or social anxiety disorder)?” and 2) “Has a doctor or other healthcare provider ever told you that you have a depressive disorder (including depression, major depression, dysthymia, or minor depression)?” Knee OA–related pain, stiffness, and functional impairment were assessed using the Western Ontario McMaster Osteoarthritis Index (WOMAC) and were summed up for a combined WOMAC total score (42,43).

Statistical analysis. Descriptive statistics, including means and SDs for continuous variables and percentages and frequencies for categorical variables, were calculated. Use of each CAM was compared by race (white versus AA) and by gender (male versus female) using logistic regression models controlling for recruitment site, age, WOMAC total, and comorbidity score. Variables previously associated with CAM use among those with OA were chosen as covariates (16,17,23,29,30).

Table 1. Demographic and clinical characteristics of 517 veterans with OA

Characteristic	Results
Age, mean (SD)	63.7 (8.5)
Female gender, n (%)	140 (27.1)
African American race, n (%)	270 (52.2)
Employment, n (%)	
Employed	144 (27.8)
Retired	205 (39.7)
Unemployed/other	51 (9.9)
Disabled	117 (22.6)
Annual income, ^a n (%)	
<\$20,000	127 (24.6)
>\$20-\$39,000	142 (27.5)
>\$40,000	220 (42.6)
History of depression, n (%)	228 (44.1)
History of anxiety, n (%)	201 (38.9)
WOMAC total, ^b mean (SD)	48.2 (16.4)
Charlson comorbidity score, n (%)	
0-1	163 (31.5)
2-3	175 (33.9)
4+	179 (34.6)

Abbreviation: OA, osteoarthritis; WOMAC, Western Ontario McMaster Osteoarthritis Index.

^a Income data missing on 28 patients.

^b Total WOMAC missing for 15 patients.

To understand the interactive effects of race and gender, we also combined race and gender into a single independent variable with the following categories: white men, white women, AA men, and AA women. We then ran separate logistic regression models to estimate race and gender group differences in the use of the different types of CAM compared with white men as the reference race/gender group. The models were adjusted for recruitment site, age, WOMAC total, and comorbidity score. We considered additionally adjusting for body mass index but found that it had minimal effect in the regression models. Likelihood ratio tests were used to determine the overall effect of the race/gender variable across all categories in each model. All analyses were performed using STATA software, version 14.0 (StataCorp LP).

RESULTS

Baseline sample characteristics. A total of 270 identified as AA (193 men and 77 women), and 247 identified as white (184 men and 63 women). Briefly, among the 517 veterans recruited for the study, the mean age was 63.7, and 27.1% were female (Table 1). Many were retired (39.7%) and had an annual income of more than \$40,000 (42.6%). More than one-third had a history of depression (44.1%) or anxiety (38.9%).

Complementary/alternative therapy use by race and gender. Frequency of use of all types of CAMs evaluated by different race and gender groups (white men, white women, AA men, and AA women) are shown in Table 2. Race and gender

Table 2. Complementary/alternative therapy use by race and gender

	White		African American	
	Male (n = 184)	Female (n = 63)	Male (n = 193)	Female (n = 77)
Natural products, n (%)				
Herbs	27 (14.7)	12 (19.1)	22 (11.4)	26 (33.8)
Vitamins/minerals	99 (53.8)	32 (50.8)	90 (46.6)	42 (54.6)
Joint health supplements	38 (20.7)	9 (14.3)	19 (9.8)	9 (11.7)
Mind and body practices, n (%)				
Yoga, tai chi, chi gong, or pilates	18 (9.8)	10 (15.9)	6 (3.1)	9 (11.7)
Acupuncture, acupressure, or massage therapy	16 (8.7)	9 (14.3)	12 (6.2)	13 (16.9)
Chiropractic care	22 (12.0)	5 (7.9)	12 (6.2)	4 (5.2)
Relaxation/mind-body activities	52 (28.3)	25 (39.7)	58 (30.1)	27 (35.1)
Spiritual activities	62 (33.7)	30 (47.6)	101 (52.3)	49 (63.6)
Others, n (%)				
Homeopathy/naturopathy	5 (2.7)	1 (1.6)	2 (1.0)	7 (9.1)
Copper bracelets/magnets	13 (7.1)	2 (3.2)	21 (10.9)	7 (9.1)

differences in CAM use for OA were evaluated after controlling for recruitment site, age, total WOMAC score (pain, stiffness, and functional impairment), and comorbidity score (Table 3).

