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Longitudinal Use of Complementary and Alternative Medicine among Older Adults with Radiographic Knee Osteoarthritis

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Abstract

Background—Osteoarthritis (OA) accounts for more mobility issues in older adults than any other disease. OA is a chronic and often painful disease for which there is no cure. Cross-sectional studies have shown that older adults frequently use complementary and alternative medicine (CAM) and arthritis is the most common reason for CAM use. While previous research has profiled the sociodemographic and clinical characteristics of CAM users, few have provided information on variation in CAM use over time and most only considered use of any CAM, which was often a mixture of heterogeneous therapies.

Objectives—This study sought to describe the longitudinal patterns of CAM use among older adults with knee OA, and to identify correlates/predictors of different commonly-used CAM therapies.

Methods—The Osteoarthritis Initiative included 1,121 adults aged 65 years and above with radiographic tibiofemoral OA in one or both knees at baseline. Annual surveys captured current use of conventional therapies and 25 CAM modalities (grouped into 6 categories) for joint pain or arthritis at baseline and during the 4-year follow-up. We assessed longitudinal use of CAM modalities by summing the number of visits with participants reporting use of each modality. Correlates of CAM use under consideration included sociodemographic indicators, body mass index, overall measures of mental and physical wellbeing, and clinical indices of knee OA.

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Conflicts of interest

CE has received grants and has served as a consultant to Pfizer; KL has served as an independent contractor to Janssen Scientific on a project related to prescription pain medication use.

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Generalized estimation equations provided adjusted odds ratio estimates and 95% confidence intervals.

Results—Nearly one third of older adults reported using one CAM modality for treating OA at all assessments. With the exception of glucosamine and chondroitin (18%), few were persistent users of other CAM modalities. One in five of those using NSAIDs or glucosamine/chondroitin were using them concurrently. Adjusted models showed: 1) adults aged ≥ 75 years were less likely to use dietary supplements than those aged between 65 and 75 years; 2) persons with more severe knee pain or stiffness reported more CAM use; 3) better knee-related physical function was correlated with more use of chiropractic/massage; 4) older adults with more comorbidities were less likely to report use of dietary supplements.

Conclusion—Patterns of CAM use are, to some extent, inconsistent with current guidelines for OA treatment. Evaluating the potential risks and benefits in older adults from commonly-used CAM modalities, with or without combination use of conventional analgesics, is warranted.

Keywords

complementary and alternative medicine; osteoarthritis; pain; older adults

Introduction

Use of complementary and alternative medicine (CAM) is widespread and increasing among older adults.¹ Among community-dwelling adults aged 65 and above, 30% to 69% reported use of CAM in the prior 12 months.^{2–5} Older adults use CAM to improve general health and to treat specific health conditions.³ Among the various conditions for which older adults are using CAM, arthritis is the most frequently cited reason.³

Osteoarthritis (OA), the most common type of arthritis, is a degenerative disease characterized by joint pain and dysfunction caused by a gradual loss of articular cartilage.⁶ One in three older adults in the United States has clinical OA.⁷ OA affecting the knee and the hip account for more problems with ambulation among older Americans than any other disease.⁸ Currently, there are no curative therapies for OA and clinical guidelines recommend both pharmacological and non-pharmacological methods to relieve symptoms.^{9,10} CAM use is common among OA patients^{11,12} perhaps due to ineffective pain management or adverse effects associated with conventional medicine^{13,14} or because of the patients' own health beliefs.¹⁵

Sociodemographic and clinical characteristics of CAM users among older adults with and without OA have been documented.^{2–5,11,12} Gaps in knowledge about how older adults use CAM exist for two reasons. First, the majority of previous studies used cross-sectional designs.^{2–5,11,12} As such, information on variation in CAM use over time is lacking. Second, many studies have identified correlates/predictors of using any sort of CAM, which often includes a variety of heterogeneous therapies.^{3,11,16,17} We hypothesized that correlates would differ for specific CAM therapies among older adults. For example, the factors associated with use of mind-body techniques such as Tai Chi may likely differ from correlates of glucosamine/chondroitin use. Therefore, using data from Osteoarthritis Initiative (OAI),¹⁸ we sought to: (1) describe the longitudinal patterns of CAM use among older adults with knee OA, and (2) identify correlates/predictors of specific commonly-used CAM therapies.

