

Complementary and Alternative Medicine Use by Normal Weight, Overweight, and Obese Patients with Arthritis or Other Musculoskeletal Diseases

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Abstract

Objectives: The Centers for Disease Control and Prevention estimates that 50 million Americans have been diagnosed with arthritis and other musculoskeletal diseases. The purpose of the current study was to (1) estimate the prevalence of overall complementary and alternative medicine (CAM) use and (2) examine the role of body mass index (BMI) on CAM use among normal weight, overweight, and obese persons with chronic lower back pain, chronic neck pain, chronic/rheumatoid arthritis, or musculoskeletal diseases, while controlling for other covariates.

Design: Cross-sectional design using secondary data for 9724 adults from the 2007 National Health Interview Survey. Data were weighted and analyzed by using Stata 12 for Windows (Stata Corp., College Station, TX). Descriptive, bivariate, and multivariate logistic regression statistics were computed.

Participants: The participants were randomly surveyed from U.S. households.

Outcome measures: CAM use was measured as reported use of any modality within the five National Center for Complementary and Integrative Health domains.

Results: CAM use was statistically significantly associated with female sex; race/ethnicity; having chronic neck pain, lower back pain, or chronic/rheumatoid arthritis; having limitations due to chronic disease; and geographic region ($p < 0.05$). Factors significantly associated with decreased odds of CAM use included age 50–64 years, income categorized as “other/missing,” and having musculoskeletal diseases. Stratification by body mass index suggested increased odds of CAM use among normal/underweight persons with chronic neck pain but decreased odds for those with chronic musculoskeletal diseases. For overweight patients, increased odds of CAM use were significant for chronic lower back pain, musculoskeletal diseases, and chronic/rheumatoid arthritis.

Conclusions: Musculoskeletal diseases and arthritis represent important public health problems with economic implications for the well-being of individuals and society. Identifying CAM use trends by patient weight can be used to improve strategies to increase awareness and access to CAM as part of comprehensive and cost-effective approaches for the management and treatment of these conditions.

Introduction

THE CENTERS FOR DISEASE CONTROL AND PREVENTION estimates 50 million Americans have arthritis, with cases increasing^{1,2} and projected to reach 25% of the adult population by 2030.³ Arthritis and chronic joint pain are the most common causes of disability in the United States, limiting activities of nearly 21 million adults.⁴ Globally, musculoskeletal conditions are the second leading cause of disability, behind only mental/behavioral disorders.^{5–7} Rheumatoid arthritis specifically is characterized by increasing

morbidity,^{2,8} excess mortality,⁹ increasing healthcare costs,¹⁰ premature mortality, disability, and compromised quality of life.^{11–14}

Equally impactful are the number of Americans with activity limitations due to chronic back or neck pain; chronic back pain is the second most cited reason for ambulatory visits.^{15,16} As a result of these conditions, more Americans will be faced with activity limitations, affecting significant aspects of their lives, including family/social relationships.¹⁷ The mental health impacts for patients concerned about loss of function or work disability due to musculoskeletal

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diseases¹⁸ further add to these costs. All these populations are at high risk for loss of employment/insurance and poor access to healthcare. The growing number of overweight and obese Americans further compounds these problems.

Recently, the United States has seen an upward trend in the use of nonconventional medicine for chronic conditions,^{19–22} mimicking trends seen internationally.^{23–25} Although many studies have examined the use of complementary and alternative medicine (CAM) within different chronic disease populations,^{16,26,27} researchers also suggest that the reasons for CAM use for chronic back or neck pain and other musculoskeletal diseases warrant further study.²⁸ Reasons for CAM use vary, ranging from concerns about costs²⁹ and potential adverse effects of conventional medicine^{30,31} to perceived benefits,^{32–35} including affordability³⁶ and cost savings due to increased patient satisfaction.²⁴

Notably, few studies have examined the prevalence of CAM use by body mass index (BMI) among persons with arthritis, chronic back or neck pain, and other musculoskeletal diseases. For example, Lapane et al. restricted their study to CAM use by BMI status only for radiographic knee osteoarthritis.³⁷ Excess weight is often associated with myriad health problems that necessitate interventions, including pharmaceutical agents with potential contraindications. Patients with chronic conditions, including musculoskeletal/joint problems and obesity, are also likely to seek CAM products/therapies for general wellness,³³ to reduce costs, or to avoid adverse effects of conventional medications.³⁸ The purpose of the current study was therefore twofold: (1) to estimate the prevalence of overall CAM use and (2) to examine the role of BMI on CAM use among normal weight, overweight, and obese persons with chronic lower back or neck pain, chronic/rheumatoid arthritis, or musculoskeletal diseases, while controlling for other covariates.

Materials and Methods

Data for 9724 adult Americans age 18 years or older from the 2007 National Health Interview Survey (NHIS) and the supplemental Adult Alternative Medicine module (administered every 5 years) were weighted and analyzed by using Stata 12 software (Stata Corp., College Station, TX). The NHIS is described elsewhere.^{1,3,16,29,39} The study population consisted of persons with self-reported chronic neck or lower back pain, chronic/rheumatoid arthritis, or other musculoskeletal diseases.

Outcome variable

CAM use was measured by collapsing reported modalities into the five domains suggested by the National Center for Complementary and Alternative Medicine:⁴⁰ (1) manipulative, including chiropractic approaches and massage; (2) mind-body, including meditation, prayer, and yoga; (3) biologically based, including herbs and diets; (4) energy therapies, including Reiki and magnet therapy; and (5) alternative/whole medical systems, including *Ayurveda*, homeopathy, and naturopathy. A composite variable for CAM use was created by combining the domains in which CAM use was present if any of the domains was coded as 1, indicating reported CAM use within that domain. The final CAM variable was dichotomized into 0 and 1, where 0 represented absence of CAM use.

