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USE OF COMPLEMENTARY AND ALTERNATIVE MEDICINE AMONG PATIENTS WITH RADIOGRAPHIC CONFIRMED KNEE OSTEOARTHRITIS

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Abstract

Objective—To examine use of complementary and alternative medicine (CAM) among individuals with radiographic confirmed osteoarthritis (OA) of the knee

Methods—We included 2,679 participants of the Osteoarthritis Initiative with radiographic tibiofemoral knee OA in at least one knee at baseline. Trained interviewers asked a series of specific questions relating to current OA treatments including CAM therapies (7 categories—alternative medical systems, mind-body interventions, manipulation and body-based methods, energy therapies, and 3 types of biologically based therapies) and conventional medications. Participants were classified as: 1) conventional medication users only, 2) CAM users only; 3) users of both; and 4) users of neither. Polytomous logistic regression identified correlates of treatment approaches including sociodemographics and clinical/functional correlates.

Results—CAM use was prevalent (47%), with 24% reporting use of both CAM and conventional medication approaches. Multi-joint OA was correlated with all treatments (adjusted

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AUTHORS' CONTRIBUTIONS

Kate L. Lapane: conception and design; drafting the article. She had full access to all the data in the study and final responsibility for the decision to submit it for publication.
Megan Sands and Shibing Yang: analysis and interpretation of data.
Charles B. Eaton and Timothy McAlindon: critical revision of the article for important intellectual content.
All authors gave final approval of the article.

CONFLICT OF INTEREST STATEMENTS

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Odds Ratio (aOR) conventional medications: 1.62; CAM only: 1.37 and both: 2.16). X-ray evidence of severe narrowing (OARSI grade 3) was associated with use of glucosamine/chondroitin (aOR: 2.20) and use of both (aOR: 1.98). The WOMAC-Pain Score was correlated with conventional medication use, either alone (aOR: 1.28) or in combination with CAM (aOR: 1.41 per one standard deviation change). KOOS-QOL and SF-12 Physical Scale scores were inversely related to all treatments.

Conclusion—CAM is commonly used to treat joint and arthritis pain among persons with knee OA. The extent to which these treatments are effective in managing symptoms and slowing disease progression remains to be proven.

Keywords

knee osteoarthritis; complementary and alternative medicine; conventional medication

INTRODUCTION

By the year 2020, 59.4 million persons in the United States will be affected by arthritis[1]. Osteoarthritis of the knee (OAK) is the leading cause of disability in the United States[2], and population-based projections of the probable need for total knee arthroplasty indicate steady increases in all age groups[3]. Patients suffering from OAK seek effective treatments (e.g. physical or occupational therapy, weight loss, pharmacologic approaches) for pain relief, as well as minimizing functional limitations of symptoms and to attempt to slow disease progression[4]. In additional to conventional medications, complementary and alternative medicine (CAM) (including herbal remedies, acupuncture, supplements)[5] increasingly are used. Indeed, arthritis is among the top 6 conditions for which CAM is used[6].

Previous reports have demonstrated that CAM use differs by age group[7], gender[8], race/ethnicity[9,10], educational attainment[11], annual household income, employment status[8], and health insurance status. However, the extent to which the existing literature on CAM use (based on self-report) extends to a population with radiographic confirmation of OAK is unknown. Also, standardized measures of performance, function, quality of life and pain are frequently absent from studies of CAM among persons with OAK. Lastly, most studies of CAM use describe correlates of CAM use only, and have not differentiated the use a combination of CAM and conventional medical approaches. Thus, we examined the use of CAM and conventional medication approaches in a large number of participants of the Osteoarthritis Initiative (OAI).

SUBJECTS AND METHODS

The Institutional Review Boards of Virginia Commonwealth University and the Memorial Hospital of Rhode Island approved the study protocol.

Data Source

We used publicly available data from the OAI (http://www.oai.ucsf.edu/) (#AllClinical00, V0.2.2). The OAI began enrolling people aged 45 through 79 years in 2004 and followed them annually for the development or progression of OAK. The clinical sites involved were Baltimore, MD; Columbus, OH; Pittsburgh, PA; and Pawtucket, RI. Participants were ineligible if any of the following were present: 1) rheumatoid arthritis or inflammatory arthritis; 2) severe joint space narrowing in both knees or unilateral total knee arthroplasty and severe joint space narrowing in the contralateral knee; 3) inability to undergo 3.0 Tesla MRI examination of the knee; 4) a positive pregnancy test; 5) inability to provide a blood sample; 6) use of ambulatory aids aside from the use of a single straight cane for 50% of

ambulation time or more; 7) co-morbid conditions that might interfere with ability to participate in a study with a 4-year follow-up time; or 8) unlikelihood to reside in the clinic area for at least 3 years[12]. The overall study included 4,796 participants.