Methods

The Institutional Review Boards of the University of Massachusetts Medical School and the Memorial Hospital of Rhode Island approved this study.

Data set and study sample

We used publicly available data from OAI, which is a longitudinal study aimed to identify risk factors for incidence and progression of knee OA.¹⁸ From February 2004 to May 2006, four study sites (i.e. Baltimore, MD; Columbus, OH; Pittsburgh, PA; and Pawtucket, RI) enrolled 4,796 participants at high risk for developing or with established knee OA.¹⁸ Key exclusion criteria included presence of rheumatoid arthritis, bilateral knee arthroplasty, comorbid conditions that may interfere with participation, and potential for moving away from the clinic areas during the follow-up period. Eligible participants provided informed consent.

The current study included OAI participants aged ≥ 65 years who had radiographic knee OA at study enrollment. Radiographic knee OA was defined as definite tibiofemoral osteophytes (equivalent to Kellgren and Lawrence (K-L) grade ≥ 2) on the fixed flexion radiograph in one or both knees.¹⁹ We identified 1,121 participants meeting these criteria.

Measurement of CAM use

At baseline and follow-up assessment visits, trained interviewers collected information on use of 25 CAM modalities for joint pain or arthritis. The frequency of assessment differed for specific CAM modalities. Four dietary supplements [glucosamine, chondroitin, S-adenosylmethionine (SAME) and methylsulfonylmethane (MSM)] were assessed at baseline and then annually for 4 years. Other CAM modalities (e.g., acupuncture, Tai Chi, topical use of capsaicin and low-fat diet) were assessed only at baseline, year 2 and year 4. At each planned assessment, we considered participants were currently using the modality if they reported using it for at least four days per week in the past 6 months (for glucosamine and chondroitin), for more than half of the days in the past month (for SAME and MSM), or “currently” (for all other modalities).

The National Center for Complementary and Alternative Medicine (NCCAM) classification system was used to group the 25 CAM modalities into six categories: 1) alternative medical systems/energy therapies, 2) mind-body interventions, 3) manipulative and body-based therapies, 4) biologically-based diets, 5) biologically-based topical agents, and 6) biologically-based supplements.²⁰ The OAI survey instrument grouped energy therapies and alternative medical systems together, thus we were unable to differentiate these CAM categories. We created six binary variables - one for each CAM category. Participants were considered to be using the CAM category if they indicated use of any CAM modality within that category. If information on half or more of the component modalities was missing, that category was coded as missing. The six category variables were created for assessments at baseline, year 2 and year 4.

Measurement of potential correlates

Potential correlates of CAM use included sociodemographic indicators, clinical indices of knee OA, overall measures of mental and physical wellbeing, obesity status and use of prescription and non-prescription conventional analgesics. Women,²¹ Non-Hispanic White,²² higher income or education²³ and having insurance coverage²⁴ have been correlated with increased CAM use in cross-sectional studies. We measured income as the personal family income for the last year, including all sources such as wages, salaries, social

security and retirement benefits. Missing income values (for 7.9% of the study sample) were imputed with conditional means given age, gender, race and education.

OAI administered comprehensive measurements of clinical characteristics of knee OA at baseline and follow-up visits. This included severity of symptoms, radiographic feature of joint damage, symptom-related multi-joint OA, and history of having a knee injury and surgery. Knee symptom and function were captured by the Western Ontario and McMaster Universities Arthritis Index (WOMAC) scale.²⁵ The WOMAC scale measures three separate dimensions: Pain, Stiffness, and Physical Function. Each scale item contains 5 Likert responses, ranging from '0=none' to '4=extreme'. Scores were summed for each dimension to produce Pain, Stiffness and Function subscale scores, with maximum values of 20, 8 and 68 respectively. WOMAC is scored on a best to worst scale, with higher scores representing greater symptom severity or worse knee-related function. WOMAC scores are knee-specific. To characterize an individual's symptom severity, we selected the worst score from the knee-specific measures.