AA individuals, compared with white individuals, were less likely to report using joint health supplements (odds ratio [OR]: 0.53; 95% confidence interval [CI]: 0.31-0.90; *P* = 0.019); yoga, tai chi, or pilates (OR: 0.39; 95% CI: 0.19-0.77; *P* = 0.007); and chiropractic care (OR: 0.51; 95% CI: 0.26-1.00; *P* = 0.051) for knee OA. They were, however, more likely to report participating in spiritual activities (OR: 2.02; 95% CI: 1.39-2.94; *P* < 0.001). No other racial differences in CAM use for knee OA were observed (Table 2).

Women, compared with men, were more likely to report using herbs (OR: 2.42; 95% CI: 1.41-4.14; *P* = 0.001); yoga, tai chi, or pilates (OR: 2.09; 95% CI: 1.04-4.19; *P* = 0.037); acupuncture, acupressure, or massage therapy (OR: 2.45; 95% CI: 1.28-4.67; *P* = 0.007); and spiritual activities (OR: 1.68; 95% CI: 1.09-2.60;

P = 0.019). No other gender differences in CAM use for knee OA were found (Table 3).

Interactions between race and gender. In models fully adjusted for recruitment site, age, WOMAC total, and comorbidities, the overall effects of the combined race/gender variable across all categories (ie, the race × gender interactions) were significant for the use of herbs (*P* = 0.008); yoga, tai chi, chi gong, or pilates (*P* = 0.011); acupuncture, acupressure, or massage therapy (*P* = 0.038); and spiritual activities (*P* < 0.001) for knee OA (Table 4).

AA women, compared with white men, had significantly higher odds of using herbs (OR: 2.43; 95% CI: 1.17-5.06; *P* = 0.018). Though not statistically significant, they also had lower odds of using joint health supplements and chiropractic care (Table 4). AA men, compared with white men, had lower odds of using joint health supplements (OR: 0.47; 95% CI: 0.25-0.87;

Table 3. Main effects of race and gender in complementary/alternative therapy use

	African American (Versus White) Race		Female (Versus Male) Gender	
	Odds Ratio (95% Confidence Interval)	<i>P</i> Value	Odds Ratio (95% Confidence Interval)	<i>P</i> Value
Natural Products				
Herbs	0.96 (0.57-1.60)	0.868	2.42 (1.41-4.14)	0.001
Vitamins/minerals	0.84 (0.58-1.22)	0.363	1.05 (0.68-1.62)	0.821
Joint health supplements	0.53 (0.31-0.90)	0.019	0.93 (0.50-1.72)	0.811
Mind and body practices				
Yoga, tai chi, chi gong, or pilates	0.39 (0.19-0.77)	0.007	2.09 (1.04-4.19)	0.037
Acupuncture, acupressure, or massage therapy	0.81 (0.44-1.50)	0.503	2.45 (1.28-4.67)	0.007
Chiropractic care	0.51 (0.26-1.00)	0.051	0.74 (0.33-1.68)	0.475
Relaxation/mind-body activities	0.94 (0.63-1.40)	0.751	1.43 (0.91-2.24)	0.122
Spiritual activities	2.02 (1.39-2.94)	<0.001	1.68 (1.09-2.60)	0.019
Others				
Homeopathy/naturopathy	1.05 (0.34-3.19)	0.935	2.92 (0.93-9.18)	0.066
Copper bracelets/magnets	1.70 (0.86-3.37)	0.125	0.70 (0.31-1.59)	0.398

Data are adjusted for recruitment site, age, Western Ontario McMaster Osteoarthritis Index total, and comorbidities.