Study Sample

For the current study, we included individuals with radiographic tibiofemoral OAK in at least one knee at baseline (n=2,679). Readers from each clinical site were trained to assess baseline fixed flexion knee x-rays for osteophytes and joint narrowing. Training consisted of a didactic and interactive components using a web-based system that included scoring a training set of knee x-rays. Radiographic tibiofemoral OAK was defined as the presence of an OARSI atlas osteophyte grade I–III (equivalent to Kellgren and Lawrence grade ≥ 2) on a fixed flexion radiograph based on the readings results provided by the individual clinical sites[13].

Exposure categories

We decided to create a four level variable to simultaneously categorize participants according to their CAM and conventional medication use. Previously, reports have focused on correlates of CAM use, without regarding use of conventional medications. Yet, we speculated that use of both strategies were common and that the factors associated with monotherapy (CAM or conventional), may be different to those associated with use of combined therapies.

Participants were asked “During the past 30 days, have you used any of the following medications for joint pain or OA on most days? By most days, we mean more than half the days of the month.” Participants were asked separate questions for: acetaminophen, over the counter non-steroidal anti-inflammatory agents (NSAIDs), prescription NSAIDs, prescription COX-II inhibitors, doxycycline and prescription “strong pain” medications such as opioids. Interviewers asked “During the past 6 months, did you use the following health supplements for joint pain or arthritis?” with separate questions for chondroitin sulfate and glucosamine. A series of questions specifically asked about the use of CAM approaches for arthritis or joint pain during the past year, as well as how frequently practitioners were seen. Responses from these questions were used to classify participants as: conventional medication users only, CAM users only, both CAM and conventional users, and users of neither.

Medications often used in the management of OAK included use of acetaminophen, over-the-counter NSAIDs (e.g. aspirin, ibuprofen, naproxen), NSAIDs requiring a prescription (e.g. ibuprofen at higher doses, diclofenac, naproxen), COX-2 selective inhibitors (e.g. valdecoxib, rofecoxib, celecoxib), hyaluronic acid, steroids/injected corticosteroids, and calcitonin. To differentiate from CAM, we labeled these treatments as Conventional Medications. We considered CAM[5] as any indication of use of: 1) alternative medical systems (acupuncture, acupressure, homeopathy and others); 2) mind-body interventions (yoga/Tai Chi/Chi Gong/pilates, spiritual activities, relaxation therapy, meditation, deep breathing or visualization); 3) manipulation and body-based methods (Chiropractic and massage); 4) energy therapies (copper bracelets or magnets); 5) topical biologically based therapies including rubs, lotions, liniments, creams or oils (tiger balm, horse liniment), capsaicin; 6) biologically based diet; or 7) biologically based supplements (e.g. herbals, glucosamine, chondroitin, vitamins/minerals, methylsulfonylmethane, S-adenosylmethionine). Because glucosamine and chondroitin are not considered as CAM in some countries, we also separated the use of glucosamine and chondroitin from other CAM treatments.

Potential correlates

Based on a non-systematic literature review, we considered several conceptual domains as potential correlates of treatment approach for OA: sociodemographic indicators, body mass index (BMI), overall measures of mental and physical well-being, and clinical indices of OAK. We hypothesized that CAM use would be different by age group[7], gender[8], race/ethnicity[9,10], educational attainment[11], annual household income, employment status[8], and health insurance status. Gender, age, and race/ethnicity were based on self-report. Participants were considered employed if they reported currently working or planning to return to work within 6 months. Health insurance coverage status was identified as "currently having private health insurance, prepaid plans, Preferred Provider Organizations or any government-sponsored plans". Participants were also classified as having insurance that covered prescription medications.

In the general population, obesity is inversely related to use of CAM[14]. Trained examiners measured height (mm) twice during held inspiration. BMI was calculated from measured height and weight [weight (kg)/height (m^2)]. Participants with a BMI between 25 and less than 30 were defined as overweight, 30 to less than 35 as obese, and 35 and over as morbidly obese[15].

The Medical Outcomes Study Short Form 12 (SF-12) was used to assess general physical health status. The SF-12 consists of 12 questions covering 8 health domains (physical functioning, social functioning, role-physical, role-emotional, mental health, energy/vitality, pain, and general health perception)[16]. The questions were combined, scored, and weighted to create the Physical Scale and Mental Health Score (ranging from 0 (lowest level of health) to 100 (highest level)). The CES-D 20 item Scale[17] was used to evaluate the depression status and participants with scores above 16 were considered to have clinical levels of depression.