Structural damage of knee OA was assessed using the K-L grade.¹⁹ This grading scheme takes into account the presence of osteophytes and joint space narrowing in the tibiofemoral joint, and is categorized into Grade 0 to 4. Grade 2 or higher is generally used as standard for diagnosis of knee OA.¹⁹ Symptom-related multi-joint OA was evaluated to capture the effect of generalized OA on CAM use. We considered symptom-related multi-joint OA present if participants had OA symptoms in at least two joints other than knee.²⁶ Information was also collected on prior history of knee injury(ies) that resulted in limited ability to walk for at least two days, and prior history of knee surgery including arthroscopy, ligament repair or meniscectomy.

The 12-item Short-Form Health Survey (SF-12) provided an assessment of general health status.²⁷ Answers to the 12 questions were combined and weighted to create Physical and Mental Component Summary scores, which range from 0 to 100, with higher scores indicating better health status. The presence of comorbid conditions was assessed using a validated self-administered questionnaire modeled on the Charlson index.²⁸ A comorbidity score was then calculated according to the algorithm proposed by Katz et al.,²⁸ which ranges from 0 to 32, with higher scores indicating greater severity in comorbid conditions. The majority of our study sample had no comorbid conditions, so the comorbidity score was categorized as 0, 1 and 2 in analyses. We also calculated body mass index (BMI) from measured height and weight [weight (kg)/height (m²)]. Participants with a BMI less than 25 were defined as normal, between 25 and less than 30 as overweight, and 30 and over as obese.

Trained interviewers assessed participants use of conventional medications for arthritis treatment. Participants were asked "During the past 30 days, have you used any of the following medications for joint pain or arthritis?" with separate questions for acetaminophen, NSAIDs, opioids, doxycycline, and injections of corticosteroid or hyaluronic acid into the knee. Participants who reported using any of these treatments were considered using conventional medication.

Statistical analyses

We first described characteristics of participants by status of using any CAM at baseline. Distributions of categorical and continuous variables were calculated with percentage and mean (standard deviation) respectively.

To describe patterns of longitudinal use of each CAM modality, we summed the number (frequency) of assessments when a participant reported use of that modality. For

glucosamine, chondroitin, SAME and MSM, five assessments were available (frequency ranged from 0 to 5), and for all other CAM modalities three assessments were available (frequency ranged from 0 to 3). We then calculated and reported the percent of each frequency level. Since almost 90% of those taking glucosamine or chondroitin were using both concurrently, we grouped them together by generating a variable (glucosamine/chondroitin) indicating whether a participant was taking glucosamine, chondroitin, or both at each assessment. When describing longitudinal use of a specific modality, we excluded participants with missing information about that modality at any assessment. Depending on the modality, the percentage of participants with missing information for one assessment ranged from 15% (for SAME) to 20% (for topical use of capsaicin).

We also identified the most common combination therapies used for treating OA. For every possible combination of two CAM modalities or of one CAM modality and one conventional medicine, we calculated the proportion of individuals using both treatments among those using at least one of the two therapies under consideration. In this process, glucosamine and chondroitin were analyzed as one modality using the same definition mentioned above.

Measurements were reported for up to three assessments for each individual, thus generalized estimating equations (GEE) were used to identify predictors/correlates for use of each CAM category.²⁹ Before starting the modeling process, we checked whether there were strong linear dependencies among the potential correlates. Variance inflation factors (VIF) for all potential correlates were obtained through linear regression modeling with CAM use as the dependent variable and all potential correlates as independent variables.³⁰ We found that VIFs for all potential covariates in our study were much smaller than 10, which is recommended as the cutoff to detect severe multicollinearity.³¹ In addition, for a small proportion of participants with missing values on correlates (ranging from 0.9% for comorbidity score to 5.3% for K-L grade), we imputed missing values with the last observation carried forward.³²