Independent variables

In addition to demographic/socioeconomic variables (age, sex, race/ethnicity, insurance status, regular source of care, family income, education, region of residence, and marital status), health status indicators (BMI, chronic neck or lower back pain, musculoskeletal diseases, chronic/rheumatoid arthritis, and activity limitation due to chronic disease) were also included. All variables were categorical except for age, income, and BMI. BMI was defined as normal/underweight ($BMI < 25 \text{ kg/m}^2$), overweight ($25 \leq BMI < 30 \text{ kg/m}^2$), and obese ($BMI \geq 30 \text{ kg/m}^2$).

Analytical methods

Frequency distributions for all covariates were generated. A chi-square test of independence was used to examine associations between covariates and CAM use. Proportions of CAM use by chronic disease status were calculated. Generalized and stratified multivariate logistic regression models were generated while controlling for potential confounders (age, sex, race/ethnicity, education, marital status, family income, insurance status, regular source of care, limitation due to chronic disease, and geographic region). The direct effect of each independent variable was assessed first on the outcome variable. Next, all demographic factors and primary variables (chronic neck pain, lower back pain, musculoskeletal disease, and chronic/rheumatoid arthritis) were included in the analysis to assess for potential confounding. Finally, other health behavior-related factors (i.e., smoking and alcohol intake) and the primary variables were included in the analysis to assess for potential confounding. Confounders were then controlled for in the multivariate logistic regression analysis. All significance levels were set at $\alpha = 0.05$.

Results

Descriptive, bivariate, and multivariate logistic regression results are presented in Table 1 for all covariates (general model). Table 2 summarizes the bivariate proportions and multivariate odds ratios for CAM use by BMI stratification.

Descriptive statistics

The sample was predominately white (79.6%), followed by black/African American (15.1%), Hispanic (1.2%), and other (4.1%). The South had the most cases (35.9%), followed by the Midwest and West (23.5% each) and the Northeast (17.1%). Approximately 61% of respondents were women, 54.4% were married, and 52.2% were 50 years of age or older. Most (75.5%) had a high school education or less, and 21.7% had graduated from college.

Approximately 57% had annual incomes below \$50,000, 86.0% had insurance, and 84.5% had a regular source of care. Two thirds were overweight to obese, 32.2% reported chronic neck pain, 62.3% had chronic lower back pain, 7.9% had chronic musculoskeletal diseases, 52.5% had chronic/rheumatoid arthritis, and 55.8% had limitation due to chronic disease.

General CAM use by demographic characteristics and health condition

Demographically, there was an approximately even distribution of CAM use within age groups, with the years <35,

TABLE 1. CHARACTERISTICS OF STUDY PARTICIPANTS AND PROPORTIONS OF COMPLEMENTARY AND ALTERNATIVE MEDICINE USE

Independent variables	Sample characteristics (n = 9724)		Chi-square results		Odds ratio of CAM use (95% CI)
	Count	Weighted (%)	CAM use (%)	Chi-square	
Age				4.7**	
<35 (ref)	1737	17.8	75.6		1.00
35–49 yr	1495	15.5	77.4		0.89 (0.73–1.08)
50–64 yr	1901	19.4	75.9		0.77 (0.64–0.92)**
>64 yr	3193	32.8	78.7		0.86 (0.71–1.03)
Missing	1398	14.5	81.3		1.09 (0.87–1.37)
Sex				77.1***	
Male (ref)	3816	39.5	73.0		1.00
Female	5908	60.5	80.9		1.57 (1.40–1.76)***
Race/ethnicity				13.1***	
White (ref)	7751	79.6	76.4		1.00
Black/African American	1466	15.1	84.8		1.74 (1.46–2.08)***
Hispanic	123	1.2	84.4		1.68 (1.04–2.72)*
Other	338	3.6	77.2		1.14 (0.83–1.55)
Missing	46	0.5	70.0		0.71 (0.38–1.36)
Education				4.3**	
Incomplete high school (ref)	1760	18.2	75.3		1.00
High school graduate	5585	57.3	77.9		1.25 (1.07–1.46)**
College graduate	2105	21.7	80.0		1.49 (1.21–1.83)***
Missing	274	2.8	73.9		1.10 (0.79–1.52)
Marital status				10.6***	
Married (ref)	5293	54.4	77.0		1.00
Widowed/divorced	2830	29.1	81.3		1.06 (0.91–1.22)
Single/never married	1565	16.1	74.3		0.85 (0.72–1.01)
Missing	36	0.4	65.4		0.59 (0.26–1.35)
Family income				75.0***	
<\$35,000 (ref)	4273	44.0	80.1		1.00
\$35,000–449,999	1229	12.5	81.3		1.14 (0.95–1.37)
\$50,000–\$74,999	1300	13.4	81.4		1.14 (0.94–1.37)
≥\$75,000	1816	18.9	80.3		1.00 (0.83–1.21)
Other (including missing)	1106	11.2	55.8		0.55 (0.47–0.65)***
Body mass index				44.1***	
Normal/underweight (ref)	3689	37.9	72.5		1.00
Overweight	3063	31.5	82.1		1.37 (1.20–1.57)***
Obese	2972	30.6	79.9		1.05 (0.91–1.21)
Insurance				34.8***	
Yes	8342	86.0	78.8		0.93 (0.77–1.11)
No (ref)	1382	14.0	71.7		1.00
Have a usual source of care				622.8***	
Yes	8216	84.5	82.6		2.96 (2.54–3.45)***
No (ref)	1508	15.5	51.5		1.00
Chronic neck pain				22.6***	
Yes	3105	32.2	82.0		1.35 (1.19–1.53)***
No (ref)	6619	67.8	75.8		1.00
Chronic lower back pain				21.9***	
Yes	6067	62.3	79.9		1.24 (1.10–1.39)**
No (ref)	3657	37.7	74.3		1.00
Chronic musculoskeletal disease				349.5***	
Yes	768	7.9	50.2		0.44 (0.37–0.52)***
No (ref)	8956	92.1	80.1		1.00
Chronic/rheumatoid arthritis				73.3***	
Yes	5100	52.5	82.2		1.2 (1.10–1.45)**
No (ref)	4624	47.5	72.9		1.00