We also considered indicators of symptoms and severity of OAK including pain, quality of life, performance and function, and disease severity. For the measure of pain, we used the Western Ontario and McMaster Universities (WOMAC) Osteoarthritis Index (Version LK 3.1). Although the WOMAC measures three separate dimensions[18,19], we only used the pain scale. Each of the 5 items of the pain scale contains 5 Likert responses, ranging from '0=none' to '4=extreme', which were summed to produce the pain subscale scores (maximum score 20 indicating the worst pain). We also used the Knee Outcomes in Osteoarthritis Survey (KOOS) as an indicator of knee related quality of life. The KOOS assesses knee symptoms and function during more demanding activities (e.g. during sport and recreation)[20]. The KOOS quality of life scale was estimated by summing the responses to 4 items with 5 Likert responses, ranging from 0 to 4 and computing a normalized score ranging from 0 to 100 (100 indicating no symptoms and 0 indicating extreme symptoms). For the WOMAC and KOOS measures, we evaluated the right and left knees separately and used the knee with worse measures. For measures of performance and function we used a 20-meter walk to measure walking ability and endurance [21]. The average duration (seconds) of completing the 20-meter walk was calculated based on two trials. The chair stand test was used as a direct assessment of integrated physical performance involving leg strength and knee function[22]. The chair stand time was defined as the time duration (seconds) of standing up and sitting down five times as quickly as possible. Disease severity was measured in two ways. First, we classified participants by the x-ray joint space narrowing as determined by the OARSI atlas osteophyte grade I–III (equivalent to Kellgren and Lawrence grade ≥ 2) on a fixed flexion radiograph[13]. The worst measure of two knees was used. Second, to capture multiple-joint OA symptoms we considered: low back pain in previous 30 days, OA in hand, hip symptoms, hip replacement and knee injury history (including knee injury and knee surgery) as reported at baseline.

Statistical analyses

We compared the sociodemographic and clinical characteristics of users in each group (conventional medication use only, CAM use only, use of both CAM and conventional medications) to the referent group – non-users of CAM/conventional medications by conducting chi-square tests for categorical data and t-tests for continuous variables. Rather than overall chi-square tests, each group was compared to the referent group. Next, we used polytomous logistic regression modeling to identify correlates of treatment approaches by comparing the odds of using conventional medications only, using CAM approaches only, using both CAM and conventional approaches with non-users. In our polytomous logistic regression model, the outcome variable represented 4 categories. The models for each (3 models for 4 categories) are simultaneously fit by using maximum likelihood to estimate adjusted odds ratios (aOR) for each group compared with a common reference group[23]. Before modeling we evaluated (and ruled out) the potential for multicollinearity amongst the potential correlate variables under study by checking correlations between the covariates. When two variables were correlated (e.g. education and income), we elected to include only one of the variables (e.g. education) in our final model. During the modeling process, the standard errors for the variables were also evaluated for indications of multicollinearity. If inflated standard errors were apparent, we dropped one of the collinear variables from the model. We used an iterative, but not computer driven approach to develop the final model of correlates. To provide more clinically meaningful results for the SF-12 Physical Scale, WOMAC-Pain, and KOOS- QOL, we provide odds ratios for a one standard deviation change in each variable. To further differentiate correlates amongst the different CAM approaches, we created a separate polytomous logistic regression model with the following outcome variable: use of glucosamine/chondroitin only, use of other CAM approaches only, using both CAM and conventional approaches and non-users. The same modeling strategies described above were applied to this model.

RESULTS

The majority of the sample was white, well educated, and covered by health insurance. Use of CAM was common (47%, 95% confidence interval (CI): 45–49%). Sixteen percent (95% CI: 15–18%) used conventional medications only, 23% (95% CI: 21–25%) used CAM only, and 24% (95% CI: 22–26%) used both CAM and conventional medications. Table 1 shows the specific types of CAM used. Forty-seven percent reported use of at least one CAM method. Of these, 32% (95% CI: 29–35%) reported use of at least two CAM approaches. The use of biologically-based supplements was the most often used method (68%), followed by biologically-based topical agents (28%), and mind-body interventions (23%). Of CAM users, 54% used chondroitin, 59% used glucosamine, 12% used Methylsulfonylmethane, and 13% used vitamins/minerals nearly every day. Almost 8% reported use of energy therapies. Use of mind-body interventions was common (23%), with 12% of CAM users reporting use of methods like yoga or Tai Chi, ~8% reporting techniques such as meditation or visualization, and 8% reporting spiritual activities. The distributions were similar regardless of conventional medication use expect for spiritual activities which were more common among users of CAM and conventional medications (26%) than CAM only users (19%).

Table 2 shows the characteristics of the participants by treatment approaches: conventional only, CAM only, both, or neither. The age distribution was similar across categories of CAM and conventional medication use, while differences in the gender distribution were present. Women were more likely to use any treatment (60% conventional medication users, 61% CAM users, 67% both and 51% neither; Conventional only p-value=0.0017; CAM only p-value=0.0006). The distribution of race/ethnicity was similar among those reporting use of both conventional and CAM approaches to those reporting use of neither approach. Those

reporting use of conventional medications only were more likely to be Black/African American, whereas users reporting only CAM use were less likely to report being Black/African American (14%) relative to nonusers of either group (18%).