We fit separate models for use of the following four CAM categories: biologically-based supplements, topical agents, mind-body interventions and manipulative and body-based therapies. Models were not developed for biologically-based diets and alternative medical systems/energy therapies as too few participants were using these categories. The model outcome was CAM category use (yes or no) at each assessment and we specified a LOGIT link to estimate the logistic GEE model. Age, gender, race, education and income at baseline were included in the model as time-invariant covariates, while insurance coverage for prescription, WOMAC scales, K-L grade, symptom-related multi-joint OA, history of injury or surgery, SF-12 measures, comorbidity score, obesity status, and use of analgesic medications (measured concurrently with CAM use) were included as time-dependent covariates. A backward variable selection procedure was used in the model building process with $\alpha=0.2$. We assumed an exchangeable within-subject correlation structure, and tested the robustness of estimates assuming auto-regressive and unstructured correlation structures.²⁹ Adjusted odds ratios and corresponding 95% confidence intervals were derived from the final models.

Results

Participant characteristics at baseline are shown in Table I. Overall, 24.4% of the study participants were aged ≥ 75 years, 58.6% were women, 82.5% were non-Hispanic White and 29.7% had at least one comorbid condition. Compared to non-CAM users at baseline, CAM users tended to be younger, were more likely to be women, and had more severe OA as measured by K-L grade and WOMAC subscales.

At baseline, 51.8% of participants reported current use of at least one CAM modality, and this proportion decreased slightly to 47.6% at year 2 and to 47.1% at year 4. The proportions of participants reporting use of different CAM categories remained stable across the study period. The most commonly used CAM category was biologically-based supplements and around one third of the participants reported using at least one supplement at baseline, year 2 and year 4. Topical agents and mind-body interventions were also commonly used, with 14% and 10% reporting use at each scheduled assessment point.

Table II shows the patterns of longitudinal use of any CAM and different CAM modalities during the four-year period. Nearly one third of participants (31.2%) reported use of at least one CAM modality at all assessments. The most persistently used CAM modality was glucosamine/chondroitin, with 17.9% reporting use at all assessment points. A considerable proportion of participants reported use at one visit of rubs/lotions/liniments/creams/oils (26.3%), MSM (19.1%), vitamins (18.5%) and yoga/Tai Chi/Chi Gong/Pilates (12.7%), but few of them consistently reported use of these modalities at all assessments.

The top five treatment combinations among CAM modalities and between CAM and conventional therapies are shown in Table III. Over 20% of the participants using glucosamine/chondroitin or MSM were using them concurrently, and 13.3% were using glucosamine/chondroitin in combination with vitamins. Individuals adopting mind-body interventions (relaxation, yoga) or biologically-based topical agents (rubs, lotions, liniments, capsaicin, etc.) tended to simultaneously use several modalities within the same category. Regarding combination treatment between CAM modality and conventional medication, 20.6% of those using glucosamine/chondroitin or NSAIDs were using them in combination, and 12.1% of those using glucosamine/chondroitin or acetaminophen were using them in combination. Participants using rubs, lotions, liniments, creams or oils were often using them in combination with acetaminophen or NSAIDs.

Correlates of using the four common CAM categories are shown in Table IV. Participants older than 75 years were less likely to report use of supplements than participants aged between 65 and 75 years (i.e., the young-old). Women tended to report more use of all CAM categories than men. Compared to Non-Hispanic Whites, Non-Hispanic Blacks were less likely to take supplements, but more likely to use topical agents. Participants with at least some college education reported more use of supplements and mind-body interventions than those with a high school education or less. Higher income was associated with using chiropractic/massage, while lower income was a correlate of using topical agents. Worse WOMAC Pain and Stiffness symptoms were associated with more CAM use, while better knee-related function was associated with use of chiropractic/massage. Obese participants reported less use of mind-body interventions and chiropractic/massage than overweight and normal-weight participants. Older adults reporting use of conventional analgesics were also more likely to use three out of the four CAM categories. Individuals with more comorbidities were less likely to report use of supplements than those with no comorbidities.

Discussion

Following 1,121 older adults with radiographic knee OA for up to four years, we revealed that CAM use was common, with half of them reporting current use of some sort of CAM at each visit and nearly a third reporting use at all assessment points. However, except glucosamine and chondroitin, none was persistently used. Participants tended to use several modalities concurrently, and used glucosamine, chondroitin or topical agents in combination with conventional analgesics. Correlates/predictors relating to CAM categories differed depending on specific CAM category.