(continued)

TABLE 1. (CONTINUED)

Independent variables	Sample characteristics (n=9724)		Chi-square results		Odds ratio of CAM use (95% CI)
	Count	Weighted (%)	CAM use (%)	Chi-square	
Limitation due to chronic disease				152.1***	
Yes	5399	55.8	82.5		1.30 (1.15–1.47)***
No (ref)	4325	44.2	71.8		1.00
Region				2.7*	
Northeast (ref)	1668	17.1	75.3		1.00
Midwest	2297	23.5	77.4		1.14 (0.95–1.36)
South	3499	35.9	79.3		1.37 (1.16–1.62)***
West	2260	23.5	77.6		1.27 (1.05–1.54)*

* $p < 0.05$.** $p < 0.01$.*** $p < 0.001$.

CAM, complementary and alternative medicine; CI, confidence interval; ref, reference category.

35–49, and 50–64 reporting 75.6%, 77.4%, and 75.9% use, respectively, and those older than age 64 years reporting the highest level of CAM use at 78.7% ($p < 0.01$). Among women, 80.9% reported CAM use compared to 73.0% of men ($p < 0.001$). Blacks/African Americans and Hispanics reported approximately even distributions of CAM use at 84%–85%, while whites and the “other” category comprised 76%–77% ($p < 0.001$). CAM use was highest in the South (79.3%), followed by the Midwest and West (77%–78% each) and the Northeast (75.3%) ($p < 0.05$).

High CAM use was associated with having less than a high school education (75.3%), as well as with high school (77.9%) and college (80.0%) graduation ($p < 0.01$). Those widowed/divorced had the highest level of CAM use (81.3%), followed by married (77.0%) and single/never married (74.3%) participants ($p < 0.001$). CAM use ranged from 80% to 81% for all income brackets, except for the “other” category (55.8%) ($p < 0.001$).

Figure 1A, derived from Table 1, shows the distribution of CAM use across all chronic conditions for the overall sample. Across all categories of BMI ($p < 0.001$), CAM use was highest among persons with chronic/rheumatoid arthritis (82.2%), followed by those with chronic neck pain (82.0%), chronic lower back pain (79.9%), and musculoskeletal diseases (50.2%). Having limitations due to chronic disease was significantly associated with CAM use (82.5% vs 71.8% without limitations; $p < 0.001$).

CAM use by BMI stratification

Figure 1B–D, derived from Table 2, summarizes CAM use by BMI stratification. In normal/underweight patients (Fig. 1B), CAM use was highest among persons with chronic neck pain (82.5%); rates were 67.7% in those without neck pain ($p < 0.001$), followed by 80.2% in those with chronic/rheumatoid arthritis (vs. 66.5% in those without; $p < 0.001$), 78.6% in those with chronic lower back pain (vs. 64.1% in those without; $p < 0.001$), and 24.8% in those with chronic musculoskeletal diseases (vs. 79.4% in those without; $p < 0.001$).

Figure 1C shows CAM use for overweight individuals. Across the four conditions, significant differences in CAM use were found only with overweight participants with and

without chronic musculoskeletal diseases (91.8% vs. 81.8%; $p < 0.01$) and those with and without chronic/rheumatoid arthritis (84.7% vs. 79.1%; $p < 0.001$).

For obese participants, CAM use (Fig. 1D) was highest among those with musculoskeletal diseases (83.4%), followed by those with chronic/rheumatoid arthritis (81.6%), chronic neck pain (80.5%), and chronic lower back pain (79.3%). However, only chronic/rheumatoid arthritis was statistically significant ($p < 0.05$). In the stratified analysis (Table 2), there was a significant direct association between limitations due to chronic disease and CAM use at all BMI levels. Among normal/underweight persons with limitations, 81.9% reported CAM use vs. 64.5% in those without limitations ($p < 0.001$). In overweight persons with limitations, CAM use was significantly higher (84.3% vs. 79.5%; $p < 0.01$). Finally, this trend was also observed among obese participants with limitations at 81.9% compared to 75.9% without limitations ($p < 0.001$).

Multivariate analysis of CAM use

Results of the multivariate logistic regression are presented in two stages: (1) a general model and (2) BMI stratification analysis while controlling for potential confounders.

General model. In the general multivariable regression model (Table 1), women were 57% more likely to report CAM use ($p < 0.001$). Blacks/African Americans were 74% more likely to report CAM use compared with whites ($p < 0.001$), while Hispanics were 68% more likely ($p < 0.05$). Living in the South or West contributed to a 37% or 27% greater likelihood of CAM use compared with living in the Northeast ($p < 0.001$ and $p < 0.05$, respectively). Compared with individuals with less than a high school education, high school and college graduates were 25% ($p < 0.01$) and 49% ($p < 0.001$) more likely to report CAM use, respectively. Compared with those younger than age 35 years, persons age 50–64 years were 23% less likely to use CAM ($p < 0.01$). Persons with “other” incomes had a 45% decrease in CAM use ($p < 0.001$) compared with those whose income was less than \$35,000. Persons with a usual source of care were nearly three times as likely as those without to use CAM ($p < 0.001$). Having limitations due to chronic disease was associated with a 30% increased odds of CAM use ($p < 0.001$). Neither