Table 4. Odds ratio of CAM treatment use among different race and gender groups in comparison with white men (n = 184)

Treatment	White Women (n = 63) ^a	African American Men (n = 193) ^a	African American Women (n = 77) ^a	P Value ^b
Natural Products				
Herbs	1.63 (0.73-3.61)	0.73 (0.39-1.40)	2.43 (1.17-5.06) ^c	0.008
Vitamins/minerals	0.93 (0.50-1.72)	0.79 (0.51-1.22)	0.93 (0.50-1.71)	0.751
Joint health supplements	0.76 (0.33-1.73)	0.47 (0.25-0.87) ^c	0.56 (0.24-1.34)	0.107
Mind and Body Practices				
Yoga, tai chi, chi gong, or pilates	1.50 (0.62-3.63)	0.26 (0.10-0.69) ^c	0.94 (0.36-2.44)	0.011
Acupuncture, acupressure, or massage therapy	1.81 (0.73-4.50)	0.64 (0.29-1.42)	2.09 (0.85-5.12)	0.038
Chiropractic care	0.54 (0.18-1.61)	0.43 (0.20-0.93) ^c	0.52 (0.16-1.69)	0.169
Relaxation/mind-body activities	1.72 (0.91-3.26)	1.04 (0.65-1.66)	1.25 (0.66-2.38)	0.354
Spiritual activities	1.99 (1.08-3.70) ^c	2.20 (1.42-3.41) ^c	3.18 (1.71-5.94) ^c	<0.001
Others				
Homeopathy/naturopathy	0.62 (0.07-5.85)	0.34 (0.06-1.87)	2.68 (0.65-11.02)	0.089
Copper bracelets/magnets	0.44 (0.10-2.07)	1.50 (0.71-3.18)	1.31 (0.45-3.79)	0.356

Abbreviation: CAM, complementary and alternative medicine.

^a Logistic regression model controlled for recruitment site, age, Western Ontario McMaster Osteoarthritis Index total, and comorbidities.

^b Likelihood ratio test for overall effect of race/gender variable across all categories.

^c $P < 0.05$.

$P = 0.016$); yoga, tai chi, chi gong, or pilates (OR: 0.26; 95% CI: 0.10-0.69; $P = 0.007$); and chiropractic care (OR: 0.43; 95% CI: 0.20-0.93; $P = 0.032$).

Although not statistically significant, white women, compared with white men, had higher odds of use of the following treatments: herbs; acupuncture, acupressure, or massage therapy; mind-body activities; and yoga, tai chi, chi gong, or pilates (Table 4). Compared with white men, white women (OR: 1.99; 95% CI: 1.08-3.70; $P = 0.028$), AA men (OR: 2.20; 95% CI: 1.42-3.41; $P < 0.001$), and AA women (OR: 3.18; 95% CI: 1.71-5.94; $P < 0.001$) all had significantly higher odds of using spiritual activities for knee OA treatment.

DISCUSSION

In this sample of patients with symptomatic knee OA, AA individuals were significantly less likely than white individuals to use several types of CAMs for pain management, including joint health supplements; yoga, tai chi, or pilates; and chiropractic care. On the other hand, AA patients were more likely to participate in spiritual activities to manage pain from arthritis. We also found that, compared with men, women were more likely to use various CAM modalities such as herbs; yoga, tai chi, or pilates; acupuncture, acupressure, or massage; and spiritual activities. Our study is novel in evaluating the combined effects of race and gender in the use of various CAMs, including recommended and nonrecommended treatments for knee OA. We appropriately controlled for variables that could affect CAM use, including age, OA-related symptoms, and number of medical comorbidities. We found significant interactions between race and gender upon evaluating the use of the following: herbs; yoga, tai chi, chi gong, or pilates; acupuncture, acupressure, or massage; and spiritual activities.