Relative to nonusers of CAM and conventional medications, those reporting only the use of conventional medications had less education, and were less likely to report being employed. Most reported health insurance coverage, with no differences in the percent with health insurance providing prescription medication coverage by treatment approach. The distribution of body mass index differed between the conventional medication only group and those reporting use of CAM and conventional medications compared to non-users of either approach. Physical summary scores were less in each treatment group relative to the group using neither approach.

Table 3 shows the clinical and functional characteristics of the participants stratified by treatment group. Compared to participants not using any CAM therapies or conventional medications, each of the other treatment groups had higher pain scores and lower quality of life indices. While CAM only users had functional and performance indicators similar to the no treatment group, users of conventional medications and users of CAM and conventional medications took longer on the functional tests (p-value=0.0001). Correspondingly, all treatment groups had worsening x-ray evidence of joint space narrowing relative to participants who reported no CAM or conventional medication use (p-value=0.0001). Users of both CAM and conventional medications (28%), CAM only users (23%), conventional medication users (22%) were more likely to have severe joint space narrowing relative to non-users of CAM and conventional medicines (14%). Although overall total hip replacement was infrequent (<3%), its occurrence was greater in the conventional medication users only and in the CAM and conventional medication use group relative to the non-users (p-value=0.01). Hand OA was twice as prevalent in each of the exposure groups relative to the non-users (p-value=0.0001). Hip symptoms in the past 12 months were most often reported in users of CAM and conventional medications (~36%) followed by conventional medication users only (28%), CAM only users (25%), and nonusers (15%). While history of knee injury was only more common in CAM only users relative to nonusers (51% vs. 45%), history of knee surgery was more prevalent among conventional medication users (32%) and CAM and conventional medication users (33%) relative to nonusers (26%).

Table 4 shows the correlates of treatment approaches among participants with radiographic confirmed knee OA. Women were more likely than men to use any method (CAM or conventional medications). Black participants were less likely than non-Hispanic Whites to use CAM therapies either alone (aOR: 0.71; 95% CI: 0.51–1.00) or in combination (aOR: 0.54; 95% CI: 0.38–0.76). Relative to participants with a high school education or less, those who graduated from college were more likely to use strategies that included CAM (aOR CAM only; 1.64; aOR Both: 1.48). Those with higher scores on the SF-12 (physical summary) and the KOOS-QOL were less likely to receive any treatments. Total hip replacement more than tripled the likelihood of use of conventional medications, either with or without CAM. X-ray evidence of severe narrowing (OARSI grade 3) was associated with strategies using CAM (aOR CAM only: 1.63; 95% CI: 1.16–2.29; aOR Both: 1.98; 95% CI: 1.39–2.82).

The analyses in Table 5 further refine the classification of CAM into: 1) glucosamine or chondroitin users (with most participants reporting use of both therapies); and 2) other CAM therapies. When classified this way, women are twice as likely to report use of other CAM therapies relative to men (aOR: 2.25; 95% CI: 1.61–3.14). While Black participants were no more or less likely to report use of other CAM treatments, they were much less likely to report use of glucosamine or chondroitin (aOR: 0.38; 95% CI: 0.24–0.65). Further, those

with at least a college education were twice as likely to report glucosamine/chondroitin use relative to those with a high school education or less, but education did not correlate with use of other CAM therapies. Severity of disease also did not correlate with other CAM use, but was associated with a greater likelihood of glucosamine/chondroitin use.

DISCUSSION

We found use of CAM approaches to be common. Forty-seven percent of participants of the OAI with radiographic-confirmed OAK reported use of at least one CAM approach, which is lower than previous reports[9,24,25], but similar as other studies with specific focus on OAK[26]. Estimates of CAM use from other studies vary widely (34% to 90%[25]) owing to differences in the operational expression of CAM use (e.g. including prayer), differences in the time referent (e.g. ever use, use in past month), population included (e.g. all conditions vs. OAK), as well as geographic differences.

This study documents that persons with OAK commonly use multiple treatment approaches. Indeed, 24% reported use of at least one CAM approach in addition to conventional pharmacologic medicines and 32% of CAM users reported recent use of multiple CAM approaches. The most common CAM approach was use of biologically-based supplements. Despite widespread use, patients may not disclose their use of CAM to physicians[27] and even if discussed, CAM use is not frequently documented in the medical record[28]. The extent to which herbal remedies and supplements may interact with conventional medications is non-trivial[29]. Unless CAM use is integrated into electronic medical records, averting such interactions is unlikely. Given the extent of dual use of approaches, physicians should be encouraged to ask patients about CAM use and document use. Electronic medical record systems allowing electronic prescribing should have the ability to check for such drug-herb or drug-supplement interactions at the point of prescribing, as this may be the only place in the pharmacy-care process where such interactions can be detected.