TABLE 2. RESULTS OF STRATIFIED ANALYSIS OF CAM USE BY BODY MASS INDEX AND CHRONIC CONDITIONS

Covariates	CAM use at bivariate level		Odds ratio of CAM use (95% CI)
	Yes (%)	Chi-square	
BMI = normal/underweight (<i>n</i> = 3689)			
Chronic neck pain		95.7***	
Yes	82.5		1.60 (1.32–1.95)***
No (ref)	67.7		1.00
Chronic lower back pain		100.0***	
Yes	78.6		1.18 (0.97–1.44)
No (ref)	64.1		1.00
Chronic musculoskeletal disease		599.9***	
Yes	24.8		0.27 (0.20–0.36)***
No (ref)	79.4		1.00
Chronic/rheumatoid arthritis		85.0***	
Yes	80.2		1.16 (0.93–1.44)
No (ref)	66.5		1.00
Limitation due to chronic disease		139.3***	
Yes	81.9		1.47 (1.21–1.79)***
No (ref)	64.5		1.00
BMI = overweight (<i>n</i> = 3063)			
Chronic neck pain		0.7	
Yes	83.0		1.23 (0.99–1.52)
No (ref)	81.7		1.00
Chronic lower back pain		0.6	
Yes	82.5		1.47 (1.18–1.84)**
No (ref)	81.4		1.00
Chronic musculoskeletal disease		7.3**	
Yes	91.8		2.13 (1.05–4.35)*
No (ref)	81.8		1.00
Chronic/rheumatoid arthritis		16.5***	
Yes	84.7		1.32 (1.03–1.69)*
No (ref)	79.1		1.00
Limitation due to chronic disease		12.0**	
Yes	84.3		1.01 (0.82–1.25)
No (ref)	79.5		1.00
BMI = obese (<i>n</i> = 2972)			
Chronic neck pain		0.2	
Yes	80.5		1.06 (0.86–1.31)
No (ref)	79.9		1.00
Chronic lower back pain		2.3	
Yes	79.3		0.89 (0.72–1.11)
No (ref)	81.7		1.00
Chronic musculoskeletal disease		1.5	
Yes	83.4		1.06 (0.71–1.58)
No (ref)	79.8		1.00
Chronic/rheumatoid arthritis		6.6*	
Yes	81.6		0.98 (0.78–1.23)
No (ref)	77.7		1.00
Limitation due to chronic disease		14.4***	
Yes	81.9		1.25 (1.00–1.55)
No (ref)	75.9		1.00

p* < 0.05.*p* < 0.01.****p* < 0.001.

BMI, body mass index

marital status nor having insurance was a significant predictor of CAM use (*p* > 0.05).

Figure 2A shows the odds of CAM use by chronic condition status for the general model. After adjustment for the effect of other covariates in the multivariate model, having chronic lower back pain, chronic/rheumatoid arthritis, or chronic neck pain led to increases in the odds of CAM use,

ranging from 24% to 35% (*p* < 0.01). Having musculoskeletal diseases was significantly associated with a 56% reduction in the odds of CAM use (*p* < 0.001).

Odds of CAM use by BMI stratification. As shown in Table 2, normal/underweight individuals with limitation due to chronic disease (47%; *p* < 0.001) or chronic neck pain

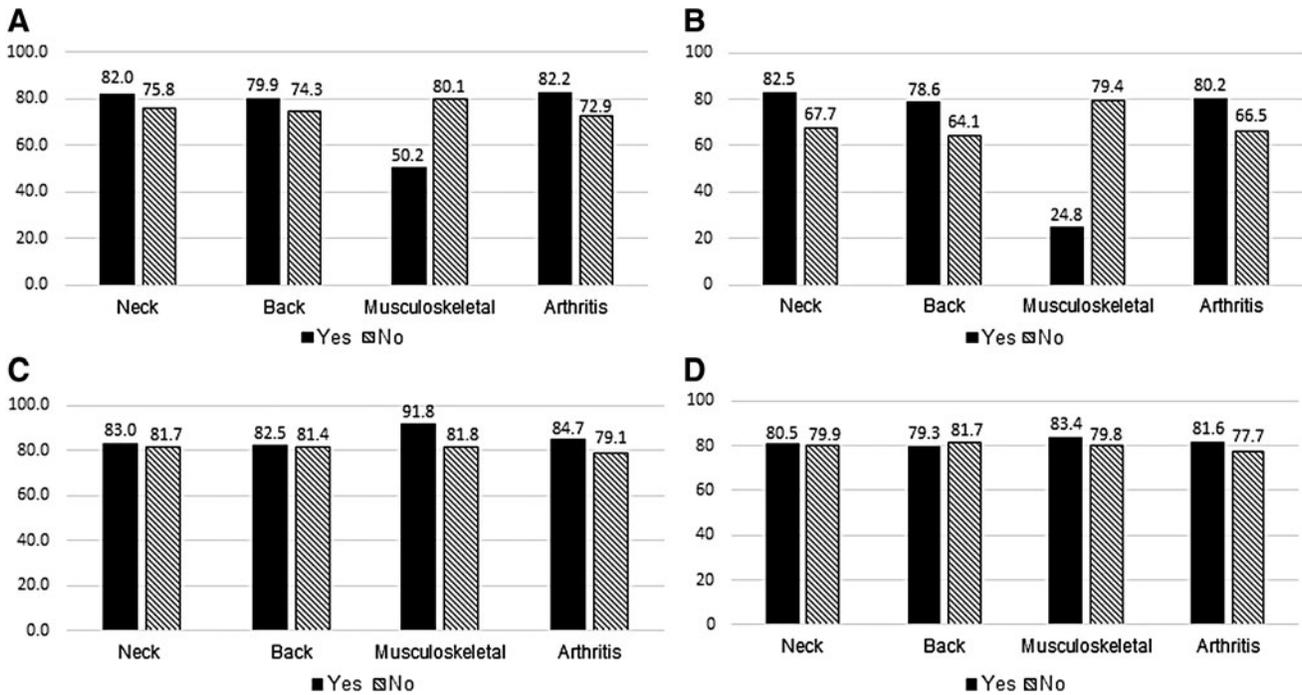


FIG. 1. Proportion of complementary and alternative medicine use by chronic pain/disease status (A) across all weights, (B) among normal/underweight participants, (C) among overweight participants, and (D) among obese participants.