Our findings on race variation in CAM use for knee OA are partially consistent with those of prior studies (16–22). Joint health supplements, such as glucosamine and chondroitin, were less likely to be used by AA patients than white patients in our study and other studies of patients with arthritis (16,17,23). Identical to our study findings, most mind-body practices (eg, yoga or chiropractic care) were less often used by AA individuals than white individuals in studies of people with and without arthritis (16–23). Spiritual activities were also more often used by AA individuals than white individuals in our study and in several other studies (16,19,20,23). Similar to what others had found, we also did not find racial differences in the use of homeopathy/naturopathy and copper for arthritis (16,23). There were mixed findings in the literature on race differences in the use of herbs and vitamins/minerals (16–21,23), and our study is more aligned with studies that have found those natural products to minimally differ by race. We found a race difference in the use of herbs *only* upon comparing AA women with white men. Finally, relaxation therapy was also more commonly reported by AA patients than white patients in two studies of patients with OA (16,23) but not in our study.

Finding that CAM use was more common in women than in men is generally consistent with other studies of patients with arthritis (22,29–32) and those with other chronic diseases (44–46). Similar to what we found, the use of movement-based practices and massage was more common in women than in men in another cohort of patients with radiographic knee OA (29). Greater use of spiritual activities to treat arthritis among women than among men was found by us and several other investigators (29,30). Similar to what others had found, we also observed no gender differences in the use of homeopathy/naturopathy and copper for OA (29). On the other hand, upon evaluating the use of natural products, we found that herbs were more often used by women than men,

but others only found gender differences in the use of vitamins/minerals for arthritis (29,30). Although our study did not find gender differences in the use of chiropractic medicine and relaxation for arthritis, others found that these practices were more common among women than among men (22,29,30).

Only a handful of these previous studies examined race (16,17,23) and gender (29,30) differences in the use of specific CAMs among those with arthritis. Our study results may not be completely consistent with these other reports for various reasons. For example, CAM use definition may vary across studies. Although we evaluated “current” use, others evaluated use in the past 1 to 12 months (16,23,29). The study populations also differed. Whereas we evaluated patients enrolled in an OA clinical trial, others evaluated study participants included in a cohort of patients with OA followed longitudinally (16,23,29) or community-dwelling patients with arthritis recruited for a cross-sectional study (17,30). All our study participants also volunteered in a clinical trial that evaluated the effects of a positive psychological intervention in OA; this selection bias might have reduced the effects of race and gender on CAM use, particularly the mind and body practices. The rate of yoga, tai chi, chi gong, or pilates use was comparable, but the rate of relaxation therapy use was higher (>30% versus <15%), in our study sample compared with rates found in other comparable studies (16,23,29).

Our study complements these previous studies by determining whether or not gender differences in CAM use differed by race and vice versa. Race and gender are some of the most powerful organizing principles in the development of cultural ideology (47). There is a consensus among sociologists that race and gender influence and structure people’s lives simultaneously and that the effects of race, gender, and other social identities cannot really be separated (33,34). Conceptualized in the 1980s, intersectionality is an analytical framework for understanding how different aspects of a person’s social identities combine to create different modes of discrimination and privilege (34,47). Therefore, we chose to analyze the interactive effects of race and gender on CAM use for OA treatment.

By stratifying people with knee OA by gender, Jawahar et al (29) found that AA women were less likely to use CAMs with conventional OA medications relative to white women and that AA men were less likely to use CAMs in general than white men. Our study is the first to examine this potential race and gender interaction in relation to the use of more specific CAMs in OA. We found that, in comparison with white men, AA women were more likely to use herbs, whereas AA men were less likely to use joint health supplements and mind–body practices (eg, yoga, tai chi, pilates, or chiropractic care) for arthritis. White men were also less likely to use spiritual activities for OA compared with all other race/gender groups in the study.

Our study findings have important clinical implications. Results from our study may guide clinicians in identifying and exploring factors that drive treatment preferences in patients with

OA who may be underutilizing recommended treatments or those overutilizing nonrecommended treatments. Among the CAM treatments that we studied, the 2019 ACR/AF Guideline for the Management of OA and the OA Research Society International Guideline for Non-Surgical OA Management recommended the use of only yoga (conditionally), tai chi (strongly), and acupuncture (conditionally) for knee/hip OA (3,6). As AA men are less likely to participate in yoga or tai chi compared with other race/gender groups, clinicians may inquire about this group’s interest in such practices and raise awareness about the treatments’ potential benefits. As men are less likely than women to use acupuncture for OA, clinicians may also encourage men to try the therapy to better control their OA symptoms. Encouraging the use of such evidence-based and guideline-recommended CAMs is appropriate for certain subsets of patients with OA, considering the underutilization of particular standard OA therapies among certain subgroups of patients (eg, joint replacement surgery among AA patients and nonsteroidal anti-inflammatory drugs among men) (28,48).