Consistent with other studies, we found that use of supplements, especially glucosamine/chondroitin, and topical agents was common among older adults with OA, while other CAM modalities, such as acupuncture, chiropractic/massage, and Tai Chi, were less commonly used.^{33,34} This usage pattern is, to some extent, inconsistent with the recommendations of current guidelines for CAM treatment of OA.^{9,10} The 2012 guideline from American College of Rheumatology “conditionally recommends that OA patients should not use chondroitin sulfate, glucosamine or topical capsaicin”, but “should participate in Tai Chi programs” and “be treated with Chinese acupuncture”.⁹ The Osteoarthritis Research Society International 2008 guideline recommended use of acupuncture and glucosamine and/or chondroitin,¹⁰ but an update of the guideline in 2010 suggested that “effect size for pain relief from glucosamine and chondroitin diminished and there was greater heterogeneity and more evidence of publication bias” among the recently-published studies.³⁵

Sharma categorized CAM users into four types: “one-off users” who discontinue the treatment after a brief experimentation, “stable users” who regularly use one form of CAM for one or more health problems, “earnest seekers” who keep trying different forms of treatment for an intractable health problem, and “eclectic users” who choose and use different forms of therapies for various problems.^{36–38} Earlier cross-sectional studies reported that a significant proportion of CAM users were “stable users” who had developed a fairly regular relationship with their particular CAM modalities.^{38,39} Our study, however, along with several other longitudinal studies,^{40,41} found that most CAM users were probably “one-off users” or “earnest seekers” who used each modality for a brief period and frequently switched between modalities. One possible explanation for this discrepancy is in varying definitions of CAM use. Instead of focusing on CAM modalities for one specific condition, cross-sectional studies assessed CAM therapies used for any purpose including promoting general health.^{38,39} Although reasons for discontinuing CAM therapies were not elicited in our study, the usage patterns revealed support the notion that whether patients continue a CAM therapy mainly relies on self-perceived effectiveness of the treatment.⁴⁰

We found that combination use of supplements and conventional analgesics is common, which may predispose older patients to harmful interaction effects. For instance, one study reported that glucosamine may decrease the analgesic effect of acetaminophen among older OA patients⁴² and another study showed that use of chondroitin may increase the risk of bleeding from concurrent use of NSAIDs.⁴³ The potential for increased gastrointestinal toxicity warrants closer attention in the elderly as this population is at higher risk of NSAID-induced gastrointestinal bleeding due to aging-related physiological changes⁴⁴ and misuse of analgesics.⁴⁵

A review by Hathcock et al of available clinical trial data concluded that use of glucosamine and chondroitin is safe.⁴⁶ The longest study duration, however, among the clinical trials included in the review was three years, which may be insufficient to observe the potential adverse effects of long-term use of these supplements. Indeed, several recent case reports from both United States⁴⁷ and Europe^{48,49} raised the concern of potential hepatotoxicity associated with use of glucosamine with or without chondroitin. While the OAI data collection tools did not capture start date of glucosamine and chondroitin use and thus did not allow us to estimate duration of use, we did find that persistent use of glucosamine/chondroitin for at least 4 years was common among older adults. Given that long-term safety data are not available, vigilant physician assessment and patient education and counseling is needed to help avoid the possible adverse effects. Previous studies have noted that underreport of dietary supplements use is common among patients⁵⁰ and that physician-patient communication is infrequent regarding efficacy and adverse effects of dietary supplements.⁵¹

Our findings are consistent with other studies regarding the relationship of CAM use to gender,²¹ race,²² and education.²³ It is also not surprising that lower income patients reported more use of topical agents and wealthier participants reported more use of manipulative and body-based therapies, given the difference in cost between these therapies.³ We found that those aged ≥ 75 years were less likely than the young-old to report use of supplements, but not other CAM therapies. This may be due to the relatively greater accessibility among the young-old to direct-to-consumer advertising of these supplements through magazine, internet, and other media.³ In addition, our study found that use of supplements was reversely associated with the number of comorbid conditions. This may suggest that OA patients with critical comorbid conditions abandoned OA supplement treatments for therapies aimed at managing their comorbidities. Furthermore, the finding that patients reporting use of conventional analgesics were also more likely to use most of the CAM therapies supports the idea that CAM therapies are complements but not substitutes of conventional medicine.⁵² Finally, a national survey showed that adults with obesity were generally less likely to use yoga or massage.⁵³ Our study confirmed these relationships among older adults with OA.