(60%; $p < 0.001$) were significantly more likely to report CAM use than those who did not have either condition. Alternatively, normal/underweight individuals with chronic musculoskeletal diseases were 73% less likely to report CAM use ($p < 0.001$). There was no significant difference in CAM use among those with chronic lower back pain or chronic/rheumatoid arthritis and those without these conditions among those normal/underweight (Fig. 2B).

Although no significant difference was observed between CAM use and overweight survey participants with chronic lower back pain (82.5%) and those without (81.4%) at the bivariate level, results suggest (Fig. 2C) that at the stratified multivariate level and after adjustment for other covariates, overweight participants with chronic back pain were 47% more likely to use CAM than those overweight and without chronic back pain ($p < 0.01$). Additionally, overweight

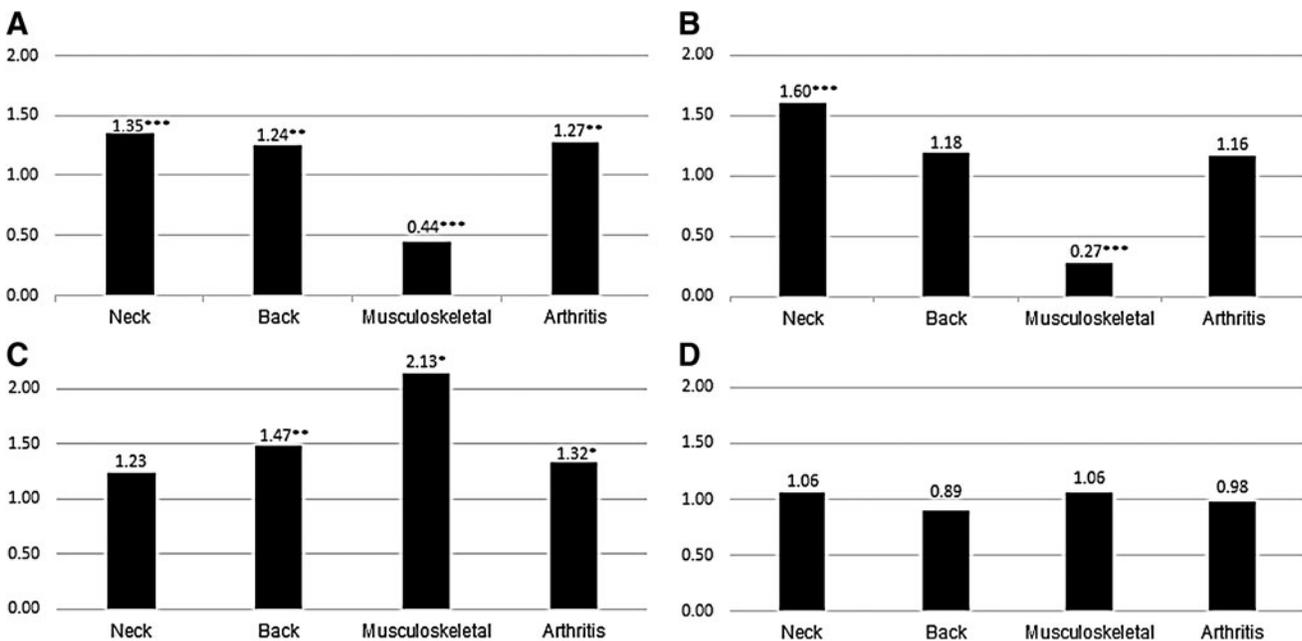


FIG. 2. Odds ratio of complementary and alternative medicine use by chronic pain/disease status (A) across all weights, (B) among normal/underweight participants, (C) among overweight participants, and (D) among obese participants. Significance levels: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

persons with chronic/rheumatoid arthritis were 32% more likely to report CAM use ($p < 0.05$). Having musculoskeletal diseases was also significantly associated with CAM use (odds ratio, 2.13; $p < 0.05$). Finally, having chronic neck pain did not indicate statistically significant differences in CAM use among overweight persons.

There were no significant associations between having chronic lower back or neck pain, chronic/rheumatoid arthritis, or chronic musculoskeletal diseases and CAM use among obese individuals (Fig. 2D). Whereas obese persons with chronic/rheumatoid arthritis had significantly higher proportions of CAM use, these results were not significant at the multivariate level after adjustment for other covariates. Finally, while limitation due to chronic disease was consistently associated with CAM use at the bivariate level for all BMI strata, at the stratified multivariate level, these associations were not significant in the overweight and obese strata.

Discussion

Musculoskeletal diseases, chronic/rheumatoid arthritis, and chronic back or neck pain represent significant public health problems with economic effects among individuals and society.^{5,6,12,17} Persons with these problems who also carry excess weight are likely to experience significant limitations in functional abilities that negatively affect their well-being,⁸ economic productivity, and quality of life.