On the other hand, the ACR/AF Guideline recommended against the use of joint health supplements (strongly), massage (conditionally), and manual therapy (conditionally) (3). As white individuals may be more likely to use joint health supplements than AA individuals, clinicians may consider questioning the perceived benefits of these nonrecommended supplements and suggesting more effective treatment approaches for those patients whose pain persists in the use of supplements. Guideline recommendations may change based on new evidence, so clinicians need to be aware of evolving recommendations. Patient preferences and clinical comorbidities should also always be taken into account when making recommendations about CAM use. Conditional recommendations in particular are preference sensitive and warrant a full shared decision-making approach involving explanation of benefits and risks of treatment in language that patients understand (49).

From a research perspective, our findings underscore the need to recruit diverse study participants when determining the efficacy of CAM treatments for OA. There are known race and gender differences in the reported benefits of certain pharmacologic treatments for pain (50,51). Investigators should strive to recruit study participants of various racial/ethnic backgrounds of both genders upon designing clinical trials that involve CAM therapies. Future studies should also strive to evaluate various patient-, provider-, and health care system-level factors that could explain race/gender differences in CAM use. There are known group differences in patient attitudes and beliefs about various OA treatments that are driven by a multitude of individual and cultural factors (52,53), and there may also be race/gender differences in attitudes and beliefs about CAMs. Affordability of and access to CAM treatments may contribute to differential uptake of these treatments among historically marginalized populations (eg, subgroups of AA women). Providers, consciously

or unconsciously, may make biased recommendations about CAMs on the basis of patient race/gender. Underrepresentation of AA and female physicians who have expertise in CAM therapy may also play a factor. Finally, access to rheumatologists, integrative medicine specialists, and other providers who may provide recommendations about CAM use in OA may vary among different race/gender groups.

There are a few limitations to this study. First, this is a cross-sectional study design. We can only examine association, but not causation, between race/gender and CAM use for OA. Second, the study participants were all clinical trial study participants, and all had to meet the inclusion and exclusion criteria set by the clinical trial (36). Study participants also self-selected into the study, although we used a very inclusive recruitment strategy with broad inclusion criteria to get as representative a sample as possible. At first glance, the generalizability of the study findings may seem to be limited, but our study findings were generally consistent with those of similar studies that evaluated community-dwelling adults (17–19,21,22,30). Third, some of the race/gender groups (eg, AA women) are small in number, limiting the power to detect differences in CAM use for these groups. Larger studies are needed to confirm or refute some of the study findings that looked potentially important but did not rise to traditional levels of statistical significance. Finally, we only studied CAM use at one point in time and did not examine the reasons underlying differential use of CAM.

In summary, among veterans with symptomatic knee OA, we found race and gender differences in the use of natural products (eg, joint health supplements) and mind and body practices (eg, yoga, tai chi, spiritual activities) for arthritis pain. Compared with white men, AA women had a higher likelihood of using herbs, whereas AA men had lower likelihood of using joint health supplements, yoga, tai chi, and chiropractic care. All other race/gender groups also had higher likelihood of participating in spiritual activities for knee OA than white men. Clinicians need to be aware of race and gender differences upon evaluating patient use of various CAMs for knee OA in order to promote evidence-based practices while educating patients about treatments that lack evidence of efficacy.

ACKNOWLEDGMENTS

The authors thank all Staying Positive With Arthritis study staff and participants.

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. Hausmann 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.

Study conception and design. Vina, Kwoh, Ibrahim, Hausmann.

Acquisition of data. Hausmann.

Analysis and interpretation of data. Vina, Youk, Quinones, Kwoh, Ibrahim, Hausmann.