The findings that persons with more severe OA or worse general physical health reported more CAM use are consistent with other studies.^{11,12} However, we did find that better knee-related physical function was correlated with more use of chiropractic/massage. This relationship was also reported by another study of persons with back pain.⁵⁴ Evaluating the extent to which this association reflects the characteristics of chiropractic/massage users or a treatment effect is beyond the scope of the current study.

Our findings have important implications for future study and clinical practice. Future studies are needed to assess the extent to which supplements and topical agents interact with conventional medications and glucosamine and/or chondroitin cause unintended adverse effects such as hepatotoxicity. In addition, both qualitative and quantitative research is needed to understand OA patients decision-making regarding the persistent use of glucosamine and chondroitin in spite of controversial evidence regarding their efficacy⁵⁵ and some guidelines recommending against using them.⁹ Future studies are also needed to understand patients decisions concerning use of efficacious CAM given that the uptake is low and persistent use is uncommon. For clinical practice, it is important for clinicians to realize the high percentage of patients utilizing CAM and improve the patient education and counseling about efficacy of available CAM therapies for OA treatment and potential adverse effects from using CAM in combination with conventional analgesics. In addition, considering that use of most CAM modalities is transient, clinicians may need to regularly review their patients current CAM regimens.

Our study has some limitations. First, our sample was not randomly drawn from the population and thus was not representative of the older population in the United States. Indeed, compared to a nationally representative sample of older adults,⁵ our participants were younger, wealthier, more educated and had fewer comorbid conditions. Second, we didn't directly measure duration of using each modality, but defined level of persistence based on frequency of assessments with participants reporting current CAM use. This may lead to an overestimation of the persistence level if participants were not on treatment during the assessment intervals. Third, we didn't have sufficient sample size to assess use of diets, alternative medical systems or energy therapies. Further, we did not have adequate sample size to evaluate correlates within specific subgroups of older adults defined by ethnicity/race, gender, specific comorbid conditions or levels of disease severity. Our previous studies have shown that correlates of CAM use differed by race/ethnicity⁵⁶ and by gender.⁵⁷

Conclusions

Among older adults with radiographic knee OA, we found that, except for glucosamine and chondroitin, there were few CAM modalities that were persistently used. Combination use of glucosamine, chondroitin or topical agents with conventional analgesics is common. Adults aged 75 years were less likely to report use of supplements than the young-old. Higher income was associated with using manipulative and body-based therapies, while lower income was a correlate of using topical agents. Participants with more severe OA disease or worse general physical health reported more CAM use. However, individuals with more comorbid conditions were less likely to report use of supplements. Future studies are needed to assess the benefits and adverse effects of using glucosamine and chondroitin alone or in combination with conventional analgesics.

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Table I

Participant characteristics by status of any CAM use at baseline among older adults with radiographic knee OA