The use of CAM for chronic diseases, such as cancer^{15,41} and diabetes,^{23,36} have increased in the last decade, alongside reported CAM use among patients with arthritis.² Musculoskeletal diseases have also been associated with frequent CAM use.^{13,42} Similarly, in the current study, while only 8% of the sample had diagnoses of musculoskeletal diseases,

approximately 50% of these reported CAM use compared with 80% among those without such conditions ($p < 0.001$). Furthermore, in the current study, having chronic/rheumatoid arthritis was consistently statistically associated with high rates (80%–85%) of CAM use at all three BMI levels. This aligns with existing research that linked chronic/rheumatoid arthritis to increased use of CAM.^{43–46}

Consistent with findings from other studies,¹⁵ persons living in the South⁴⁷ and West²⁰ were significantly more likely to report CAM use. These observations could be attributed to the greater likelihood of Blacks/African Americans using CAM (odds ratio, 1.74) and Hispanics (odds ratio, 1.68) compared to whites and the higher percentage of Hispanics in the West and blacks/African Americans in the South.⁴⁸ With respect to Hispanics, the regional increased use of CAM has been explored by other researchers,⁴⁹ and other studies have shown that a large proportion hold on to tenets of their cultural heritage, which includes alternative or natural therapies to treat different ailments.^{50,51} The Southern and Western regions of the United States also have large segments of the population with low income that may also lack health insurance.⁵² Interestingly, as shown in Table 3, in the stratified model, among normal/underweight participants, neither race nor region was a significant indicator of CAM use. However, among the overweight and obese racial/ethnic groups, blacks/African Americans were significantly more likely to report CAM use compared with whites (2.46 times and 94%, respectively; both $p < 0.001$). Furthermore, overweight participants from the South and West were approximately 35%–43% more likely to report CAM use than those from the Northeast (both $p < 0.05$). Obese participants from the South had a 57% increased odds of CAM use compared with obese individuals in the Northeast ($p < 0.01$).

TABLE 3. RESULTS OF STRATIFIED ANALYSIS OF CAM USE BY BMI AND SOCIOECONOMIC FACTORS

Covariates	Odds ratio (95% CI)		
	BMI = normal/underweight (n = 3689)	BMI = overweight (n = 3063)	BMI = obese (n = 2972)
Race/ethnicity			
White (ref)	1.00	1.00	1.00
Black/African American	1.28 (0.96–1.70)	2.46 (1.72–3.52)***	1.94 (1.47–2.57)***
Hispanic	1.40 (0.59–3.31)	1.44 (0.59–3.54)	1.81 (0.74–4.42)
Other	0.89 (0.61–1.28)	2.03 (0.98–4.20)	0.98 (0.51–1.90)
Missing	0.68 (0.21–2.22)	0.57 (0.18–1.86)	0.51 (0.18–1.48)
Region			
Northeast (ref)	1.00	1.00	1.00
Midwest	1.10 (0.84–1.42)	1.14 (0.85–1.53)	1.21 (0.91–1.61)
South	1.20 (0.93–1.54)	1.35 (1.02–1.78)*	1.57 (1.20–2.07)**
West	1.28 (0.98–1.68)	1.43 (1.06–1.92)*	1.24 (0.92–1.67)
Sex			
Male (ref)	1.00	1.00	1.00
Female	1.52 (1.27–1.83)***	1.66 (1.35–2.02)***	1.68 (1.38–2.03)***
Education			
Incomplete high school (ref)	1.00	1.00	1.00
High school graduate	1.32 (1.03–1.68)*	1.65 (1.27–2.13)***	1.01 (0.79–1.29)
College graduate	1.57 (1.16–2.12)**	2.25 (1.61–3.14)***	0.92 (0.66–1.27)
Missing	0.84 (0.51–1.39)	0.94 (0.51–1.74)	1.54 (0.78–3.04)

* $p < 0.05$.

** $p < 0.01$.

*** $p < 0.001$.

The findings with regard to sex are consistent with previous research.⁵³ Results further suggest that the odds of CAM use among women increases with each BMI level (52%, 66%, and 68% for normal/underweight, overweight, and obese participants, respectively; all $p < 0.001$). There was also a gradient pattern in CAM use by educational attainment, which is consistent with findings from other studies.⁵⁴ For the normal/underweight category, CAM use nearly doubled (from 32% to 57%) between high school graduates ($p < 0.05$) and college graduates ($p < 0.01$), relative to those with less than a high school education. A similar increasing trend for high school and college graduates was seen in the overweight category (both $p < 0.001$). After stratification by BMI status, however, there were no significant differences among obese participants with the various education levels.

A major strength of the current study is the relatively large sample size based on a nationally representative sample. In addition, the current study analyzed CAM use before the passing of the Affordable Care Act in 2010, which emphasizes preventive medicine and employer purchasing decisions and is likely to increase the number of Americans with chronic diseases seeking CAM modalities.⁵⁵

This study has several limitations. The current study used data from 2007, and, therefore, proportions of CAM use reported here may not reflect the current extent of CAM use in the United States and the understanding of CAM benefits based on newly disseminated research. In addition, data are self-reported; thus, a cautious interpretation is warranted.

Conclusions

To avert the major complications of arthritis, chronic neck or lower back pain, and other musculoskeletal diseases, individuals must have access to and use effective preventive and maintenance services. This study supports existing research in identifying populations with unmet needs for outreach on the potential additive benefits of CAM.⁵⁶ Notably, the odds of CAM use were not significant for obese participants with any of the study conditions vs those without. One possible low-risk CAM suggestion for this group might be yoga, which was found in a recent meta-analysis of randomized trials and prospective cohort studies to address lower back pain, as well as weight loss and maintenance for both overweight and obese patients.³⁸

Other recent studies suggest that 1 in 3 young adults are using CAM, with a higher proportion in women than men.⁵⁷ In the current study, CAM use was high among women and also across all age groups, including young adults (<35 years old). However, there were significant differences in odds of CAM use among different age groups when stratified by BMI. Normal/underweight persons 50 years and older were approximately 40% less likely to report CAM use compared with those younger than 35 years ($p < 0.01$). This may be a factor to consider when older women are engaged, while additionally addressing various strategies reported to be more influential to this group when deciding to experiment with CAM.²

Although our study did not explore the reasons for CAM use, and in light of the high proportions of utilization reported in the current sample, it is important that persons with chronic diseases disclose their use of CAM with their

medical providers to avoid any potential counter effects with conventional treatments. This would further ensure the effective management of these potentially debilitating conditions. Studies should continue to explore the reasons for CAM use among persons with weight and chronic conditions, as well as examine the effectiveness of these products and therapies in managing chronic conditions.