We found that participants with greater physical wellbeing as measured with standardized tools including the KOOS-QOL and SF-12 had reduced use of any treatment. Indication of clinical depression was not associated with OA treatment. Although there are many accepted CAM approaches to treatment of depression[30], increased use of CAM among persons with depression was not observed in previous research[11] or in the current study. Indeed, persons with depression were half as likely to report glucosamine/chondroitin use. Our findings contradict previous research linking depression among persons with OA to greater health care utilization (e.g. greater contacts with primary care providers, orthopedic doctors, and CAM practitioners) [31]. These important differences between CAM and non-CAM users in co-morbid conditions, physical functioning and severity of illness will likely lead to confounding by indication when evaluating the benefits of CAM use using non-experimental paradigms. As such, novel analytic approaches to address such confounding in comparative effectiveness research of CAM must be employed.

Our study confirmed several important associations between treatment approaches and sociodemographic factors. We confirmed previous reports between gender and treatment options[32], with greater associations noted with CAM use (either alone or in conjunction with conventional medications). As others have shown[11], persons with more education were more likely to select treatment options including CAM. In our study, more education was associated with increased reported use of glucosamine/chondroitin. Relative to non-Hispanic Whites, Blacks were less likely to use CAM treatments (either alone or in conjunction with conventional medications) relative to no treatments. The lack of CAM use by Blacks was owing to decreased use of glucosamine/chondroitin. This finding contradicts previous reports showing that Black persons with OA are more likely to use CAM and conventional

medications[9]. The extent to which our findings are subject to information bias, as others suggest[27] remains unknown. Persons with greater levels of obesity were more likely to report use of conventional medications than those with BMI <25k/m^2. Previous research[14] noted that adults with higher BMIs were no more likely to use each of the individual CAM therapy and less likely to use supplements relative to normal weight adults. This is consistent with the finding in our study that morbidly obese persons were almost half as likely to report use of glucosamine/chondroitin.

Our findings must be considered with limitations in mind. The data on treatments were obtained at the same time the measures of function and pain were collected. No questions were asked about omega-3 or seal oil. This cross-sectional study precludes statements of predictors of use and associations are confounded by potential treatment effects. Recall bias of treatments among persons with OAK has been documented[33]. Treatments were based on a 30 day and 6 month recall so it is possible that participants did not accurately report the use of treatments. These concerns may have introduced misclassification in assignment of participants to the treatment approaches which would have diluted any observed associations. The OAI data do not provide information regarding whether or not CAM treatments and conventional medications were actually covered by the participants' health insurance. We were unable to evaluate the impact of insurance coverage on use of these treatments. As with other studies[34], our findings are not generalizable to all persons with OAK owing to selective participation in research. In particular, most of the people in our sample were employed, had health insurance, and were well educated. The sample also excluded persons with severe OAK.

Our study demonstrates that CAM use (with or without conventional medication use) is common in persons with radiographic-confirmed OAK, and that frequently multiple CAM approaches are used either alone or in conjunction with conventional medication use. Our finding that use of treatments is associated with severity of disease and pain indicators suggests that management of OAK may not be optimal. Sociodemographic, as well as functional and clinical factors related to pain and quality of life are correlated to choice of treatment options. Physicians caring for persons with OAK should understand their patients' CAM practices, educate patients of the latest understanding of the usefulness of CAM approaches, and discuss the potential risks associated with CAM and conventional treatments. While previous research has documented the potential adverse effects of both conventional and CAM approaches, more evidence is needed to demonstrate the effectiveness of these treatment approaches either alone or in combination with other CAM approaches[35] or conventional medications[36,37] as the costs of treatment equal to costs of traditional medicine[26]. Our data demonstrate the need for improved overall management, and potentially greater access to total knee replacements if non-surgical approaches do not sufficiently address the patients' needs.

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Table 1

Characteristics of CAM use by Category* (N=1,259)

Category	n	% of all CAM users (95% CI &)
Alternative medical systems	**31**	**2.5 (1.6–3.3)**
Acupuncture	17	1.4 (0.7–2.0)
Acupressure	6	0.5 (0.1–0.9)
Chelation therapy	0	0
Folk medicine	0	0
Homeopathy	6	0.5 (0.1–0.9)
Ayurveda/biofeedback/energy healing/hypnosis/naturopathy	10	0.8 (0.3–1.3)
Mind-body interventions	**285**	**22.6 (20.3–24.9)**
Yoga/Tai Chi/Chi Gong/Pilates	153	12.2 (10.3–14.0)
Relaxation therapy, meditation, deep breathing or visualization	94	7.5 (6.0–8.9)
Spiritual activities	104	8.3 (6.7–9.8)
Manipulation and body-based methods	**140**	**11.1 (9.4–12.9)**
Chiropractic	115	9.1 (7.5–10.7)
Massage	48	3.8 (2.8–4.9)
Energy therapies (Copper bracelets or magnets)	**95**	**7.6 (6.1–9.0)**
Biologically based therapies: topical agent	**358**	**28.4 (25.9–30.9)**
Rubs, lotions, liniments, creams or oils(tiger balm/horse liniment)	352	28.0 (25.5–30.4)
Capsaicin	45	3.6 (2.5–4.6)
Biologically based therapies: diet	**31**	**2.5 (1.6–3.3)**
Biologically based therapies: supplements	**856**	**68.0 (65.4–70.6)**
Herbs	43	3.4 (2.4–4.4)
Vitamins/minerals (nearly every day)	168	13.3 (11.5–15.2)
Glucosamine (nearly every day)	740	58.8 (56.1–61.5)
Methylsulfonylmethane (MSM)	153	12.2 (10.3–14.0)
S-adenosylmethionine (SAME)	13	1.0 (0.5–1.6)
Chondroitin (nearly every day)	675	53.6 (50.9–56.4)