Characteristics	CAM Users (N=581)	Non-CAM users (N=540)	Total (N=1,121)
	<i>Percentage</i>		
Age (75 years)	21.3	27.8	24.4
Women	65.1	51.7	58.6
Ethnicity/Race			
Non-Hispanic White	82.4	82.6	82.5
Non-Hispanic Black	12.7	15.6	14.1
Other	4.8	1.9	3.4
Education			
High school or less	18.0	22.2	20.0
Some college	24.0	22.9	23.5
College graduate	21.1	21.6	21.3
Graduate Degree	37.0	33.3	35.2
Income (\$)			
<25,000	17.0	18.7	17.8
25,000 – 50,000	36.2	36.0	36.1
>50,000	46.9	45.3	46.1
Insurance coverage of Rx	83.0	82.2	82.7
K-L grade 3 or 4	59.2	48.9	54.2
Symptom-related multi-joint OA	57.8	42.0	50.2
Use of analgesics	48.2	33.3	41.0
History of knee injury	43.6	39.9	41.8
History of knee surgery	26.3	24.1	25.3
Body mass index (kg/m ²)			
<25	21.3	17.6	19.5
25 – <30	41.5	44.3	42.8
30	37.2	38.2	37.6
Comorbidity score			
0	71.9	68.6	70.3
1	15.8	16.5	16.1
2	12.3	15.0	13.6
	<i>Mean (Standard Deviation)</i>		
WOMAC Pain	4.3 (3.7)	3.1 (3.5)	3.8 (3.7)
WOMAC Stiffness	2.4 (1.7)	1.9 (1.7)	2.1 (1.7)
WOMAC Physical Function	13.4 (12.1)	10.4 (11.6)	12.0 (11.9)
SF-12 PCS	46.7 (8.9)	48.4 (8.8)	47.5 (8.9)
SF-12 MCS	55.6 (7.2)	55.4 (7.2)	55.5 (7.2)

K-L grade: Kellgren-Lawrence grade; MCS: Mental Component Summary score; PCS: Physical Component Summary score; Rx: prescription; SF-12: 12-item Short-Form Health Survey; WOMAC: Western Ontario and McMaster Universities Arthritis Index scale.

Table II

Patterns of longitudinal use of CAM modalities among older adults with radiographic knee OA

	Number of assessments reporting CAM use[†]			
	0	1	2	3
	<i>Percentage[†]</i>			
Any CAM	29.8	21.4	17.6	31.2
Biologically based supplements				
Glucosamine/Chondroitin*	52.7	15.4	14.1	17.9
Methylsulfonylmethane*	80.9	13.3	4.8	0.9
S-adenosylmethionine*	98.7	1.1	0.1	0.1
Herbs	95.3	3.9	0.6	0.2
Vitamins	81.5	13.6	4.6	0.3
Biologically based topical agents				
Rubs, lotions, liniments, creams or oils	73.7	16.7	5.7	3.9
Capsaicin	94.4	4.9	0.7	0.1
Mind-body interventions				
Yoga, Tai Chi, Chi Gong, Pilates	87.2	8.7	3.1	0.9
Relaxation therapy, meditation, deep breathing or visualization	93.3	5.0	1.3	0.3
Spiritual activities	91.8	6.1	1.6	0.6
Manipulation and body-based methods				
Chiropractic	93.3	4.6	1.7	0.5
Massage	97.0	2.1	0.6	0.3
Alternative medical system/Energy therapy				
Acupuncture	98.2	1.5	0.2	0.1
Acupressure	99.4	0.5	0.1	0.0
Copper, magnet bracelet	93.8	4.7	1.0	0.5
Homeopathy/Chelation therapy/Folk medicine/Ayurveda/biofeedback/hypnosis/ naturopathy/energy therapy	99.1	0.9	0.0	0.0
Biologically based diets	97.3	2.2	0.2	0.2

[†]The number of assessments represents the total number of assessments (or frequency) when a participant reported using the CAM modality. The percentage was calculated as the proportion of each frequency level.

* 0, 1, 2 and 3 respectively represents 0, 1–2, 3–4, and all 5 assessments when participants reported use of the four supplements.

Table III

The top five treatment combinations among CAM modalities and between CAM modality and conventional medication among older adults with radiographic knee OA

Rank	Combination use	Percent *
CAM modalities		
1	GLUCHON & MSM	21.6
2	RELAX & Spiritual activity	20.7
3	RELAX & YOGA	16.5
4	RUB & Capsaicin	13.4
5	GLUCHON & Vitamins	13.3
CAM & Conventional medication		
1	GLUCHON & NSAIDs	21.6
2	RUB & NSAIDs	14.6
3	RUB & Acetaminophen	13.9
4	GLUCHON & Acetaminophen	12.1
5	Chiropractic & NSAIDs	10.0

GLUCHON: glucosamine/chondroitin; MSM: methylsulfonylmethane; RELAX: relaxation therapy, meditation, deep breathing or visualization; RUB: rubs, lotions, liniments, creams or oils; YOGA: Yoga, Tai Chi, Chi Gong, or Pilates.