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Author Disclosure Statement

The project is based on publicly available and de-identified data. No competing financial interests exist.

References

- Centers for Disease Control and Prevention. Prevalence of doctor-diagnosed arthritis and arthritis-attributable activity limitation—United States, 2007–2009. *MMWR Morb Mortal Wkly Rep* 2010;59:1261–1265.
- Cheung C, Geisler C, Sunneberg J. Complementary/alternative medicine use for arthritis by older women of urban-rural settings. *J Am Assoc Nurse Pract* 2014;26:273–280.
- Hootman JM, Helmick CG. Projections of US prevalence of arthritis and associated activity limitations. *Arthritis Rheum* 2006;54:226–229.
- Murphy L, Helmick CG. The impact of osteoarthritis in the United States: a population-health perspective. *Am J Nurs* 2012;112:S13–S19.
- Smolen JS, van der Heijde DM, Keystone EC, et al. Association of joint space narrowing with impairment of physical function and work ability in patients with early rheumatoid arthritis: protection beyond disease control by adalimumab plus methotrexate. *Ann Rheum Dis* 2013;72:1156–1162.
- Sokka T, Kautiainen H, Pincus T, et al. Work disability remains a major problem in rheumatoid arthritis in the 2000s: data from 32 countries in the QUEST-RA study. *Arthritis Res Ther* 2010;12:R42.
- Vos T, Flaxman AD, Naghavi M, et al. Years lived with disability (YLDs) for 1160 sequelae of 289 diseases and injuries 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet* 2012;380:2163–2196.
- Sacks JJ, Helmick CG, Langmaid G. Deaths from arthritis and other rheumatic conditions, United States, 1979–1998. *J Rheumatol* 2004;31:1823–1828.
- Pincus T, Callahan LF. What is the natural history of rheumatoid arthritis? *Rheum Dis Clin North Am* 1993;19:123–151.
- Zhang W, Anis AH. The economic burden of rheumatoid arthritis: beyond health care costs. *Clin Rheumatol* 2011;30:25–32.
- Brooks PM. The burden of musculoskeletal disease—a global perspective. *Clin Rheumatol* 2006;25:778–781.
- Dominick KL, Ahern FM, Gold CH, Heller DA. Health-related quality of life among older adults with arthritis. *Health Qual Life Outcomes* 2004;2:5.
- Rao JK, Kroenke K, Mihaliak KA, et al. Rheumatology patients' use of complementary therapies: results from a one-year longitudinal study. *Arthritis Rheum* 2003;49:619–625.
- Tanaka E, Hoshi D, Igarashi A, et al. Analysis of direct medical and nonmedical costs for care of rheumatoid