REFERENCES

1. Lawrence RC, Felson DT, Helmick CG, Arnold LM, Choi H, Deyo RA, et al. Estimates of the prevalence of arthritis and other rheumatic conditions in the United States. Part II. *Arthritis Rheum* 2008;58:26–35.
2. Murphy L, Schwartz TA, Helmick CG, Renner JB, Tudor G, Koch G, et al. Lifetime risk of symptomatic knee osteoarthritis. *Arthritis Rheum* 2008;59:1207–13.
3. Kolasinski SL, Neogi T, Hochberg MC, Oatis C, Guyatt G, Block J, et al. 2019 American College of Rheumatology/Arthritis Foundation guideline for the management of osteoarthritis of the hand, hip, and knee. *Arthritis Care Res* 2020;72:149–62.
4. Cross M, Smith E, Hoy D, Nolte S, Ackerman I, Fransen M, et al. The global burden of hip and knee osteoarthritis: estimates from the global burden of disease 2010 study. *Ann Rheum Dis* 2014;73:1323–30.
5. Lapane KL, Sands MR, Yang S, McAlindon TE, Eaton CB. Use of complementary and alternative medicine among patients with radiographic-confirmed knee osteoarthritis. *Osteoarthritis Cartilage* 2012;20:22–8.
6. Bannuru RR, Osani MC, Vaysbrot EE, Arden NK, Bennell K, Bierma-Zeinstra SM, et al. OARSI guidelines for the non-surgical management of knee, hip, and polyarticular osteoarthritis. *Osteoarthritis Cartilage* 2019;27:1578–89.
7. Liu X, Machado GC, Eyles JP, Ravi V, Hunter DJ. Dietary supplements for treating osteoarthritis: a systematic review and meta-analysis. *Br J Sports Med* 2018;52:167–75.
8. Allen KD, Golightly YM. State of the evidence. *Curr Opin Rheumatol* 2015;27:276–83.
9. Allen KD, Helmick CG, Schwartz TA, DeVellis RF, Renner JB, Jordan JM. Racial differences in self-reported pain and function among individuals with radiographic hip and knee osteoarthritis: the Johnston County Osteoarthritis Project. *Osteoarthritis Cartilage* 2009;17:1132–6.
10. Vina ER, Ran D, Ashbeck EL, Kwoh CK. Natural history of pain and disability among African-Americans and Whites with or at risk for knee osteoarthritis: a longitudinal study. *Osteoarthritis Cartilage* 2018;26:471–9.
11. Braga L, Renner JB, Schwartz TA, Woodard J, Helmick CG, Hochberg MC, et al. Differences in radiographic features of knee osteoarthritis in African-Americans and Caucasians: the Johnston county osteoarthritis project. *Osteoarthritis Cartilage* 2009;17:1554–61.
12. Kopec JA, Sayre EC, Schwartz TA, Renner JB, Helmick CG, Badley EM, et al. Occurrence of radiographic osteoarthritis of the knee and hip among African Americans and whites: a population-based prospective cohort study. *Arthritis Rheum* 2013;65:928–35.
13. Vina ER, Ran D, Ashbeck EL, Ratzlaff C, Kwoh CK. Race, sex, and risk factors in radiographic worsening of knee osteoarthritis. *Semin Arthritis Rheum* 2018;47:464–71.
14. Dominick KL, Bosworth HB, Jeffreys AS, Grambow SC, Oddone EZ, Horner RD. Racial/ethnic variations in non-steroidal anti-inflammatory drug (NSAID) use among patients with osteoarthritis. *Pharmacoepidemiol Drug Saf* 2004;13:683–94.
15. Dominick KL, Bosworth HB, Dudley TK, Waters SJ, Campbell LC, Keefe FJ. Patterns of opioid analgesic prescription among patients with osteoarthritis. *J Pain Palliat Care Pharmacother* 2004;18:31–46.
16. Yang S, Jawahar R, McAlindon TE, Eaton CB, Lapane KL. Racial differences in symptom management approaches among persons with radiographic knee osteoarthritis. *BMC Complement Altern Med* 2012;12:86.
17. Mikuls TR, Mudano AS, Pulley L, Saag KG. The association of race/ethnicity with the receipt of traditional and alternative arthritis-specific health care. *Med Care* 2003;41:1233–9.
18. Rhee TG, Evans RL, McAlpine DD, Johnson PJ. Racial/ethnic differences in the use of complementary and alternative medicine in