* Percent= No. of person-visits using both therapies/No. of person-visits using at least one of the two therapies × 100%.

Table IV

Correlates of CAM use among older adults with radiographic knee OA[‡]

	Supplements (34.7% [‡])	Topical agents (13.8% [‡])	Mind-body intervention (9.8% [‡])	Manipulative and body-based therapies (3.7% [‡])
Time-invariant variables (Baseline)				
<i>Adjusted odds ratio (95% confidence interval)</i>				
Age (< 75 years)	0.69 (0.54–0.89)			
Women	1.44 (1.15–1.81)	1.56 (1.16–2.10)	2.53 (1.75–3.64)	1.56 (0.90–2.69)
Ethnicity/Race				
Non-Hispanic Black	0.49 (0.36–0.67)	1.86 (1.31–2.64)		0.58 (0.25–1.35)
Other	1.07 (0.59–1.94)	2.68 (1.44–4.99)		2.06 (0.60–7.04)
Non-Hispanic White	1.0	1.0		1.0
Education				
Graduate Degree	2.03 (1.48–2.80)		3.41 (2.13–5.44)	
College graduate	1.75 (1.23–2.47)		1.96 (1.17–3.31)	
Some college	1.37 (0.98–1.93)		2.09 (1.31–3.33)	
High school or less	1.0		1.0	
Income (\$)				
>50,000		0.67 (0.46–0.98)	0.69 (0.44–1.10)	2.05 (0.94–4.47)
25,000 – 50,000		1.03 (0.73–1.47)	0.97 (0.64–1.46)	1.75 (0.76–4.01)
<25,000		1.0	1.0	1.0
Time-varying variables (Concurrent)				
Insurance coverage for prescriptions				
WOMAC Pain *	1.12 (1.04–1.22)	1.29 (1.11–1.50)	1.18 (0.99–1.41)	2.00 (0.73–5.46)
WOMAC Stiffness *		1.17 (1.01–1.34)	1.18 (0.99–1.40)	1.44 (1.09–1.88)
WOMAC Function *				0.68 (0.48–0.94)
K/L grade: 3/4 vs. 1/2	1.39 (1.13–1.72)		0.79 (0.59–1.05)	
Symptom-related multi-joint OA	1.12 (0.98–1.28)	1.57 (1.24–1.99)		2.05 (1.36–3.08)
History of knee injury	1.25 (1.02–1.53)	1.21 (0.93–1.56)	1.31 (0.96–1.78)	0.70 (0.43–1.13)
History of knee surgery				1.70 (0.99–2.92)
Body Mass Index (kg/m ²)				
30	0.94 (0.71–1.23)		0.63 (0.42–0.93)	0.54 (0.29–1.00)
25 – <30	1.20 (0.96–1.50)		0.78 (0.54–1.12)	0.79 (0.44–1.40)

	Supplements (34.7% ‡)	Topical agents (13.8% ‡)	Mind-body intervention (9.8% ‡)	Manipulative and body-based therapies (3.7% ‡)
<25	1.0	1.0	1.0	1.0
Use of analgesics	1.20 (1.02–1.41)	1.34 (1.05–1.72)	1.50 (1.14–1.97)	
SF-12 PCS *		0.91 (0.81–1.02)	0.80 (0.70–0.92)	0.82 (0.64–1.06)
SF-12 MCS *			0.90 (0.80–1.02)	
Comorbidity score				
2	0.66 (0.52–0.85)			
1	0.84 (0.68–1.02)			
0	1.0			

K-L grade: Kellgren-Lawrence grade; MCS: Mental Component Summary score; PCS: Physical Component Summary score; Rx: prescription; SF-12: 12-item Short-Form Health Survey; WOMAC: Western Ontario and McMaster Universities Arthritis Index scale.

‡ Backward variable selection procedure was used to build models. Covariates with p-value 0.2 were included in this table.

‡ Percent=No. of person-visits reporting use of the CAM category/No. of person-visits with non-missing information × 100%.

* Odds ratios are per one standard deviation change in WOMAC subscales or SF-12 subscales.