- arthritis patients using the large cohort database, IORRA. *Mod Rheumatol* 2013;23:742–751.
15. Barnes PM, Powell-Griner E, McFann K, Nahin RL. Complementary and alternative medicine use among adults: United States, 2002. *Semin Integrative Med* 2004;2:54–71.
 16. Kanodia AK, Legedza ATR, Davis RB, et al. Perceived benefit of complementary and alternative medicine (CAM) for back pain: a national survey. *J Am Board Fam Med* 2010;23:354–362.
 17. Woolf AD, Erwin J, March L. The need to address the burden of musculoskeletal conditions. *Best Pract Res Clin Rheumatol* 2012;26:183–224.
 18. Sheehy C, Murphy E, Barry M. Depression in rheumatoid arthritis—underscoring the problem. *Rheumatol* 2006;45:1325–1327.
 19. Armstrong AR, Thiébaud SP, Brown LJ, Nepal, B. Australian adults use complementary and alternative medicine in the treatment of chronic illness: a national study. *Aust N Z J Public Health* 2011;35:384–390.
 20. Jones JF, Maloney EM, Boneva RS, et al. Complementary and alternative medical therapy utilization by people with chronic fatiguing illnesses in the United States. *BMC Complement Altern Med* 2007;7:12.
 21. Tait EM, Laditka SB, Laditka JN, et al. Use of complementary and alternative medicine for physical performance, energy, immune function, and general health among older women and men in the United States. *J Women Aging* 2012; 24:23–43.
 22. Upchurch DM, Chyu L. Use of complementary and alternative medicine among American women. *Womens Health Issues* 2005;15:5–13.
 23. Lee MS, Lee, MS, Lim HJ, Moon, SR. Survey of the use of complementary and alternative medicine among Korean diabetes mellitus patients. *Pharmacoepidemiol Drug Saf* 2004;13:167–171.
 24. Mermod J, Fischer L, Staub L, Busato A. Patient satisfaction of primary care for musculoskeletal diseases: a comparison between Neural Therapy and conventional medicine. *BMC Complement Altern Med* 2008;8:33.
 25. Gaul C, Schmidt T, Czaja E, et al. Attitudes towards complementary and alternative medicine in chronic pain syndromes: a questionnaire-based comparison between primary headache and low back pain. *BMC Complement Altern Med* 2011;11:89.
 26. Bishop FL, Lewith, GT. Who uses CAM? A narrative review of demographic characteristics and health factors associated with CAM use. *Evid Based Complement Alternat Med* 2010;7:11–28.
 27. Saydah SH, Eberhardt MS. Use of complementary and alternative medicine among adults with chronic diseases: United States 2002. *J Altern Complement Med* 2006;12: 805–812.
 28. Furlan AD, Yazdi F, Tsertsvadze A, et al. A systematic review and meta-analysis of efficacy, cost-effectiveness, and safety of selected complementary and alternative medicine for neck and low-back pain. *Evid Based Complement Alternat Med* 2012;953139.
 29. Su D, Li L. Trends in the use of complementary and alternative medicine in the United States: 2002–2007. *J Health Care Poor Underserved* 2011;22:296–310.
 30. Rossignol M, Begaud B, Engel P, et al. Impact of physician preferences for homeopathic or conventional medicines on patients with musculoskeletal disorders: Results from the EPI3-MSD cohort. *Pharmacoepidemiol Drug Saf* 2012;21: 1093–1101.
 31. Walach H, Pietikäinen S. A roadmap for CAM research towards the horizon of 2020. *Forsch Komplementmed/ Research Complementary Med* 2014;21:80–81.
 32. Bishop FL, Yardley L, Lewith GT. Why consumers maintain complementary and alternative medicine use: a qualitative study. *J Altern Complement Med* 2010;16:175–182.
 33. Lee MS, Lee M.S, Yang CY, et al. Use of complementary and alternative medicine by rheumatoid arthritis patients in Korea. *Clin Rheumatol* 2008;27:29–33.
 34. Pradhan EK, Baumgarten M, Langenberg P, et al. Effect of mindfulness-based stress reduction in rheumatoid arthritis patients. *Arthritis Rheum* 2007;57:1134–1142.
 35. Honda K, Jacobson JS. Use of complementary and alternative medicine among United States adults: the influences of personality, coping strategies, and social support. *Prev Med* 2005;40:46–53.
 36. Moolasam S, Sripa S, Kuessirikiet V, et al. Usage of and cost of complementary/alternative medicine in diabetic patients. *J Med Assoc Thai* 2005;88:1630–1637.
 37. Lapane KL, Yang S, Jawahar R, et al. CAM use among overweight and obese persons with radiographic knee osteoarthritis. *BMC Complement Altern Med* 2013;13:241.
 38. Bernstein AM, Bar J, Ehrman, JP, et al. Yoga in the management of overweight and obesity. *Am J Lifestyle Med* 2014;8:33–41.
 39. Parsons VL, Moriarity C, Jonas K, et al. Design and estimation for the national health interview survey, 2006–2015. *Vital Health Stat 2* 2014;2014:1–53.
 40. National Center for Complementary and Alternative Medicine [homepage on the Internet]. Online document at: <https://nccih.nih.gov/> Accessed December 15, 2014.
 41. Lee E, Shin YC, Lee J, et al. Use of complementary and alternative medicine in cancer patients at 7 general hospitals in Seoul. *J Korean Public Health Assoc* 2002;28:225–238.
 42. Ernst E. Musculoskeletal conditions and complementary/alternative medicine. *Best Pract Res Clin Rheumatol* 2004; 18:539–556.
 43. Breuer GS, Orbach H, Elkayam O, et al. Use of complementary and alternative medicine among patients attending rheumatology clinics in Israel. *Isr Med Assoc J* 2006;8: 184–187.
 44. Callahan LF, Wiley-Exley EK, Mielenz TJ, et al. Use of complementary and alternative medicine among patients with arthritis. *Prev Chronic Dis* 2009;6:1–23.
 45. Klingberg E, Wallerstedt, SM, Torstenson T, et al. The use of complementary and alternative medicine in outpatients with inflammatory rheumatic diseases in Sweden. *Scand J Rheumatol* 2009;38:472–480.
 46. Lee EN, Son HM. Predictive factors for use of complementary-alternative therapies in rheumatoid arthritis patients. *Korean J Adult Nurs* 2002;14:184–193.
 47. Xu KT, Farrell TW. The complementarity and substitution between unconventional and mainstream medicine among racial and ethnic groups in the United States. *Health Serv Res* 2007;42:811–826.
 48. Aud S, Fox MA, KewalRamani A. Status and Trends in the Education of Racial and Ethnic Groups (NCES 2010–015). Washington, DC, US: National Center for Education Statistics, 2010:181.
 49. Gardiner P, Whelan J, White LF, et al. A systematic review of the prevalence of herb usage among racial/ethnic

- minorities in the United States. *J Immigr Minor Health* 2013;15:817–828.
50. Gallant MP, Spitze G, Grove JG. Chronic illness self-care and the family lives of older adults: a synthetic review across four ethnic groups. *J Cross Cult Gerontol* 2010;25:21–43.
 51. Hatcher E, Whittemore R. Hispanic adults' beliefs about type 2 diabetes: clinical implications. *J Am Acad Nurse Pract* 2007;19:536–545.
 52. Holahan J, Cook, A. The U.S. economy and changes in health insurance coverage, 2000–2006. *Health Aff* 2008;27:w135–w144.
 53. Adams J, Sibbritt D, Lui CW. The urban-rural divide in complementary and alternative medicine use: a longitudinal study of 10,638 women. *BMC Complement Altern Med* 2011;11:2.
 54. Ndao-Brumblay SK, Green CR. Predictors of complementary and alternative medicine use in chronic pain patients. *Pain Med* 2010;11:16–24.
 55. Pelletier KR, Herman PM, Metz RD, Nelson CF. Health and medical economics applied to integrative medicine. *Explore* 2010;6:86–99.
 56. Hoerster KD, Butler DA, Mayer JA, et al. Use of conventional care and complementary/alternative medicine among US adults with arthritis. *Prev Med* 2012;54:13–17.
 57. Upchurch DM, Rainisch BKW. Racial and ethnic profiles of complementary and alternative medicine use among young adults in the United States: Findings from the National Longitudinal Study of Adolescent Health. *J Evid Based Complementary Altern Med* 2012;17:172–179.

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