*As defined by the National Center for Complementary and Alternative Medicine

&Confidence intervals were calculated based on asymptotic Gaussian approximation

CAM= Complementary and Alternative Medicine.

CI=Confidence Interval

Table 2

Characteristics of participants with radiographic confirmed knee osteoarthritis by conventional and CAM treatment approaches (N=2,679)

	Conventional Medications Only (N=440)	CAM Use ONLY (N=618)	Both (N=641)	Neither (N=980)
	*Percentage * (95% Confidence Intervals &)*			
Women	59.6 (55.0–64.1)	60.5 (56.7–64.4)	66.6 (63.0–70.3)	51.0 (47.9–54.2)
Age (years): ≥ 65	41.4 (36.8–46.0)	45.2 (41.2–49.1)	44.3 (40.5–48.2)	42.4 (39.3–45.4)
Race/ethnicity:				
White	68.9 (64.5–73.2)	81.2 (78.2–84.3)	77.0 (73.8–80.3)	79.3 (76.7–81.8)
Black/African American	28.6 (24.4–32.9)	13.6 (10.9–16.3)	19.8 (16.8–22.9)	17.5 (15.1–19.8)
Latino	1.4 (0.3–2.4)	1.1 (0.3–2.0)	1.9 (0.8–2.9)	1.3 (0.6–2.0)
Other	1.1 (0.1–2.1)	4.1 (2.5–5.6)	1.3 (0.4–2.1)	1.9 (1.1–2.8)
Education: > College	45.0 (40.3–49.6)	63.0 (59.2–66.8)	52.1 (48.2–56.0)	57.6 (54.5–60.7)
Some college	28.9 (24.6–33.2)	23.0 (19.6–26.3)	29.8 (26.2–33.3)	24.4 (21.7–27.1)
≤ High school	26.2 (22.0–30.3)	14.0 (11.3–16.8)	18.1 (15.1–21.1)	18.0 (15.6–20.4)
Income ($): > 100,000	17.7 (14.0–21.4)	21.6 (18.2–24.9)	22.7 (19.3–26.1)	22.3 (19.6–25.0)
50k – 100k	32.4 (27.9–37.0)	38.4 (34.5–42.4)	31.8 (28.0–35.6)	38.3 (35.2–41.5)
25k – 50k	27.8 (23.4–32.1)	28.0 (24.3–31.7)	28.7 (25.1–32.4)	25.8 (23.0–28.6)
≤25,000	22.1 (18.1–26.1)	12.0 (9.3–14.7)	16.8 (13.7–19.8)	13.6 (11.4–15.8)
Married/partnered	61.5 (56.9–66.0)	70.0 (66.4–73.6)	63.5 (59.8–67.3)	66.4 (63.4–69.3)
Working (for pay)	54.2 (49.6–58.9)	61.3 (57.5–65.2)	55.5 (51.6–59.4)	60.2 (57.2–63.3)
Health insurance	92.9 (90.4–95.3)	97.7 (96.5–98.9)	97.2 (95.9–98.5)	97.6 (96.7–98.6)
Insurance covers prescriptions	84.7 (81.2–88.1)	86.0 (83.2–88.7)	87.0 (84.4–89.6)	88.6 (86.5–90.6)
Body mass index (kg/m^2)				
≥ 35 (morbidly obese)	19.2 (15.5–22.9)	8.3 (6.1–10.4)	17.3 (14.4–20.3)	12.0 (10–14.1)
30 – <35 (obese)	34.0 (29.6–38.5)	30.0 (26.4–33.6)	28.9 (25.4–32.4)	29.1 (26.2–31.9)
25 – <30 (overweight)	36.5 (32.0–41.0)	40.4 (36.5–44.2)	35.3 (31.6–39.0)	41.5 (38.4–44.6)
<25 (normal)	10.3 (7.4–13.1)	21.4 (18.2–24.6)	18.4 (15.4–21.4)	17.4 (15.0–19.7)
CES-D > 16 (Depressed)	15.0 (11.7–18.3)	5.8 (4.0–7.7)	12.0 (9.5–14.5)	7.1 (5.5–8.8)
		mean (standard deviation)		
SF-12 Mental Summary	52.7 (9.7)	54.7 (7.3)	53.8 (8.9)	53.9 (7.5)
SF-12 Physical Summary	44.3 (10.1)	48.8 (8.8)	44.1 (9.6)	50.7 (8.3)

* May not total 100% due to rounding.