- US adults with moderate mental distress. *J Prim Care Community Health* 2017;8:43–54.
19. Kronenberg F, Cushman LF, Wade CM, Kalmuss D, Chao MT. Race/ethnicity and women's use of complementary and alternative medicine in the United States: results of a national survey. *Am J Public Health* 2006;96:1236–42.
 20. Hsiao AF, Wong MD, Goldstein MS, Yu HJ, Andersen RM, Brown ER, et al. Variation in complementary and alternative medicine (CAM) use across racial/ethnic groups and the development of ethnic-specific measures of CAM use. *J Altern Complement Med* 2006;12:281–90.
 21. Johnson PJ, Jou J, Rockwood TH, Upchurch DM. Perceived benefits of using complementary and alternative medicine by race/ethnicity among midlife and older adults in the United States. *J Aging Health* 2019;31:1376–97.
 22. Ndao-Brumblay SK, Green CR. Predictors of complementary and alternative medicine use in chronic pain patients. *Pain Med* 2010;11:16–24.
 23. Katz P, Lee F. Racial/ethnic differences in the use of complementary and alternative medicine in patients with arthritis. *J Clin Rheumatol* 2007;13:3–11.
 24. Herman CJ, Dente JM, Allen P, Hunt WC. Ethnic differences in the use of complementary and alternative therapies among adults with osteoarthritis. *Prev Chronic Dis* 2006;3:A80.
 25. Srikanth VK, Fryer JL, Zhai G, Winzenberg TM, Hosmer D, Jones G. A meta-analysis of sex differences prevalence, incidence and severity of osteoarthritis. *Osteoarthritis Cartilage* 2005;13:769–81.
 26. Cimmino MA, Sarzi-Puttini P, Scarpa R, Caporali R, Parazzini F, Zaninelli A, et al. Clinical presentation of osteoarthritis in general practice: determinants of pain in Italian patients in the AMICA study. *Semin Arthritis Rheum* 2005;35 Suppl 1:17–23.
 27. Paradowski PT, Bergman S, Sunden-Lundius A, Lohmander LS, Roos EM. Knee complaints vary with age and gender in the adult population. Population-based reference data for the Knee injury and Osteoarthritis Outcome Score (KOOS). *BMC Musculoskeletal Disord* 2006;7:38.
 28. Dominick KL, Ahern FM, Gold CH, Heller DA. Gender differences in NSAID use among older adults with osteoarthritis. *Ann Pharmacother* 2003;37:1566–71.
 29. Jawahar R, Yang S, Eaton CB, McAlindon T, Lapane KL. Gender-specific correlates of complementary and alternative medicine use for knee osteoarthritis. *J Womens Health* 2012;21:1091–9.
 30. Sleath B, Cahoon WD, Sloane PD, Callahan LF. Use of conventional and nonconventional treatments for osteoarthritis in the family medicine setting. *South Med J* 2008;101:252–9.
 31. Herman CJ, Allen P, Hunt WC, Prasad A, Brady TJ. Use of complementary therapies among primary care clinic patients with arthritis. *Prev Chronic Dis* 2004;1:A12.
 32. Callahan LF, Wiley-Exley EK, Mielenz TJ, Brady TJ, Xiao C, Currey SS, et al. Use of complementary and alternative medicine among patients with arthritis. *Prev Chronic Dis* 2009;6:A44.
 33. Andersen ML, Hill Collins P. Race, class, and gender : an anthology. 6th ed. Belmont (CA): Thomson/Wadsworth; 2007.
 34. Cuadraz G, Uttal L. Intersectionality and In-Depth Interviews: Methodological Strategies for Analyzing Race, Class, and Gender. *Race, Gender & Class* 1999;6:156–86.
 35. Smedley B, Smith A, Nelson A, Committee on Understanding & Eliminating Racial and Ethnic Disparities in Health Care BoHSP, Institute of Medicine. Unequal treatment: confronting racial and ethnic disparities in health care. Washington (DC): National Academies Press; 2003.