& Confidence intervals were calculated based on asymptotic Gaussian approximation

Table 3

Clinical characteristics of participants with radiographic confirmed knee osteoarthritis by conventional and CAM treatment approaches (N=2,679)

	Conventional Medications Only (N=440)	CAM Use ONLY (N=618)	Both (N=641)	Neither (N=980)
Symptoms		*mean (standard deviation)*		
WOMAC – Pain	5.3 (4.4)	3.5 (3.4)	5.8 (4.2)	2.8 (3.3)
KOOS – QOL	57.0 (23.5)	64.0 (20.7)	52.0 (22.0)	70.9 (21.6)
Function and Performance				
Chair stands (seconds)	13.0 (4.5)	11.2 (3.6)	12.4 (4.2)	11.1 (3.3)
20-meter walk (seconds)	16.8 (3.5)	15.6 (2.9)	16.5 (3.6)	15.4 (2.5)
Joint space narrowing: x-ray evidence of knee severity		*Percentage * (95% Confidence Intervals &)*		
OARSI grade 0 (normal)	28.2 (24.0–32.4)	29.1 (25.5–32.7)	24.5 (21.2–27.8)	35.3 (32.3–38.3)
OARSI grade 1–2 (narrowed)	50.2 (45.6–54.9)	48.2 (44.3–52.2)	46.8 (42.9–50.7)	50.6 (47.5–53.7)
OARSI grade 3 (severe)	21.6 (17.7–25.4)	22.7 (19.4–26.0)	28.7 (25.2–32.2)	14.1 (11.9–16.3)
Multi-joint osteoarthritis				
Any back pain (30 days)	63.4 (58.9–67.9)	55.2 (51.3–59.1)	69.0 (65.4–72.5)	51.1 (47.9–54.2)
Hand osteoarthritis	23.2 (19.2–27.2)	18.7 (15.5–21.8)	26.8 (23.3–30.4)	10.5 (8.6–12.5)
Hip symptoms (12 months)	28.3 (24.1–32.5)	25.0 (21.6–28.4)	36.1 (32.3–39.8)	15.0 (12.8–17.3)
Total hip replacement	3.0 (1.4–4.5)	1.5 (0.5–2.4)	3.0 (1.7–4.3)	1.0 (0.4–1.6)
History				
History of knee injury	46.4 (41.7–51.0)	51.0 (47.0–54.9)	49.8 (45.9–53.6)	44.7 (41.6–47.8)
History of knee surgery	32.3 (27.9–36.6)	30.7 (27.1–34.4)	32.9 (29.2–36.5)	25.5 (22.8–28.2)
		mean (standard deviation)		
Weight at age 25 (kg)	68.8 (13.8)	66.8 (13.6)	67.3 (13.9)	68.7 (14.0)

&Confidence intervals were calculated based on asymptotic Gaussian approximation

WOMAC= Western Ontario and McMaster Universities (WOMAC) Osteoarthritis Index

QOL = Quality of Life

KOOS=Knee Outcomes in Osteoarthritis Survey

Table 4

Sociodemographic and clinical correlates[§] of treatment use among participants with radiographic confirmed knee osteoarthritis (N=2,679)

	Conventional Medications Only (N=440)	CAM Use ONLY (N=618)	Both (N=641)
	Adjusted odds ratios (95% Confidence Intervals)		
Age ≥ 65 years	1.01 (0.77–1.33)	1.18 (0.93–1.49)	1.17 (0.91–1.50)
Women	1.37 (1.04–1.79)	1.86 (1.47–2.34)	2.21 (1.72–2.84)
Race/ethnicity			
Black	0.90 (0.64–1.27)	0.71 (0.51–1.00)	0.54 (0.38–0.76)
Latino	0.77 (0.23–2.61)	0.61 (0.19–1.98)	1.47 (0.57–3.76)
Other	0.65 (0.23–1.85)	2.00 (1.03–3.91)	0.43 (0.16–1.18)
Non-Hispanic White	1.0	1.0	1.0
Education			
≥College graduate	0.91 (0.65–1.29)	1.64 (1.19–2.28)	1.48 (1.06–2.07)
Some college	0.99 (0.69–1.42)	1.26 (0.88–1.80)	1.35 (0.94–1.93)
High school or less	1.0	1.0	1.0
Body Mass Index			
Morbid obesity	1.53 (0.93–2.53)	0.61 (0.39–0.94)	0.85 (0.55–1.30)
Obesity	1.41 (0.91–2.17)	0.91 (0.66–1.26)	0.75 (0.52–1.06)
Overweight	1.33 (0.88–2.02)	0.88 (0.65–1.18)	0.71 (0.51–0.99)
Normal weight	1.0	1.0	1.0
Depression	1.31 (0.87–1.99)	0.80 (0.51–1.24)	1.09 (0.72–1.63)
SF-12 Physical Scale [#]	0.74 (0.63–0.87)	0.88 (0.76–1.03)	0.83 (0.71–0.96)
WOMAC – Pain [#]	1.28 (1.05–1.55)	1.01 (0.84–1.22)	1.41 (1.18–1.68)
KOOS – QOL [#]	0.75 (0.62–0.91)	0.69 (0.58–0.82)	0.54 (0.45–0.64)
History of knee injury/surgery	1.13 (0.86–1.47)	1.28 (1.02–1.61)	1.01 (0.79–1.29)
Hip replacement	3.86 (1.54–9.67)	1.41 (0.51–3.93)	4.49 (1.84–10.96)
Multi-joint osteoarthritis:	1.62 (1.22–2.14)	1.37 (1.09–1.72)	2.16 (1.65–2.81)
Chair stands (seconds)	1.03 (0.99–1.07)	0.97 (0.94–1.01)	1.00 (0.96–1.03)
OARSI[*] grade			
Grade 3 (severe)	1.38 (0.94–2.03)	1.63 (1.16–2.29)	1.98 (1.39–2.82)
Grade 1–2 (narrowed)	1.06 (0.79–1.41)	1.13 (0.88–1.44)	1.19 (0.91–1.57)
Grade 0 (normal)	1.0	1.0	1.0

[§]Reference group for the outcome includes patients who did not report use of CAM or conventional medications for osteoarthritis treatment. Odds ratios shown are adjusted for all variables shown on the table.

[#]Odds ratios are per one standard deviation change in SF-12 Physical Scale (standard deviation=9.5), WOMAC Pain Scale (standard deviation=4.0), and KOOS QOL scale (standard deviation=23.1).

[*]X-ray evidence of joint space narrowing.

Table 5

Sociodemographic and clinical correlates[§] of Glucosamine/Chondroitin Use, Other CAM use use among participants with radiographic confirmed knee osteoarthritis

	Glucosamine/Chondroitin Use Only (N=373)	Other CAM Use Only (N=245)
	Adjusted odds ratios (95% Confidence Intervals)	
Age ≥ 65 years	1.26 (0.95–1.67)	1.10 (0.79–1.53)
Women	1.66 (1.26–2.18)	2.25 (1.61–3.14)
Race/ethnicity		
Black	0.39 (0.24–0.65)	1.09 (0.72–1.63)
Latino	0.47 (0.10–2.21)	0.82 (0.18–3.86)
Other	1.74 (0.80–3.78)	2.52 (1.12–5.67)
Non–Hispanic White	1.0	1.0
Education		
≥College graduate	2.18 (1.42–3.34)	1.19 (0.78–1.82)
Some college	1.37 (0.85–2.22)	1.21 (0.77–1.90)
High school or less	1.0	1.0
Body Mass Index		
Morbid obesity	0.56 (0.32–0.96)	0.73 (0.40–1.35)
Obesity	0.81 (0.55–1.17)	1.19 (0.75–1.89)
Overweight	0.78 (0.56–1.10)	1.12 (0.72–1.75)
Normal weight	1.0	1.0
Depression	0.50 (0.26–0.94)	1.16 (0.68–1.95)
SF-12 Physical Scale [#]	0.98 (0.81–1.19)	0.78 (0.64–0.96)
WOMAC – Pain [#]	0.92 (0.73–1.15)	1.14 (0.90–1.45)
KOOS – QOL [#]	0.63 (0.51–0.76)	0.80 (0.63–1.01)
History of knee injury/surgery	1.35 (1.02–1.78)	1.16 (0.85–1.59)
Hip replacement	1.72 (0.55–5.36)	1.00 (0.21–4.75)
Multi-joint osteoarthritis:	1.35 (1.03–1.77)	1.41 (1.02–1.95)
Chair stands (seconds)	0.96 (0.91–1.00)	0.99 (0.94–1.04)
OARSI[*] grade		
Grade 3 (severe)	2.20 (1.48–3.26)	1.02 (0.63–1.64)
Grade 1–2 (narrowed)	1.33 (0.98–1.81)	0.90 (0.65–1.26)
Grade 0 (normal)	1.0	1.0

[§]Reference group for the outcome includes patients who did not report use of CAM or conventional medications for osteoarthritis treatment. Odds ratios shown are adjusted for all variables shown on the table. Results for Conventional Medications Only and Users of Both CAM and Conventional Medications are not shown as the odds ratios are virtually the same as those shown in Table 4.

[#]Odds ratios are per one standard deviation change in SF-12 Physical Scale (standard deviation=9.5), WOMAC Pain Scale (standard deviation=4.0), and KOOS QOL scale (standard deviation=23.1).

[*]X-ray evidence of joint space narrowing.