 36. Hausmann LR, Ibrahim SA, Kwok CK, Youk A, Obrosky DS, Weiner DK, et al. Rationale and design of the Staying Positive with Arthritis (SPA) Study: a randomized controlled trial testing the impact of a positive psychology intervention on racial disparities in pain. *Contemp Clin Trials* 2018;64:243–53.
 37. Nevitt MC, Felson DT, Lester G. The Osteoarthritis Initiative: protocol for the cohort study 2006. URL: <http://oai.epi-ucsf.org/datarelease/docs/StudyDesignProtocol.pdf>.
 38. Callahan CM, Unverzagt FW, Hui SL, Perkins AJ, Hendrie HC. Six-item screener to identify cognitive impairment among potential subjects for clinical research. *Med Care* 2002;40:771–81.
 39. National Center for Complementary and Alternative Medicine. Complementary, Alternative, or Integrative Health: What's In a Name? 2020. URL: <https://www.nccih.nih.gov/health/complementary-alternative-or-integrative-health-whats-in-a-name>.
 40. Chaudhry S, Jin L, Meltzer D. Use of a self-report-generated Charlson Comorbidity Index for predicting mortality. *Med Care* 2005;43:607–15.
 41. Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System Questionnaire 2010. 2009 [accessed February 17, 2017]. URL: <http://www.cdc.gov/bfss/questionnaires/pdf-ques/2010brfss.pdf>.
 42. Bellamy N, Buchanan WW, Goldsmith CH, Campbell J, Stitt LW. Validation study of WOMAC: a health status instrument for measuring clinically important patient relevant outcomes to antirheumatic drug therapy in patients with osteoarthritis of the hip or knee. *J Rheumatol* 1988;15:1833–40.
 43. Bellamy N. WOMAC Osteoarthritis Index: User Guide IX. Brisbane (Australia): Brisbane, Qld.; 2008.
 44. Bell RA, Suerken CK, Grzywacz JG, Lang W, Quandt SA, Arcury TA. Complementary and alternative medicine use among adults with diabetes in the United States. *Altern Ther Health Med* 2006;12:16–22.
 45. Klingberg E, Wallerstedt SM, Torstenson T, Hawi G, Forsblad-d'Elia H. The use of complementary and alternative medicine in outpatients with inflammatory rheumatic diseases in Sweden. *Scand J Rheumatol* 2009;38:472–80.
 46. Fouladbakhsh JM, Stommel M. Gender, symptom experience, and use of complementary and alternative medicine practices among cancer survivors in the U.S. cancer population. *Oncol Nurs Forum* 2010;37:E7–15.
 47. Belkhir JA, Barnett BM. Race, gender and class intersectionality. *Race, Gender & Class* 2001;8:157–74.
 48. Ibrahim SA. Racial variations in the utilization of knee and hip joint replacement: an introduction and review of the most recent literature. *Curr Orthop Pract* 2010;21:126–31.
 49. Elwyn G, Frosch D, Thomson R, Joseph-Williams N, Lloyd A, Kinnersley P, et al. Shared decision making: a model for clinical practice. *J Gen Intern Med* 2012;27:1361–7.
 50. Templeton KJ. Sex and gender issues in pain management. *J Bone Joint Surg Am* 2020;102 Suppl 1:32–5.
 51. Campbell CM, Edwards RR. Ethnic differences in pain and pain management. *Pain Manag* 2012;2:219–30.
 52. Vina ER, Hannon MJ, Hausmann LR, Ibrahim SA, Dagnino J, Arellano A, et al. Modifiable determinants of exercise use in a diverse ethnic population with osteoarthritis. *Arthritis Care Res* 2019;71:1495–1503.
 53. Suarez-Almazor ME, Soucek J, Kelly PA, O'Malley K, Byrne M, Richardson M, et al. Ethnic variation in knee replacement: patient preferences or uninformed disparity? [Original research article]. *Arch Intern Med* 2005;165:1117–24.